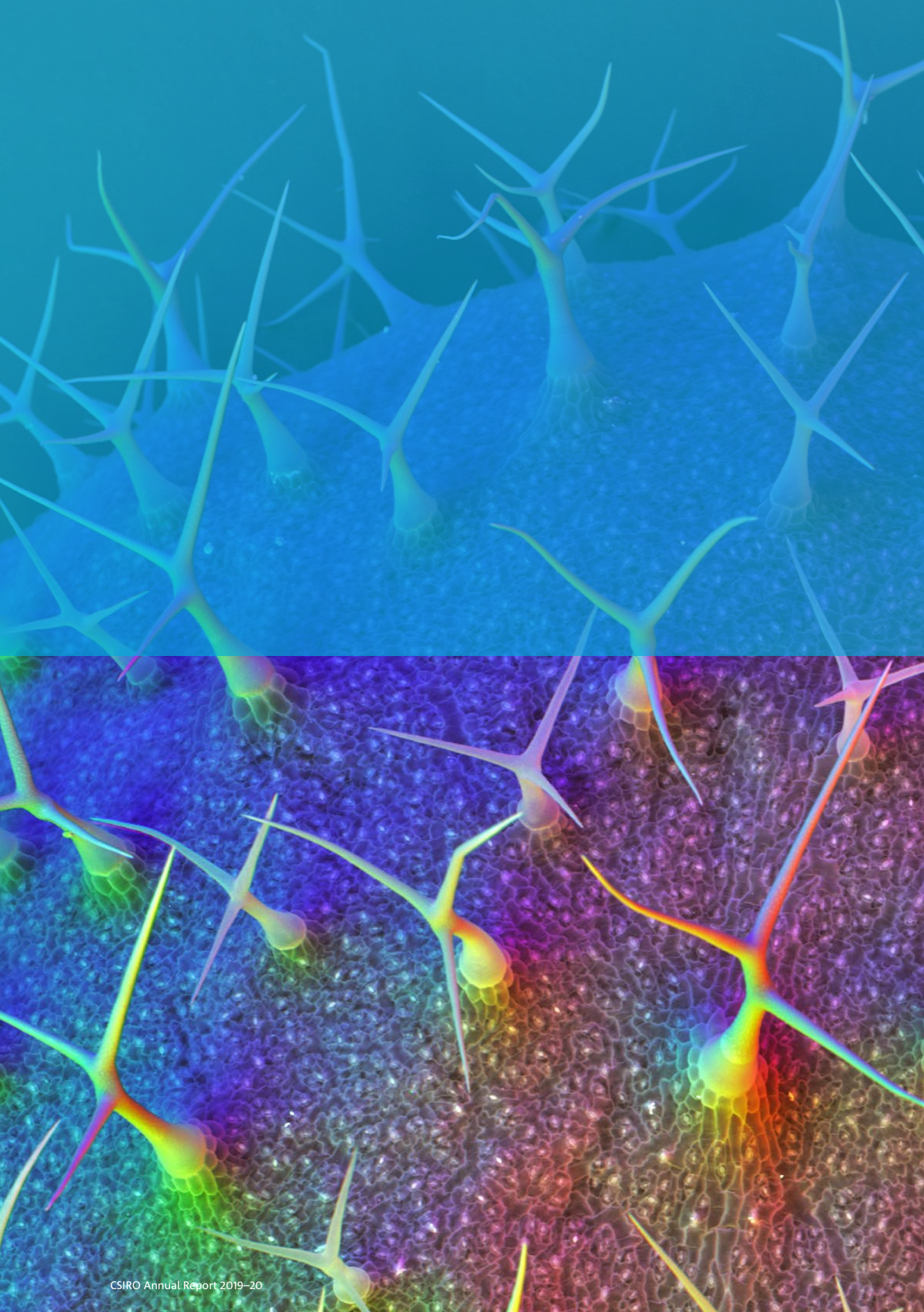
CSIRO

Australia's National
Science Agency

Annual Report 2019–20



Our annual report

This annual report provides a summary of our activities and performance for the financial year ended 30 June 2020 against the planned objectives and outcomes in our Corporate Plan and Portfolio Budget Statements.

Read the annual report online: csiro.au/annualreport2020.

CSIRO

We are Australia's national science agency and innovation catalyst. As one of the largest and most multidisciplinary mission-driven research organisations in the world, we unlock a better future for everyone.

Our purpose

Solving the greatest challenges through innovative science and technology.

Our vision

We are Australia's innovation catalyst, collaborating to boost Australia's innovation performance.

Cover: We undertake fundamental research into the behaviour and suppression of bushfires for state land management agencies and rural fire authorities.

We're working on better detection methods, enhanced fire spread simulating models (Spark) and suppression effectiveness models to allow agencies to prioritise efforts to suppress new and running fires according to their potential to cause loss.

Read more about our response to the bushfires on pages 18–19 and about Spark on page 40.

Image: New post-fire regrowth in the Adelaide Hills, February 2020 and a virtual reality simulation of a bushfire.

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28 August 2020

The Hon Karen Andrews MP
Minister for Industry, Science and Technology
Parliament House
CANBERRA ACT 2600

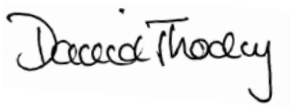
We have pleasure in submitting to you, for presentation to Parliament, the 72nd Annual Report of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the year ending 30 June 2020. This report has been prepared in accordance with the requirements of the *Science and Industry Research Act 1949*, section 46 of the *Public Governance, Performance and Accountability Act 2013* and the *Public Governance, Performance and Accountability Rule 2014*.

The report was endorsed at the meeting of the CSIRO Board members on 28 August 2020.

Part 6 is a report on the operations of the Science and Industry Endowment Fund (the Fund), which was established under the *Science and Industry Endowment Act 1926*. It also includes a report by the Auditor-General on the accounts of the Fund.

The Corporate Commonwealth Annual Reporting Rule requires CSIRO to report any significant activities and changes that affected the organisation or structure. During the reporting period, we responded to your Statement of Expectations with our Statement of Intent, outlining how CSIRO will meet these expectations as an organisation, we have also been responding to widespread drought, bushfires, hailstorms and the global pandemic COVID-19.

We are proud of CSIRO's achievements this year.



Mr David Thodey AO
Chairman of the CSIRO Board

Dr Larry Marshall
Chief Executive of the CSIRO

CSIRO
Australia's National Science Agency

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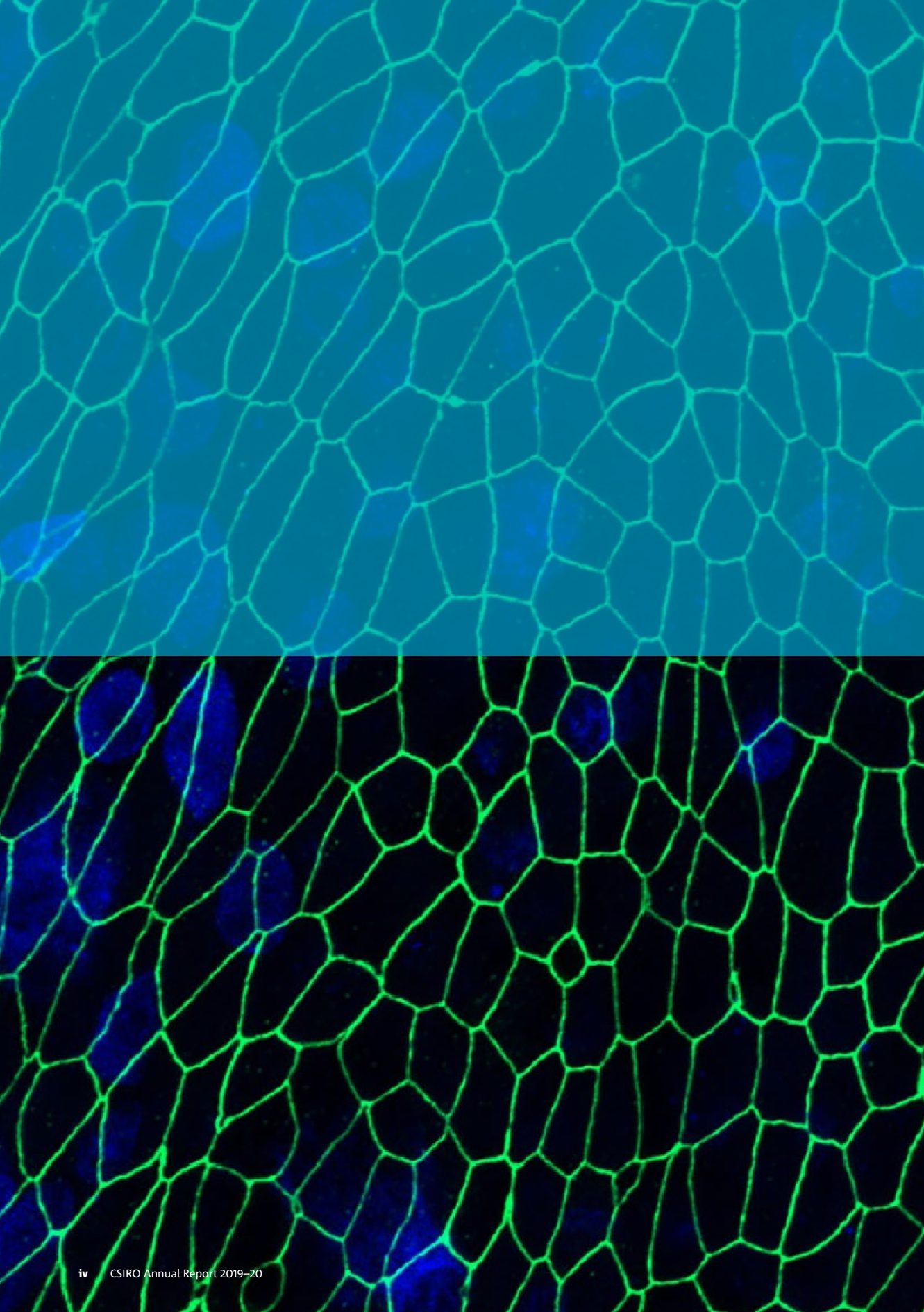


Part 1
Overview

Foreword by the Chairman

It has been challenging on so many fronts this year – bushfires, floods and the pandemic. As we look towards recovery and building resilience, the importance of Australia's national science agency has never been clearer. CSIRO's science excellence, broad partnerships, and talented people continue to deliver innovative solutions that protect our quality of life, our economic health, and our environmental sustainability through this difficult time. We continue to invest for our brighter future.

I am extremely proud of the contribution CSIRO has made to Australia this year, which has ranged from vaccine development and outbreak management through to bushfire response and economic recovery. CSIRO's people have risen to these challenges without hesitation, while continuing their important work across the full research portfolio, including climate change, agriculture, health and wellbeing, cyber security, and in applying emerging technologies like artificial intelligence to increase the pace and scale of our impact.

On 13 February this year, the Minister issued a new Statement of Expectations for CSIRO, which we responded to with a Statement of Intent reaffirming our commitment to solving the greatest challenges for Australia and providing comment from the Board on how we will do this.

It is a privilege for us all to serve our nation through outstanding science and research. As the national science agency, we will continue to deliver on our core mission to deliver science impact for the whole nation – working collaboratively across the research system and with industry, government, and universities, both in Australia and globally.

We are focusing our science in areas that are aligned with government priorities: the digital economy; working collaboratively to advance Australian industry; building small to medium-sized enterprise (SME) engagement; encouraging access to national research infrastructure; promoting science, technology, engineering and mathematics (STEM) careers and equity; and facilitating the translation of research and commercialisation of outcomes.

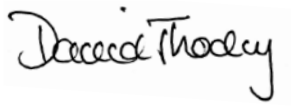
We are committed to using science to guide our investments in securing Australia's future prosperity, as outlined in our Australian National Outlook 2019.

This annual report tells many stories about the value we have delivered to partners and customers this year, particularly as they too adapt to this changing landscape. What I hope you sense through this report is the dedication, collaborative spirit and integrity of our CSIRO colleagues – something that we experience every day when we work with them. I want to thank them for their efforts, which have gone above and beyond our expectations, to deliver excellent and impactful science when it is needed most.

As Australia contemplates a very different outlook after the events of this year, CSIRO has shared plans of a new missions program to bolster Australia's COVID-19 recovery and build long-term resilience. The program of large-scale, major scientific and collaborative research initiatives will be aimed at solving some of Australia's greatest challenges, focused on outcomes that lead to positive impact, new jobs and economic growth. These challenges cannot be met by CSIRO alone, so the missions program will bring together government, universities, industry and the community to develop the program.

CSIRO is not immune from the economic impact of COVID-19, and the Board is preparing for a revenue shortfall in the next financial year. This annual report demonstrates the strong scientific and financial foundation from which we can explore new opportunities.

I am confident that CSIRO will endure for another 100 years as we evolve and adapt to the changing environment. I look forward to CSIRO continuing to shape and guide Australia's recovery effort as we build a new and bright future for our economy.



Mr David Thodey AO
Chairman of the CSIRO Board

Chief Executive's report

CSIRO was founded 100 years ago on a vision of science redefining our future. This year, your national science agency has lived this purpose like no other year in recent memory – at the forefront responding to a widespread drought, then a devastating bushfire season, followed by a global pandemic. Now we are preparing Australian industry to respond to our first recession in 30 years. We are precisely in the place our founder envisioned us to be – using science and data to light the way through crises and delivering solutions to Australia's greatest challenges.

This annual report captures why there has never been a more important time for a mission-directed organisation like ours to rise to these challenges and bring science to the fore to guide us to a better future. While many of this year's crises were unprecedented, they were not unforeseen. In these pages, you'll see the results of strategic changes we have made to CSIRO in recent years to prepare for events like these, which gave us the capability to hit the ground running in our response.

To prepare for a pandemic, our One Health model, launched in 2016, allowed us to respond to a new disease threat in multiple ways, from vaccine development (CSIRO was first in the world to initiate multi-vaccine animal efficacy studies) and medical supply production to data modelling (creating and populating COVID-19 tracking dashboards for each state) and environmental science.

While all this was happening, thanks to our digital transformation over the past four years, up to 80 per cent of our workforce seamlessly transitioned to working from home. We were only able to achieve this thanks to the digital transformation program and bolstered cyber security we have put in place over the last few years.

With our initial investment in adaptation four years ago, we were also in good standing to respond to the bushfire crisis, drawing on more than 70 years of expertise in bushfire research. Today we bring everything from bushfire modelling, prediction and preparation to management, monitoring and recovery. That work continues and will remain an ongoing priority as we work to build resilience to Australia's warmer, drier climate.

As Australia looks for pathways back to prosperity from the impacts of the pandemic, our work to strengthen Australia's innovation and commercialisation pipeline will be more important than ever. Over the last five years, CSIRO's ON Accelerator program has supported the creation of more than 60 new companies that have attracted more than $75 million in venture funding and commercialisation grants. At the same time, CSIRO's Innovation Fund, managed by Main Sequence Ventures, has grown from an initial $100 million to $240 million, supporting a portfolio of more than 20 sci-tech start-ups.

CSIRO's purpose isn't to generate revenue, but it's remarkable to see the organisation deliver another record revenue year – over $500 million – with underlying profitability for the second year in a row.

These successes have enabled investment and progress in many areas across the organisation to prepare Australia better for the challenges that lie ahead. This includes breakthrough science through our Future Science Platforms, which reached a total annual investment of $90 million last financial year, and our collaboration rates with universities and industry, which are at an all-time high.

It also includes the progress we have made on our Science in Australia Gender Equity (SAGE) Action Plan, which saw us reach the Green Zone for our Business Unit leader cohort for the first time in our history. Also for the first time, we were awarded Gold Employer Status in the 2020 Australian Workplace Equality Index. We are making good progress, but there is more work to be done.

As we look ahead, it is fitting that 100 years since CSIRO's first mission – to rid Australia of the invasive weed the prickly pear, which rendered so much prime agriculture land unusable – we are developing a program of missions to help solve some of Australia's greatest challenges.

These large-scale, major scientific and collaborative research initiatives will be co-created and delivered by the brightest minds across government, industry, universities and the community, and will be focused on outcomes that lead to positive impact, new jobs and economic growth through:

- increasing our resilience and preparedness against pandemics
- mitigating the impact of disasters: drought, bushfires and floods
- creating a hydrogen industry to generate a new clean energy export industry
- accelerating the transition to agile manufacturing for higher revenue and sovereign supply
- overcoming our growing resistance to antibiotics, so they keep saving lives
- creating a national climate capability to navigate climate change uncertainty
- helping our farmers overcome drought, mitigate climate impacts, increase yield and profitability, create a sustainable future protein industry and leverage the world's love of Australian-grown food to collectively drive our trusted agriculture and food exports to $100 billion
- using technology to navigate Australia's transition to net zero emissions without derailing our economy
- safeguarding the health of our waterways by monitoring the quality of our water resources from space
- creating new industries that transform raw mineral commodities into unique higher-value products like critical energy metals that build Australia's value-added offering, jobs, and sovereign supply
- ending plastic waste by reinventing the way plastic is made, processed and recycled
- doubling the number of SMEs benefitting from Australian science to become a collaboration nation.

I am incredibly proud of our people and the important work they do to secure Australia's future. Their passion and commitment will be critical into the next financial year as we launch our new portfolio of missions and manage the impacts from COVID-19 on our own financial position. Our missions speak to the importance of deep and broad collaboration across Australia to solve our challenges, and as Australia responds as a whole to widespread economic challenges, the only way we will be able to do this is through a Team Australia approach.

As Australia's national science agency, CSIRO will continue to push the boundaries of science and technology to ensure Australia is ready to meet our future challenges head-on, together.

Dr Larry Marshall
Chief Executive, CSIRO

About us

As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology.

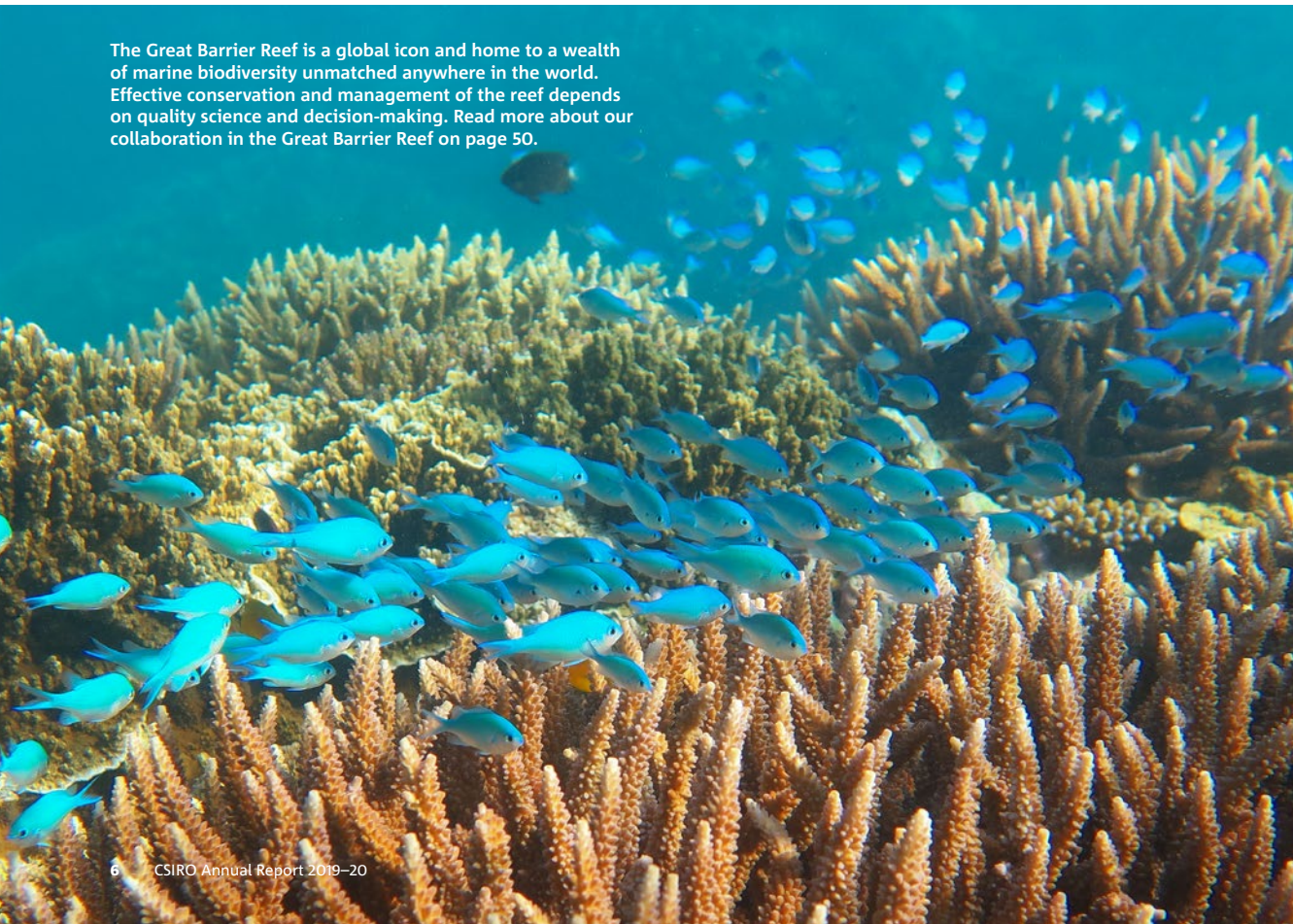
We are Australia's most trusted research institution and most connected innovator, working with every Australian university, government department and major Australian industry.

We are one of the largest and most multidisciplinary mission-driven research agencies in the world. Our more than 5,000 people are based across 58 sites in Australia and around the world, and we manage state-of-the-art research facilities for the nation.

Our collaborative research turns science into solutions for food security and quality, clean energy and resources, health and wellbeing, resilient and valuable environments, innovative industries, and a secure Australia and region.

We deliver around $7.6 billion of benefit to the nation each year as a result of our science, securing our future national prosperity as well as environmental and social benefits.

CSIRO. Unlocking a better future for everyone.



The Great Barrier Reef is a global icon and home to a wealth of marine biodiversity unmatched anywhere in the world. Effective conservation and management of the reef depends on quality science and decision-making. Read more about our collaboration in the Great Barrier Reef on page 50.

WE DELIVERED

$7.6 billion

of benefit to the nation.

WE INJECTED MORE THAN

$20 million

into the research and development of SME projects.

We received

Gold Employer Status

IN THE 2020 AUSTRALIAN WORKPLACE EQUALITY INDEX.

Our Future Science Platforms program grew to a total annual investment of

$90 million.

WE ENGAGED WITH

3,600

customers.

5,000 people committed to solving the greatest challenges.

WE WORKED WITH

378 international customers and collaborators from more than 50 countries.

WE HAVE

58 sites

in Australia and around the world.

WE RECEIVED MORE THAN

$500 million

in external revenue.

Through company formation, we helped to create more than

650 new jobs.

200,000+

people took part in our community events.

WE CONTRIBUTED TO

17 Cooperative Research Centres.

192,000+

students took part in STEM EDUCATION PROGRAMS.

Celebrating our people

Our extraordinary people bring our excellent science to life. They're committed to fulfilling the purpose of our organisation and delivering the greatest national benefit. Many of our people receive awards from a variety of institutions and we're incredibly proud of their achievements. This is a selection of their recognitions during 2019–20.

Member of the Order of Australia (AM)

Dr Peter Riddles (CSIRO Board member), for significant service to science, to biotechnology, and to innovation.

Officer of the Order of Australia (AO)

Dr Catherine Foley PSM (CSIRO Chief Scientist), for distinguished service to research science, to the advancement of women in physics, and to professional scientific organisations

Dr Brian Walker (CSIRO Fellow), for distinguished service to science, particularly to ecosystem ecology and research, and to professional scientific bodies.

Public Service Medal (PSM)

Associate Professor Matthew Hill (Principal Research Scientist CSIRO to 2019; joint position between CSIRO and Monash), for outstanding public service to materials development for industry and the Australian Defence Force.

Australian Academy of Science Fellowship

Dr Wenju Cai, a prominent world authority and leader on climate variability, ocean dynamics, ocean-atmosphere interactions, and climate change, for work leading to significant improvements in fundamental knowledge, climate simulations and climate projections.

Dr Catherine Foley PSM, for significant contributions to the understanding of superconducting materials and to the development of devices using superconductors to detect magnetic fields and locate valuable mineral deposits. Also, for significant contributions to Australian science as an adviser to federal and state governments and to numerous research and teaching institutions.

Dr Jenny Stauber, an international leader in ecotoxicology, particularly on metal contaminants in aquatic environments, for ground-breaking research on environmental risk assessment and protocols that are being applied worldwide.

Australian Academy of Science 2020 David Craig Medal

Dr Graeme Moad, for world leading polymer chemistry research ranging from fundamental chemistry to new materials for industrial uses, nanotechnology, organic electronics and bioapplications including new synthetic methods for the controlled synthesis of polymers that have revolutionised the field.

Australian Academy of Technology, Science and Engineering (ATSE) Fellowship

Dr Douglas Bock, for strategic vision, innovative technical design, research and expertise in constructing world-class radio telescopes with complex electronics and precision engineering including the Australian Square Kilometre Array Pathfinder.

Dr Helen Cleugh, for research discovery, delivery and leadership in atmospheric science to quantify the interactions between the land surface and the atmosphere, and their effects on weather, climate and hydrology, and water-use and carbon uptake.

Dr Martin Cole (CSIRO Scientist to 2020), for internationally recognised food science research and senior management with significant impactful commercial outcomes for novel food technology, diet programs and agricultural bioproducts.

Dr Andy Sheppard, for globally recognised scientific reputation and academic achievements in invasion ecology and classical biological control of weeds and expertise in risk analysis, biosecurity science and biodiversity enhancement.

Dr Surinder Singh, for pioneering the genetic modification of fatty acid composition in oilseed crops to provide improved nutritional value for human health and improved functionality for novel industrial end uses.

David and Valerie Solomon Award (ATSE) 2019 for research-industry collaboration

Associate Professor Matthew Hill, for developing metal organic frameworks with many applications from cleaning gases and liquids to mining and drug production. His research includes development and application of porous materials, flow chemistry, and lithium-sulfur batteries.

Web of Science Highly Cited Researchers 2019

Dr Wenju Cai, Dr Josep Canadell, Dr Peter Dodds, Dr Elizabeth Fulton, Dr Mario Herrero, Dr Alistair Hobday, Dr Kemal Kazan, Dr John Kirkegaard, Dr Evans Lagudah, Dr John Manners, Dr Craig Moritz, Dr Alan Richardson, Dr Jacob Tse-Wei Wang, Dr Brian Walker and Dr Yingping Wang were among the most cited authors in their respective fields of study. The Highly Cited Researchers list recognises leading researchers in the sciences and social sciences through the publications indexed in the Web of Science core collection that rank in the top one per cent by citations for their field and year.

2020 Telstra NSW Business Woman of the Year

New South Wales State Winner **Dr Sarah Pearce**, for her contribution to the development of the astronomy and space sectors and to delivering world-leading facilities for the international astronomy community.

The Chairman's Medal for Science Excellence

This award recognises teams who have made significant scientific or technological advances that create value for our customers via innovation that delivers positive impact for Australia.

The Tasmanian Atlantic salmon applied breeding program team received the medal for taking selective breeding from concept to world-leading in little over a decade. The breeding program now underpins the entire industry and has been central to its continuous growth. The salmon now grow 35 per cent faster and are 40 per cent more disease-resistant. Gains continue to accumulate at four to five per cent every year.

The Chairman's Medal for Science Excellence winners: The Tasmanian Atlantic salmon applied breeding program team.

CSIRO Medal for Impact from Science

This award recognises exceptional individuals or teams who have created value for customers through innovation that delivers impact for Australia.

The Infrastructure Technologies – Fire Science Team was awarded the medal for the experimental design and completion of 14 full-scale fire tests to evaluate the performance of sprinkler designs for residential apartments. The research project provided evidence to support changes to Australia's National Construction Code for the mandatory installation of fire sprinklers in low rise residential apartment buildings. This significantly contributed to improving life safety for occupants and firefighters.

CSIRO Medal for Lifetime Achievement

This award recognises individuals who have a record of sustained and meritorious achievements in science, technology and innovation or the support of science, technology and innovation.

Dr Andrew Ash's career exemplifies a lifetime of collaborative service from science. His work in science has changed our understanding of rangeland management in Australia. He has led the development of climate adaptation science in Australia, built the development potential of Northern Australia and helped thousands of smallholders in Indonesia. Andrew has developed networks, colleagues and technologies to ensure his legacy lives on in the organisation.

Robin Wark started her career at our iconic Parkes radio telescope in 1984. She then moved to the Australia Telescope Compact Array (ATCA) shortly after it opened in 1988, where she was at the forefront of observer support for the instrument. Robin is co-author of several of ATCA's most highly cited papers. Robin oversaw the maintenance of ATCA's Observing Archive from tape through to virtual server, retaining access to 99 per cent of data taken with the telescope. The data are still in use as astronomers supplement new observations or contrast them with the archive. Generations of astronomers have benefited from Robin's support of our radio telescopes, obtaining better quality data with a greater scientific impact due to her careful eye and prompt support.

CSIRO Medal for Lifetime Achievement winner: Dr Andrew Ash.

CSIRO Medal for Lifetime Achievement winner: Robin Wark.

Protecting apartment residents from fires

The Infrastructure Technologies team, led by Mark Burgess, Alex Webb and Brett Roddy partnered with Fire and Rescue New South Wales (NSW) and the Fire Protection Association to protect the safety of Australians living in apartments. Prior to this significant research project, apartment buildings below 25 metres in height did not require the installation of fire sprinklers to protect occupants from the outbreak of fire.

Conducting fire tests at our North Ryde fire-testing facility.

Following a tragic Sydney apartment fire, Fire and Rescue NSW were asked to explore options for installing cost-effective sprinkler systems in all residential apartment buildings.

Our Fire Science Team, in collaboration with industry stakeholders, undertook extensive design and testing. We developed the experimental methodology and delivered 14 full-scale apartment fire tests at our North Ryde fire-testing facility. The data generated proved the effectiveness of the new sprinkler system designs, which improved occupant safety and reduced construction costs.

With this evidence, the Australian National Construction Code was changed – fire sprinkler systems are now required in residential apartment buildings below 25 metres. According to the Commissioner of Fire and Rescue NSW, this signalled 'the most significant shift in fire safety since 2006, when legislation mandated the installation of smoke alarms...'.

These regulatory changes reduce the risk to life from 3.9 fatalities per 1,000 fire starts to 1.1–1.3 fatalities, creating a long-lasting impact for Australia.

CSIRO Medal for Impact from Science winners: The Infrastructure Technologies – Fire Science Team.

Part 2

Our purpose and strategy

Our purpose

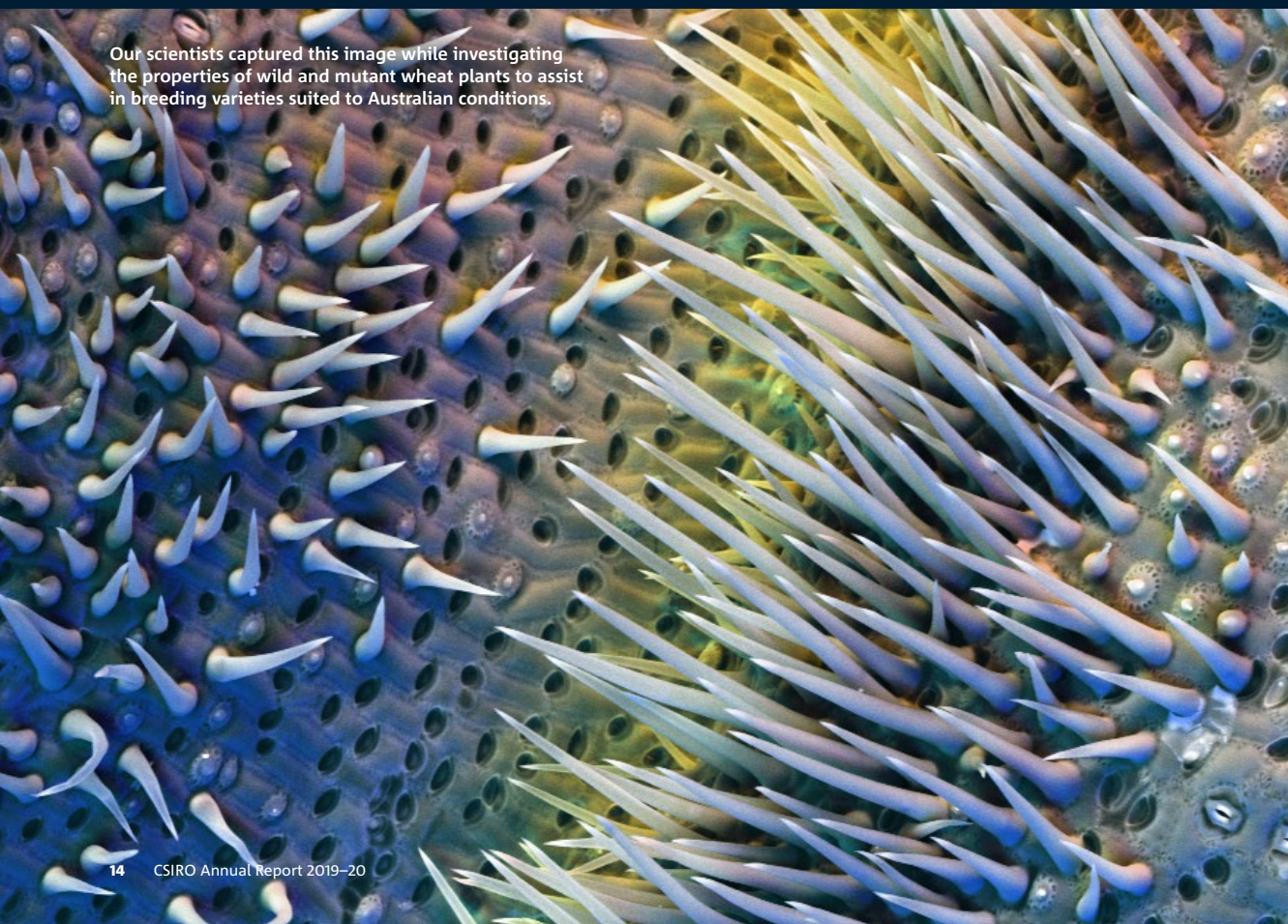
We are an Australian Government statutory authority within the Industry, Science, Energy and Resources portfolio, operating under the provisions of the *Science and Industry Research Act 1949* (SIR Act). To align with our Portfolio Budget Statement outcome statement, we describe our purpose as:

Solving the greatest challenges through innovative science and technology.

Our vision

Recognising our unique role in Australia and the highly collaborative and innovative nature of what is needed to solve the greatest challenges, our vision is:

Australia's innovation catalyst, collaborating to boost Australia's innovation performance.



Our scientists captured this image while investigating the properties of wild and mutant wheat plants to assist in breeding varieties suited to Australian conditions.

Our strategy, as captured in our Corporate Plan

Our strategy directs how we will achieve our purpose and comprises our objectives and outcomes. We are guided by strategic pillars as the key areas for how we deliver our science to meet our purpose and vision.

Our objectives

For over 100 years, we have been the mission-led national science agency, collaborating across the innovation system. These primary objectives, guided by the SIR Act, help us to deliver on our purpose:

1. Conduct and encourage the uptake of world-class scientific research.
2. Mobilise and develop the best talent for the benefit of Australia.
3. Manage national research infrastructure for the benefit of the nation.
4. Ensure the sustainability of CSIRO.

Our outcomes

Our high-level outcomes show the results of our work:

- triple-bottom-line impact to Australia
- lift Australia's science capacity and capability
- accessible world-class facilities to underpin research and innovation
- sustainable operations, cultural health, safety and wellbeing.

Solving the greatest challenges

We identified these challenges as the areas of greatest importance to Australians. We solve these challenges through our portfolio of missions. Together the challenges and missions are driving Australia's recovery and resilience following recent national crises.

Food security and quality

Achieving sustainable regional food security and growing Australia's share of premium agri-food markets.

Health and wellbeing

Enhancing health for all through preventive, personalised, biomedical and digital health services.

Resilient and valuable environments

Enhancing the resilience, sustainable use and value of our environments.

Sustainable energy and resources

Building regional energy and resource security and our competitiveness while lowering emissions.

Future industries

Creating Australia's future industries and jobs by collaborating to boost innovation performance and STEM skills.

A secure Australia and region

Safeguarding Australia from risks such as war, terrorism, pandemics, disasters and cyber-attacks.

Strategic pillars

Our pillars, defined in our Corporate Plan 2019–20, guide our operations and bring our purpose, vision and strategy to life.

Customer first: creating deeper innovation relationships with our customers and prioritising the highest impact investments.

Thriving people and teams: putting people and their safety first while supporting them to thrive and adapt in a changing world.

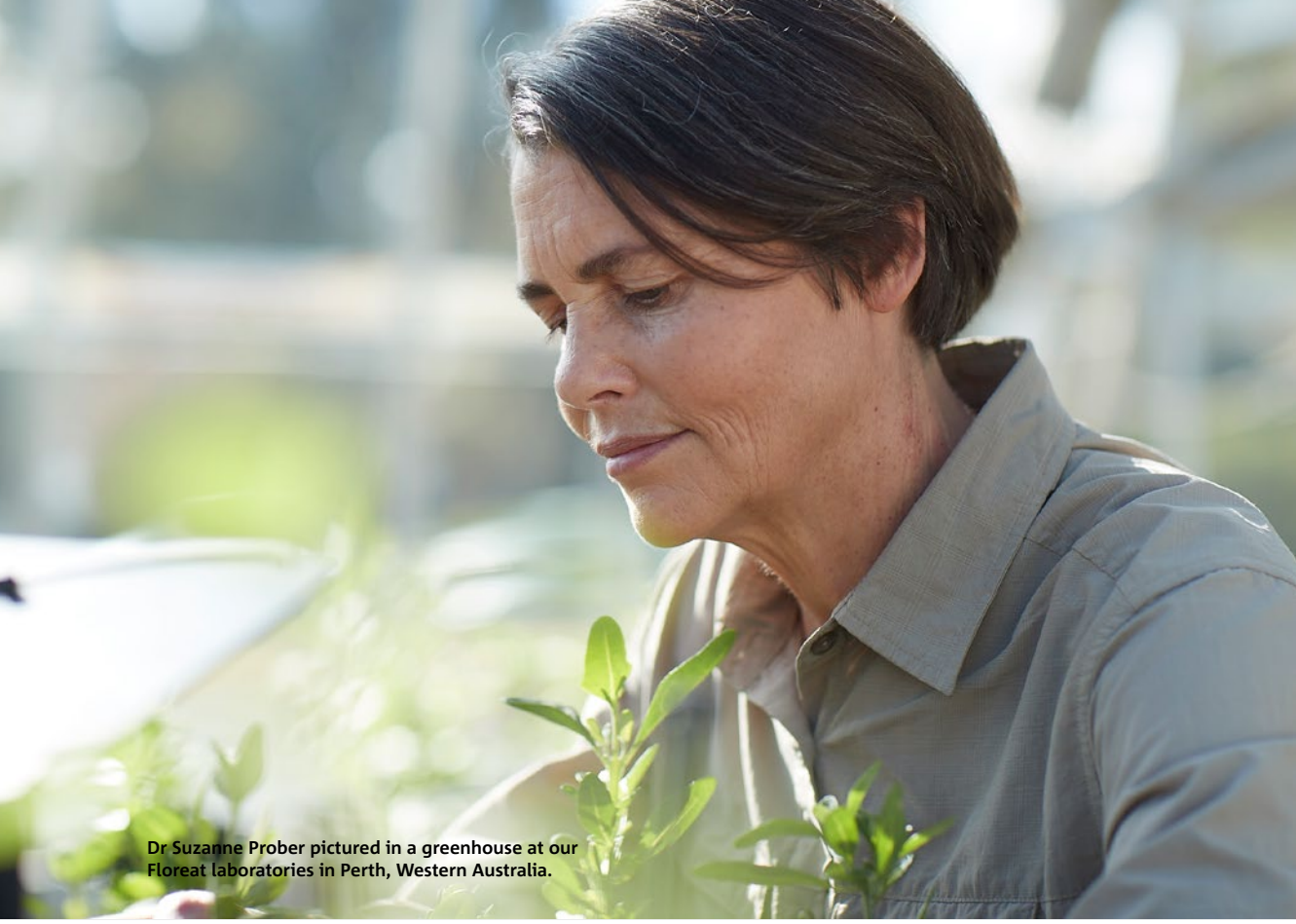
Collaborative networks: integrating the best solutions for our customers, increasing our flexibility, and enhancing Australia's innovation performance.

Science excellence: creating breakthrough technology and knowledge, being a trusted advisor for Australia.

Global engagement for national benefit: delivering connectivity to the global science, technology and innovation frontier, as well as accessing new markets for Australian innovation.

Breakthrough innovation: increasing our capacity to help reinvent existing industries and creating new industries for Australia and delivering public good.

Our BIA5 Titan robot on the Queensland Centre for Advanced Technologies' underground simulation tunnel. The robot is used by our DARPA Subterranean Challenge team to help deploy WiFi nodes and form the main communications trunk for use by other autonomous robots.



Dr Suzanne Prober pictured in a greenhouse at our Floreat laboratories in Perth, Western Australia.

Values

We have worked with our people to co-create our core set of values. These values are central to our cultural vision – they collectively describe what is unique about CSIRO and help us deliver on our strategy.

People first

Caring for everyone's safety and wellbeing. Seeking out, listening to and learning from our differences. We do this by being respectful, caring and inclusive.

Further together

Achieving more together than we ever can alone. Celebrating our successes and our failures, leveraging them to achieve even greater things. We do this by partnering, cooperating and by being humble.

Making it real

Embracing ambiguity, taking educated risks, stimulating discussion and delivering science for impact. We do this by being curious, adaptive and entrepreneurial.

Trusted

Providing dependable, evidence-based answers driven by purpose. Earning trust through everything we do. We do this by being accountable, authentic and courageous.

Preparing Australia for future extreme bushfire events

For almost 70 years we have worked collaboratively in bushfire research, from understanding and modelling the impact of bushfires on the environment to post-fire assessments and improving infrastructure design. We work in partnership with all levels of government, state fire agencies, Traditional Owners, the private sector and communities.

Our scientists are developing reliable tools to predict bushfire behaviour, and advance fire spread prediction and bushfire suppression systems to support recovery and rehabilitation. We train all state fire agencies in fire behaviour and prediction, using world-class facilities and models to understand and manage fires under future climate conditions. Our research and expertise are critical to the timely identification of potential impacts and the ability to issue emergency warnings.

In 1988, we were the first agency internationally to link an increase in bushfire weather severity to climate change. Our research and practical resilience measures relating to bushfires and climate change are vital as Australia faces continued extreme fire weather into the future.

Resprouts of blady grass and pink bloodwood on the foothills of the Great Dividing Range on the Atherton Tablelands, September 2009.

Our diverse bushfire research includes the following: full-scale house burnover experiments; personal bushfire shelter tests and advice; smoke forecasting for bushfires and prescribed burns; testing and the evaluation of fire-safe construction products and materials; and understanding the link between climate, emissions and bushfires. This work has led to improved national building standards and materials, guidelines and regulatory systems, more effective prediction tools, and an improved understanding of the links between climate variability and bushfire weather. Our post-bushfire surveys and research provide invaluable information on how fires impact buildings and communities.

Creating a climate-resistant and bushfire-ready nation

Advice to governments

Following the 2019–20 Australian bushfire season, the Australian Government called on us to help to deliver practical resilience measures in relation to bushfires and climate change. We were tasked by the Prime Minister to deliver a report to Australian governments on climate and disaster resilience, working with the Expert Advisory Panel led by Australia's Chief Scientist, Dr Alan Finkel.

Fire behaviour science

We focus on the study of the behaviour of bushfires and the development of systems to predict their spread and behaviour. We train all state agencies in fire behaviour and prediction, and have world-class facilities and models to understand, predict, and manage fires under future climate conditions. Agencies use our suite of models to predict fire behaviour, and these have been critical to issuing timely emergency warnings.

Spark

We are working on better detection methods, enhanced fire spread simulation models and suppression effectiveness models. When these are linked into a single modelling environment (Spark), they allow agencies to prioritise efforts to suppress new and running fires according to their potential to cause loss. Spark is a state-of-the-art framework for simulating the spread of fire across the landscape and is used by fire authorities in New South Wales (NSW), South Australia, Queensland, Victoria and Tasmania. Read more about Spark on page 40.

Smoke forecasting for bushfires and prescribed burns

We worked with Victoria's Department of Environment, Land, Water and Planning, the Bureau of Meteorology (the Bureau), and the university sector to develop a tool that is being used to help manage smoke exposure from prescribed burns and bushfires. AQFx (the air quality forecasting system) is run by the Bureau and uses a fire spread model to calculate smoke emissions from ongoing fires and planned burns. Forecasts provided by AQFx in 2019–20 were used in Victoria and NSW to anticipate hazards to health, aviation and Australian Defence Force operations. A national rollout of AQFx (endorsed by the Australasian Fire and Emergency Service Authorities Council) is being planned to ensure that advanced warnings of community exposure to smoke from vegetation fires are available for all Australians.

Understanding land management and wildlife impacts

We work in collaborative partnership with Indigenous groups to apply traditional knowledge to bushfire management. This includes the development of protocols for Indigenous fire management partnerships through the Northern Australia Environmental Research Portal. We recognise that Indigenous cultural fire management or 'cultural burning' practices have been crucial to the successful management of Australian landscapes for thousands of years.

Find out more about how we're using science and technology to reduce the impact of fire on Australia's people, environment and economy: www.csiro.au/Research/Environment/Extreme-Events/Bushfire/frontline-support/Preparing-Australia.

Collaborating through adversity to solve challenges

As an organisation we are at our best when responding to big challenges. This year, devastating bushfires, smoke, hailstorms, floods and the global COVID-19 pandemic have tested us personally and professionally on every level.

At CSIRO, we're here to help the nation, but we can't do our best work unless we're looking after ourselves and each other. That's what it means to be a part of Team CSIRO.

Our people have been adaptable and supportive of one another in the challenging circumstances we have been facing. We have rallied to support each other and our communities.

At a time when social distancing pushed us apart physically, it was critical to remember that collaboration and cooperation are the only way to defeat a global challenge, because we can only get further by working together.

A focus on people first from our leadership, like providing flexible work practices via our Balance program, making it real for staff by implementing mobile work practices to support field work, and our ongoing strategy to deliver digital transformation has critically enabled us to get to this point.

Virtually unstoppable: how we delivered our new way of working

During COVID-19, we've had at least 80 per cent of our people working from home – around 4,600 people.

In response, we scaled our remote access and our collaboration and communication services to cater for the increased levels of use.

On average, we were seeing 28,700 minutes of video calls and 1,600 Webex meetings daily, with more than 7,500 participants from around the globe.

Our digital capabilities enabled a relatively smooth transition to working from home, which kept us all connected to ensure we could continue delivering on our purpose.

80%	people working from home
28,700	minutes of video calls
1,600	daily Webex meetings
7,500+	participants from around the globe

Our Research Scientist, Justin Perry, working at Kakadu National Park mixing responsible artificial intelligence and modern science with traditional knowledge.

For the common good

Volunteers have an incredibly positive impact on their communities. We have some amazing volunteers among our people who provided their expert services for the common good during the bushfires.

'During the summer bushfires, I was deployed with the ACT State Emergency Services in support of the NSW Rural Fire Service. I also spent some time at Canberra headquarters in the Emergency Coordination Centre supporting the ACT Rural Fire Service. I have a background in radio operations and volunteered with incident management to dispatch jobs, take radio calls and monitor screens. Volunteering is a great way to get involved in your community, give something back and meet like-minded people.' Jennifer Zhu, CSIRO Senior Coordination and Communications Officer and ACT State Emergency Services (ACT SES).

'I was deployed to fight a fire near Tamworth, New South Wales, for four nights over Christmas. I joined the Country Fire Service because I wanted to contribute to the community. The only thing that is valuable to me is time. Giving up your own time to help someone else less fortunate is the most important thing.' Bill Flynn, CSIRO Education Specialist and Country Fire Service (CFS), South Australia.

Self-distancing support for our working parents

Working from home with young children is challenging. It means working more at night with breaks throughout the day, frequent interruptions, and balancing trying to be a great employee and a great parent.

To support each other, our Director Strategy and Chief of Staff, Mark Bazzacco, started the *CSIRO parents working from home surviving COVID-19* Yammer group (an internal online network).

'We talk a lot about putting our people first, and this group is one small way we are able to recognise the human side of each other's lives and connect on a more personal level,' Mark said.

The group has more than 500 participants who continue to share their tips and tricks during this challenging time.

Understanding COVID-19

Around the world, we're seeing countries and communities being reshaped by the COVID-19 global pandemic.

To assist the nation and the world in understanding the virus, we're drawing on our world-leading researchers to help in the quest for a vaccine. The work builds on our strong history of protecting people in Australia and around the world from the threat of infectious diseases.

Global response

Last year, we entered into a partnership with the Coalition for Epidemic Preparedness Innovations (CEPI) to prepare for disease outbreaks. In January, a CEPI-led consortium including CSIRO and the University of Queensland started developing and testing potential vaccines, aiming to reduce development time from years to weeks. Using the virus strain developed by the Doherty Institute, we were the first research organisation outside of China to generate sufficient stock of the virus to enable pre-clinical studies and research on COVID-19. We commenced testing candidate vaccines from the University of Oxford in the United Kingdom and Inovio Pharmaceuticals Inc in the United States. This work is being conducted at the Australian Centre for Disease Preparedness in Geelong. It is a truly global effort and we know that collaboration and cooperation are the only way to defeat a global challenge.

Around the world, we're seeing countries and communities being reshaped by the COVID-19 global pandemic. To assist the nation and the world in understanding the virus, we're drawing on our world-leading researchers to help Australia's quest for a vaccine.

Understanding the virus that causes COVID-19

Our researchers have been studying the virus – how long it takes to develop and replicate, how it impacts the respiratory system, how the host responds and how it can be transmitted. We're also looking to understand its origins, how it may be changing and how it behaves. We're looking at questions such as what the virus is and how it spreads, where this virus came from, how the virus is changing, how the virus is behaving, and how long the virus can survive.

Fighting the virus

We're working on the testing and manufacture of a vaccine for the novel coronavirus responsible for causing COVID-19. We're working with vaccine developers to produce small volumes of candidate vaccines to the highest quality standards for use in trials. We commenced the first stage of testing potential vaccines for COVID-19 in late March. We are also working with the research sector and industry regarding the preclinical evaluation of therapeutics, to see if they are effective against COVID-19.

Protection from the virus

We're testing the performance of advanced materials produced by local manufacturers to boost the supply of medical equipment, including face masks, needed in Australia's fight against COVID-19. We're also using 3D printing to produce two designs of protective face shields for Queensland healthcare workers.

Understanding the spread

Our researchers, in partnership with the University of Queensland, are refining a wastewater surveillance system to monitor COVID-19 prevalence through tracing fragments of the novel coronavirus gene in raw sewerage. The test provides an early warning of infection, as the virus sheds in the stools of infected people even before they show symptoms. This gives governments an extra public health management tool, which can be used in vulnerable communities, long-haul transport, and even nursing homes.

From advanced analytics, artificial intelligence, social media data analysis, simulation and scenario planning, we're helping government and industry partners inform decision-making.

In Indonesia, through our partnership with the Department of Foreign Affairs and Trade, we're developing a data decision-making platform to help authorities understand where the need for targeted action, direct testing, medical resources and social assistance is needed most.

Investing in innovative Australian companies

The CSIRO Innovation Fund, operated by Main Sequence Ventures, invests in translating publicly funded Australian research into extraordinary global companies. Founded with $100 million from CSIRO and the Australian Government, the Fund has now grown to $240 million following a successful capital raise in 2018.

Since it commenced in September 2017, the Fund has invested in 25 companies across priority areas of feeding 10 billion people, humanity scaled healthcare, exponential machines, space and transport, and new societies.

The Fund has helped to create more than 400 deep technology jobs across the Main Sequence Ventures portfolio of companies.

Coviu

Coviu is a cloud-based video consultation platform that removes the need for physical presence during practitioner-patient consultations. Coviu was co-founded in 2015 by Silvia Pfeiffer and Nathan Oehlman. In 2016, the team participated in the ON Accelerate program and in 2018, raised $1 million from CSIRO Innovation Fund. The investment allowed them to scale and further embed themselves into the primary healthcare space. Read more about Coviu on page 27.

Emesent

Emesent was spun out of CSIRO by scientists Dr Stefan Hrabar and Dr Farid Kendoul in 2018 to commercialise their data collection and drone autonomy, Hovermap. Hovermap automates the collection and analysis of data in challenging, inaccessible environments. Its strongest use is in underground mining where it keeps surveyors safe and away from hazardous areas. After completing our ON Accelerate program, they raised $4.5 million in a funding round led by Main Sequence Ventures.

In less than 18 months, Emesent has grown from a start-up to a mid-sized business; they employ nearly 40 staff and have produced more than 100 Hovermap units.

Hovermap is used at over 60 mine sites around the world, and over 3,000 autonomous flights have been performed. BHP's Olympic Dam site in South Australia was Emesent's first mining customer in Australia, with Anglo American, Newmont, Glencore and Newcrest also on the books. In May, the LKAB-owned mine in Kiruna, Sweden, suffered a severe earthquake. Hovermap was used to map the seismic-hit area and assess the extent of the damage, and support decision-making on safely re-entering the mine. Read more about how Hovermap's technology is being used in the DARPA Subterranean Challenge on page 45.

PROJECT STORY

v2food: delivering on the promise of alternative protein foods

Global population growth requires additional food sources to be developed to complement existing sources of food production. There is also a growing demand for protein products that are produced more sustainably. While plant-based protein alternatives have been available for some time, most are dissimilar substitutes for meat products without the same sensory properties.

Main Sequence Ventures partnered with Competitive Foods Australia and CSIRO to create a new meat alternative company, v2food.

Underpinned by decades of sensory research into food, our leading food research scientists at the CSIRO Food Innovation Centre developed a new line of products with the appearance, texture, smell and taste of meat-based products.

Known as sculptured food, our scientists developed a commercially ready product in only eight months. The products mimic the fibrous and cartilaginous texture of meat, and were produced from legumes, plant fibre, and sunflower and coconut oils.

In October, the v2food product launched and was sold in Hungry Jack's stores in Australia, and in Burger King in New Zealand. Further products have been launched into other food outlets through ingredients delivery company, Marley Spoon, and products will continue to roll out across supermarkets and food service outlets in 2020–21.

As part of the development, we conducted a nutritional analysis and lifecycle assessment to evaluate the full production pathway for plant-based alternative protein foods. We are now working with v2food to access local growers to secure a domestic supply chain for future products, to realise the economic and environmental benefits of alternative protein foods.

In December, v2food secured $35 million in Series A venture capital funding led by Main Sequence Ventures for international and domestic investors to fund further opportunities.

CSIRO's *Growth opportunities for Australian food and agribusiness* report in 2019 found that Australian alternative protein-derived foods could see revenue from domestic and export sales reach $6.6 billion by 2030, highlighting the economic size of the opportunity. Additionally, alternative proteins could add $5.4 billion in carbon emission and water savings compared to traditional sources.

CSIRO-developed alternative protein food is now available to consumers.

Supporting researchers to shape the future

When ON was created in 2015, we were determined to help Australia's most talented researchers and scientists create a positive social, environmental and economic impact with their research and technology.

We received $20 million in funding over four years under the Australian Government's National Innovation and Science Agenda and since then, we've seen just how impactful ON has been.

We have worked with over 700 teams, supported over 2,500 people, collaborated with over 40 partners and our ON Alumni have raised over $75 million in venture funding and commercialisation grants.

Post-program there have been over 60 new companies formed, creating over 250 new jobs – an incredible demonstration of how we've supported the Australian economy and contributed to uplifting the capability of our amazing researchers and entrepreneurs across the nation.

ON's story

2015 ON launched as a CSIRO pilot program and 9 teams completed our first ON Accelerate.

2016 By the end of 2016, we'd helped 58 teams through our ON Prime and ON Accelerate programs.

2017 By the end of 2017, we'd helped 199 teams through ON Prime and ON Accelerate.

2018 By the end of 2018, we'd helped 293 teams through ON Prime and ON Accelerate.

2019 We had our highest number of ON Prime graduates for the second time in a year. By the end of 2019, we'd helped 477 teams through ON Prime and ON Accelerate.

2020 ON has impacted more than 726 teams and 2,549 people through our programs.

ON program highlights:

- we formed more than 60 new companies
- we raised over $37.4 million in investment
- we attracted over $37.9 million in commercialisation grants
- we created more than 250 new jobs
- we partnered with 40 universities and research institutes nationally
- more than 90 per cent of our participants were satisfied with the program
- we embraced digital transformation and delivered our ON Accelerate program virtually this year.

Our graduates

Increasing conservation impacts

After going through the ON Prime program, CSIRO scientist Dr Iadine Chades was inspired to apply lean start-up methodology to conservation technologies and published a paper in *Frontiers in Ecology and the Environment* describing how the techniques could be useful in increasing the impact of conservation efforts. This led to a partnership with multiple governments to use artificial intelligence in their land management. Read more about Iadine's work on page 69.

Silentium Defence

Silentium Defence commercialised a passive surveillance system to address critical surveillance and traffic management demands to better define risk and protect assets. ON Accelerate provided Silentium Defence with business and commercialisation skills, access to networks and mentors, and a pathway from being a research team to a growing small to medium-sized enterprise.

PROJECT STORY

Coviu's video consultation platform removes the need for physical presence during practitioner-patient consultations.

Coviu: putting remote medical access in good health

It's easy to take accessible medical treatment in Australia for granted. If you're an able-bodied person living in or near an urban centre, you're likely to have a suite of medical services at your fingertips.

For the elderly, those with decreased mobility, members of remote communities and individuals with a compromised immune system, physically visiting a medical specialist can be unfeasible. Recently, the COVID-19 outbreak has challenged practitioners and patients to adopt a safe and secure method to deliver and receive healthcare without physical contact.

Coviu is a cloud-based video consultation platform that removes the need for physical presence during practitioner-patient consultations. After participating in the ON Accelerate program in 2016 as a research team, the Coviu team gained the confidence to target the right market segment with their product, and the ability to pitch their idea and product to the healthcare sector. Designed to mimic traditional brick-and-mortar clinics, Coviu's platform facilitates in-house payments, online appointment bookings, in-call clinical tools, and integrates with practice management systems to provide improved continuity of care, greater flexibility, reduced costs and more efficient use of resources.

Practitioners of any profession can set up their own digital practice in under five minutes and start delivering end-to-end encrypted services immediately. Through Coviu's platform, clinicians can connect with their patients remotely, allowing potentially infectious patients to be triaged away from crowded waiting rooms and physical clinics.

The COVID-19 pandemic has seen a rapid uptake of healthcare businesses accessing Coviu since March, with over 10,000 medical professionals using the platform to provide comprehensive, safe and quarantine-compliant healthcare to their patients. Users include physiotherapists, speech pathologists, occupational therapists, dietitians and general practitioners.

Coviu has now held over 200,000 consultations online, and since September it has supported Healthdirect's National Video Call Platform. In 2018, ACIL Allen estimated the net present value of the ON program to Coviu to be $16.72 million.

Our investment in emerging areas of science

A key mechanism to solving the greatest challenges is our investment in cutting-edge, transformative science – science that creates impact.

Our Future Science Platforms (FSPs) are multidisciplinary investments that are reinventing existing industries, creating new industries for Australia, and providing a better future for us all. These strategic initiatives are turning the greatest challenges into opportunities, where innovative science and technology can break through seemingly impossible problems to improve Australia's sustainability and prosperity.

Through FSPs, we're also growing the capability of a new generation of researchers and allowing Australia to attract the best students and experts to work with us on future science.

Since 2016, we've invested in 11 areas of promising new science under our FSPs. Together with our partners, we've developed new technologies and platforms that are changing the way we live. During this year, the program grew to a total annual investment of $90 million.

Our Future Science Platforms

FUTURE SCIENCE PLATFORM	ACHIEVEMENTS IN 2019–20
Active Integrated Matter: ground-breaking advances at the interface of big data, advanced autonomous systems and materials science	Our flow electrochemical reactor, designed using computational fluid dynamic modelling and made using high surface area 3D printed materials, can accelerate a continuous chemical reaction by up to 30 times and dramatically improve productivity for research and industry. Our flexible robot skin protects the vital components of robotic devices from the extreme radiant heat of fires. This protective skin allows robotic devices to be deployed in reconnaissance and victim recovery, avoiding unnecessary risk to emergency services personnel.
Artificial Intelligence and Machine Learning: new approaches to understanding increasingly complex, large and interlinked data sets, ensuring they are interpretable, scalable, ethical and trustworthy	We analysed animal and plant data and proposed new methods to select for higher yields and more resilient strains. We developed privacy preserving machine learning algorithms on federated data, and computer vision algorithms for identifying anomalous events, such as by-catch on fishing vessels or illegal fishing. We also integrated spatial, temporal, and genomic information about the environment for tracking and managing threats, such as germs or invasive species.
Deep Earth Imaging: imaging subsurface rock properties to unlock the potential of the greater depths in the Earth	Government agencies and industry adopted remotely sensed land deformation data to monitor groundwater resources. We received a provisional patent for automated rock typing to speed up the identification of rock types and the acquisition of knowledge about their properties and the resources they host. We developed a new algorithm to harness more of the seismic wavefield to derive more detailed images of the deep earth to guide exploration for mineral and energy resources.

FUTURE SCIENCE PLATFORM	ACHIEVEMENTS IN 2019–20
Digiscape: building a common big data infrastructure to support Australian farmers and land managers	We licensed the Graincast™ crop yield forecasting system to Digital Agriculture Services, opening a path to it becoming an export technology. We also licensed the WaterWise digital irrigation scheduling system to Goanna Ag, who will take it to Australian farmers. We launched two software tools at the environment and agriculture interface: LOOC-C, which allows farmers to quickly assess whether carbon farming will work on their property; and 1622WQ™, which determines if nitrogen from a sugar farm is heading towards the Great Barrier Reef.
Environomics: reinventing how we measure and monitor ecosystem health, predicting environmental change and finding new resources in nature	We discovered a simple way to estimate how long a species lives using DNA. The discovery revealed the lifespans of extinct species such as woolly mammoths and of long-lived and vulnerable species such as whales and turtles. We collected 'eDNA' (the fragments of DNA that animals in the ocean shed) and used this data to quickly and accurately identify the presence of important species of fishes, plants and insects. We are developing a strategy for how Australia's marine reserves can be monitored with eDNA. By reading the DNA sequences and studying the pollen that bees collect on their bodies when they visit flowers, we measured plant biodiversity. Read more about how we're using bees to monitor environmental change on page 96. We also developed a fast and inexpensive way to read DNA sequences from the millions of preserved specimens in Australia's National Collections. This will fast-track how we identify species and how we find new and useful biological resources.
Hydrogen Energy Systems: creating new science, capabilities and technologies across the emerging hydrogen value chain to support new Australian industries and large-scale emissions reduction	We took our world-class plant biology and industry-proofed nitrogen-fixing enzymes and laid the scientific foundation for a game-changing technology to produce hydrogen from sunlight, air, and water. We are building a coalition of partners around a hydrogen industry for Australia, which will accelerate the translation of our multidisciplinary science and technology at an industry-scale. Our hydrogen energy technoeconomics work created new projects for our researchers and for local and international customers.
Precision Health: engaging with communities to create an integrated platform to manage a person's health through tailored food, nutrition and lifestyle interventions	We launched the Innovations in Food for Precision Health initiative, which considers individual and population-level health challenges to give us a better understanding of current and future consumer dietary needs and the environmental, health and economic impacts of food consumption. The initiative will strengthen Australia's science and innovation relationship as part of Australia's Comprehensive Strategic Partnership with Singapore. We partnered with Singapore's Nanyang Technological University to work on the Healthy Ageing Project. Australian and Singaporean health, nutrition and data scientists will explore the cultural differences in people's food and lifestyle behaviours as they age.

FUTURE SCIENCE PLATFORM	ACHIEVEMENTS IN 2019–20
Probing Biosystems: obtaining real-time information from living organisms to provide customised health and medical interventions	NeuroLiB is currently under validation in a prospective clinical trial. This trial will guide clinical translational and generation of commercialisation pathways for this novel diagnostic blood test, which diagnoses traumatic brain injury. We partnered with GenesisCare, the largest provider of cancer care services in Australia, to develop novel theranostic agents for targeting difficult-to-treat cancers. We secured four patents covering novel technologies across multiple MedTech domains, including implantable sensors, diagnostics, therapeutics and small molecule encapsulation.
Responsible Innovation: how we respond to the significant challenges presented by innovation in science and technology	By reviewing the risk governance of nanotechnology research and development in Australia over the last 15 years, we identified a range of well-developed practices in responsible innovation within our organisation along with opportunities to address social risks posted by new technologies more systematically. We identified a range of specific conditions that are likely to affect the confidence of end users who are tasked with making high-risk, high-consequence decisions that rely on predicted data.
Space Technology: identifying and developing the science to leapfrog traditional technologies and find new areas for Australian industry to work in	We're developing a smart, power-efficient data processing system that can get more satellite data to the ground in a short period of time; it will be launched onboard CSIROSat-1 – our first CubeSat – in 2021. We're also enhancing the international Open Data Cube satellite data management and analysis platform to include new types of data that will increase its use and impact.
Synthetic Biology: artificial engineering of biological systems	Using directed evolution, we made coral more tolerant to temperature-induced bleaching. This assisted the coral to adapt and survive hotter conditions and has the potential to reduce the impact of reef bleaching from marine heat waves. We also developed platform technology that enables an engineered bacterial strain to be used as the first step towards developing microbial factories to sustainably produce chemicals that currently come from non-renewable sources.

Our Digiscape Future Science Platform is harnessing the digital revolution for Australian farmers and land managers.

Digiscape

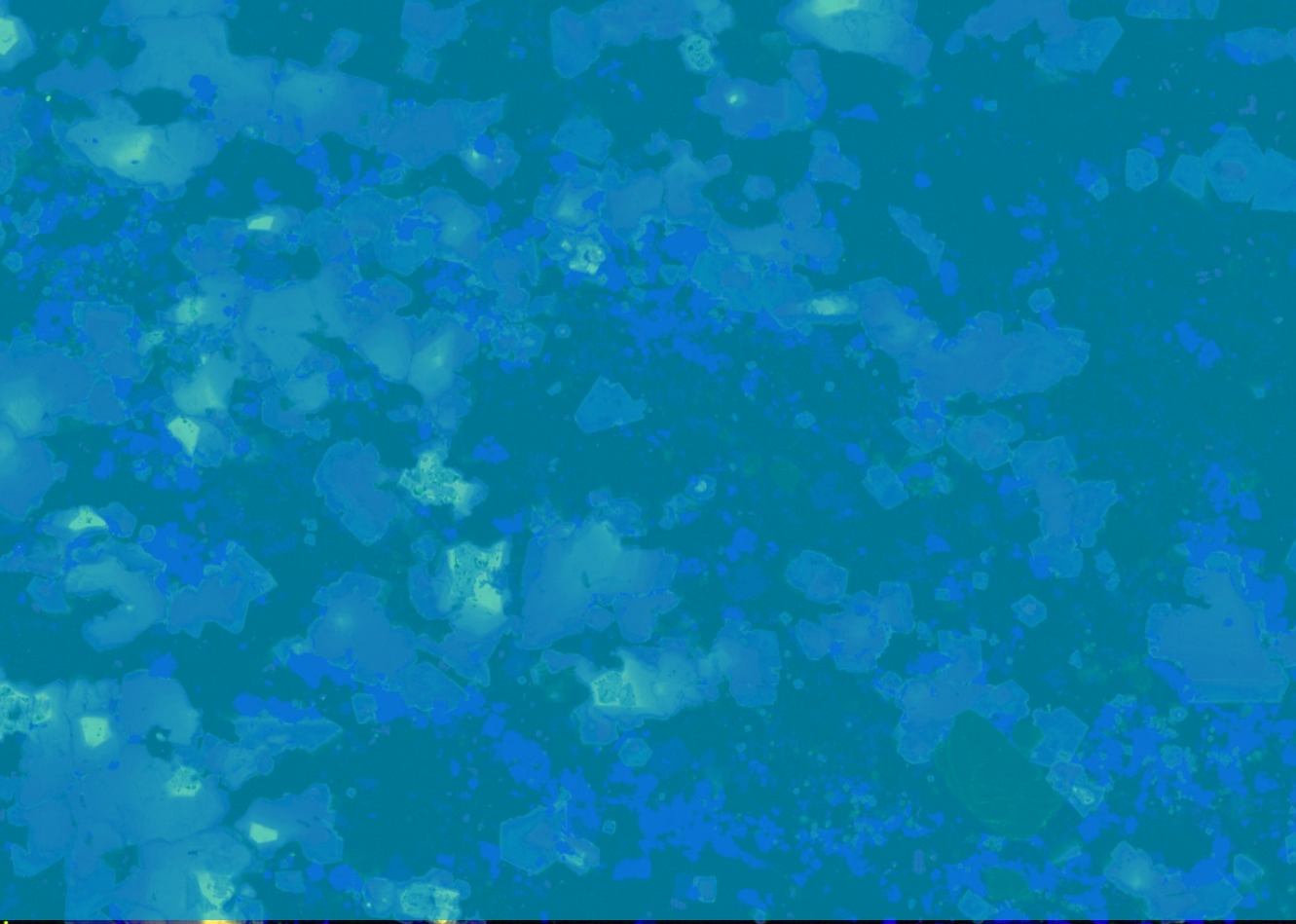
During 2019–20, our Graincast™ crop production forecasting technology was licensed to Digital Agriculture Services, creating a pathway for it to become an export technology. Handling grain in Australia costs approximately $1 billion each year. The Graincast™ app allows farmers to monitor their soil moisture and yield potential to help with sowing and harvesting decisions. This will help to improve harvest, transport and storage efficiency – and as a result – the national economy. Read more about Graincast™on pages 41, 46 and 51.

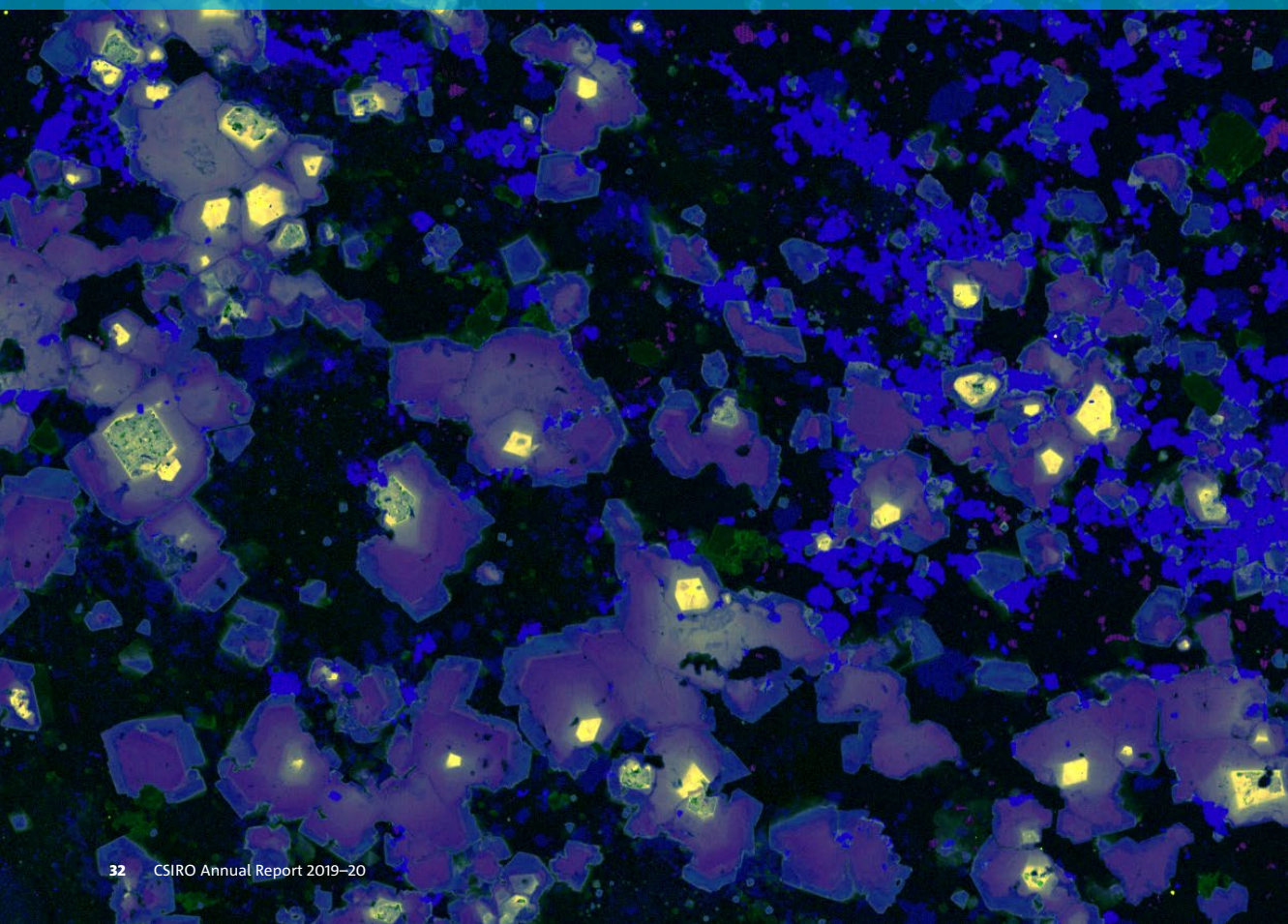
Under Digiscape, we also launched a tool for landholders, LOOC-C ('look see'), to mitigate greenhouse gases. This will help farmers and land managers discover possible carbon projects for their land, assess whether they can participate profitably in greenhouse gas mitigation and maximise the benefits to the land from carbon markets.

We also signed a licensing agreement for WaterWise, an initiative that provides Australian irrigators with digital strategies to apply irrigation water at the right time to optimise yield. Predicting the future is true breakthrough science. It means for the first time, growers can see the water stress of their crops at any point and predict their future water needs.

Environomics

This year, we formed a joint working group with the Federal Department of Agriculture, Water and the Environment to co-develop a strategy for monitoring Commonwealth Marine Reserves with eDNA technologies. Animals in the ocean shed cells and fragments of DNA in the water. We collected water samples, extracted the DNA present, and used barcoding – a global scientific project that identifies a unique sequence of DNA for each species – to identify the species present. Our scientists compared results from eDNA sampling to results gained via more traditional methods, such as counting fish via underwater video footage, to help barcode important species of fishes, plants and insects.





Part 3

Annual performance statements

Introductory statement

The CSIRO Board, as the accountable authority of CSIRO, presents the 2019–20 annual performance statements as required under s39 (1) (b) of the *Public Governance, Performance and Accountability Act 2013* (PGPA Act). These annual performance statements are based on properly maintained records and accurately present CSIRO's performance in accordance with s39 (2) of the PGPA Act.

Delivering on our purpose

We solve the greatest challenges through innovative science and technology.

Our Corporate Plan objectives help us deliver on our purpose and respond to the internal and external environment.

OBJECTIVES	STRATEGIC OUTCOMES
1. Conduct and encourage the uptake of world-class scientific research.	Triple-bottom-line impact to Australia
2. Mobilise and develop the best talent, for the benefit of Australia.	Lift Australia's science capacity and capability
3. Manage national research infrastructure for the nation.	Accessible world-class facilities to underpin research and innovation
4. Ensure the sustainability of CSIRO.	Sustainable operations, cultural health, safety and wellbeing

Revenues from our partnerships, business and commercialisation activities described in this section are summarised in Table 3.1.

We have been successful in managing through the financial disruption caused by the COVID-19 pandemic to deliver an operating deficit of $7 million, which is slightly better than the budget deficit approved by the Australian Government. This was achieved through careful financial management, with total expenses of $1,418 million, externally generated revenue of $573 million, and government appropriations of $838 million. These figures remained materially consistent with the approved budgets.

Results

This section of our annual report provides evidence of our results against the activities and performance measures set out in our Corporate Plan 2019–20 and the Portfolio Budget Statements 2019–20.

Table 3.1: Investment in our research by source, $m

REVENUE SOURCE	2015–16	2016–17	2017–18	2018–19	2019–20
Australian private sector	80.1	86.9	84.4	85.9	86.4
Australian governments	147.8	165.6	173.9	208.9	208.8
Rural industry research and development corporations	31.7	38.7	42.7	44.5	38.2
Cooperative Research Centres	10	12	9.1	9.8	9.5
International and overseas entities	99.3	80.7	93.6	93.2	98.6
Work in progress/deferred revenue	-4.0	-9.3	-2.8	-8.9	-9.2
Total co-investment, consulting and services	**364.9**	**374.7**	**400.8**	**433.4**	**432.2**
Intellectual property – royalty and licence revenues	59.7	51.1	43.2	34.4	28.6
Total research and services revenue	**424.7**	**425.8**	**444.0**	**467.8**	**460.8**
Other external revenue	37.8	57.3	55.1	48.6	40.6
Gain/(loss) on sale of assets	1.2	0.9	0.1	11.5	31.2
Other fair value gains and reversals	-	-	-	1.1	40.8
Total external revenue	**463.7**	**484**	**499.2**	**529.0**	**573.4**
Revenue from government	750.3	787.3	793.5	834.6	837.9
Total revenue	**1,214.0**	**1,271.3**	**1,292.7**	**1,363.6**	**1411.3**
Less expenses	1,270.6	1,292.1	1,352.5	1,396.4	1418.3
Operating result	**-56.6**	**-20.8**	**-59.8**	**-32.8**	**-7.0**

Objective 1:

Conduct and encourage the uptake of world-class scientific research

Our first objective is addressed by three key functions:

FUNCTION		ACHIEVEMENTS	PERFORMANCE MEASURES AND ANALYSIS
1.1	Conduct and facilitate the uptake of excellent scientific and technology solutions to deliver impact to the nation.	Pages 37–57	Pages 57–60
1.2	Connect to global science, technology and innovation to access new opportunities for Australian innovation.	Pages 62–67	Pages 67–68
1.3	Manage funding directed to industrial scientific research activities, commercialisation of technologies and assistance to industry through research collaboration and capacity building.	Pages 71 and 194–198	Pages 71–72

Function 1.1: Conduct and facilitate the uptake of excellent scientific and technology solutions to deliver impact to the nation

Our key activities for Function 1.1 contributed to our strategic focus areas by:

- focusing on challenges and missions
- improving underpinning digital capability
- greater investment in emerging areas of science
- greater commercialisation focus
- industry engagement.

We delivered on this function by:

- conducting scientific research aligned to key national and global challenges and encouraging or facilitating the application or utilisation of results
- establishing collaborations and multidisciplinary research partnerships (with public and private sector organisations, other publicly funded research agencies, universities and schools) to integrate the best solution for our customers
- providing products and technical and advisory services to industry and government including professional consulting and testing facilities.

Conducting scientific research aligned to key national and global challenges

Impact for Australia

Impact is central to our purpose and represents the value created for Australia by the public and industry funding of CSIRO. To achieve impact, we collaborate with other researchers and partner with industry and government bodies that make use of our research.

We use the term 'impact' to define an effect, change or benefit to the economy, society or environment. It arises when industry, government and society implement and use our research outcomes.

To measure and assess our impact, we take an in-depth case study approach to evaluate the diverse benefits from our research activities. Our published Impact Evaluation Guide, updated during 2019–20[1], articulates a common framework, ensuring consistent and rigorous use across our organisation.

This method provides an opportunity to learn from detailed accounts of if and how impact was delivered, leading to a deeper understanding of the mechanisms of systemic change. Case studies are validated by external experts and published on our website: www.csiro.au/About/Our-impact.

We also regularly commission an external assessment of the overall value we deliver to the nation, mainly drawing upon the aggregated impact of case study findings. The most recent finding, from an independent study concluded in June, reports our return on investment to the nation as 7.6:1.

7.6:1 impact return on investment

This has been underpinned by a strong capacity to deliver impact through durable and trusting relationships, a solid understanding of the problems facing our customers and the nation, as well as a deep commitment to building not just our own capability but also that of those in industry, government and the community when it comes to STEM knowledge and skills. When all these factors combine, uptake and adoption of our collaboratively created solutions is more effective, resulting in greater impacts for Australia.

1 CSIRO Impact Evaluation Guide: www.csiro.au/About/Our-impact/Evaluating-our-impact

Partnership with government

Central to our role as the national science agency is to be a trusted advisor and partner to government, ensuring we are working with government to understand and align with national, state and territory priorities, and sharing our research to deliver benefits to industry, the environment and our communities.

We maintain an active relationship with the federal, state, territory and local governments to ensure the breadth and quality of our research is understood and accessible for decision-makers.

Our engagement with government is a two-way partnership. Working in partnership with the federal government helps increase the impact of our research through regulatory change, policy change, and the dissemination of new ideas and technology. Our partnerships with individual state and territory governments are critical to the impactful delivery of our science.

For all tiers of government, having access to world-class research and cutting-edge technological expertise provides insights for current policy development, the creation of future industries and a view over the horizon to challenges that may affect Australia in the future.

State, territory and local governments

State, territory and local governments, as on-the-ground service deliverers and policy makers, are core partners in delivering impact in critical areas of our work. We work across a range of areas, with different and tailored engagements in each region depending on local needs and government priorities. We seek to align our research and research translation strengths to government policies and to optimise outcomes by drawing on the significant research capabilities in state and territory governments and universities. By doing so we can better deliver on our mutual public good goals.

Our Gas Industry Social and Environmental Research Alliance (GISERA), supported by federal, state and territory governments, conducts research into impacts of onshore gas development in Queensland, New South Wales, the Northern Territory, Western Australia and South Australia. In south-east South Australia, our scientists completed four GISERA research projects, with two further projects nearing completion and four additional projects planned. Results of this research provide independent information for communities, government and industry on the environmental, social and economic impacts of conventional gas development in the Limestone Coast region of South Australia. Read more about GISERA's work on page 73.

In May, we announced research that has produced new understanding of mineralisation in the Yilgarn Province in Western Australia, supported by the Western Australian government through the Minerals Research Institute of Western Australia. Researchers found the formation of ancient gold deposits during the Archean period over 2,500 million years ago also produced distinctive patterns of chemical alteration in the surrounding rocks. Looking for these distinctive patterns will make it faster and more efficient for exploration companies to identify potential new deposits.

A cutting-edge 3D visualisation of Western Sydney was launched in February, in a demonstration of what is set to become a step change in urban planning. The digital twin technology was developed by our digital specialists and the New South Wales (NSW) Department of Customer Service's Spatial Services. Digital twin is an open platform that can visualise 3D and 4D data over time, such as buildings, strata plans, terrain, property boundaries, and utilities including power, water and sewer pipes. The technology will allow planners, developers and policy makers to make more informed decisions, saving costs and creating efficiencies. This first phase of the NSW Spatial Digital Twin includes visualisations of the local government areas that comprise the Western Sydney City Deal and Greater Parramatta to the Olympic Peninsula. Future phases of the digital twin in collaboration with NSW Spatial Services will include other areas of NSW.

We are also working with the NSW Government to embed our capabilities in each of the Sydney Lighthouse Precincts: the Aerotropolis, Westmead Health Precinct; and the Sydney Innovation and Technology Precinct. In addition, we are assisting the Regional Growth NSW Development Corporation to develop new industries, capabilities and skills in the regional Special Activation Precincts.

In Darwin, leading researchers and practitioners will examine how the city can cope with future temperatures that remain hotter for longer. In December, as part of the Darwin City Deal, we joined forces with the Northern Territory Government, the City of Darwin and Australian Government to establish the Darwin Living Lab. The Darwin Living Lab is using science and collaboration to support a liveable, sustainable and resilient Darwin and has been tasked with finding out just how hot Darwin is, who is likely to be impacted by extreme heat, and what can be done about it.

Partnership with industry

Businesses work with us to improve competitiveness, reduce risk, expand markets and develop new industries based on our research. It may be to overcome a specific challenge or capitalise on new opportunities. The partnerships we form with our customers enable us to encourage the uptake of our world-class scientific research.

This year we collaborated with both small and large businesses, in addition to government bodies, international organisations and universities. We adopt a range of commercialisation pathways to take our research to market including licensing our intellectual property, providing research in exchange for equity, embarking on joint ventures and establishing spin-outs.

Over the last four years, we have invested in developing our people's commercial and customer engagement skills. More than 1,000 people have participated in this training, and as a result our customers have experienced more targeted conversations, business solutions and impactful commercialisation deals.

Our customers asked for more holistic engagement and we responded with more Strategic Account Managers for our state government collaborations and Account Relationship Managers for industry, commercial, university and international customers.

During 2019–20, more than $510 million, across more than 1,800 commercial contracts, was committed to be invested in our research and services. While this is less than usual due to the disruptions of COVID-19, the average contract value of $282,000 is higher than the five-year average. We engaged with 3,600 industry and government entities, attracting 938 new customers and retaining repeat and ongoing business from more than 2,600 customers.

>$510 million

committed to our research and services

We developed a new Commercialisation Marketplace portal[2], making it easier for companies to explore our pipeline of investment and partnership opportunities, as well as a range of licensing options to catalyse innovation and create competitive advantage. It made 32 technologies available and received 104 commercial interest enquiries from over 20,000 site interactions.

2 CSIRO Marketplace: www.csiro.au/Do-business/Commercialisation/Marketplace

Predicting bushfire spread with next-generation modelling

In Australia, the annual cost of natural disasters is forecast to quadruple from $6.3 billion a year to approximately $23 billion by 2050.[3] Although a natural occurrence in Australia, bushfires can be devastating, particularly when they encounter homes, infrastructure and people. Improved knowledge of how bushfires spread is critical for emergency management operations, risk prediction and issuing timely warnings.

This knowledge can also be used to predict the spread of bushfires using computer models. Predictions can allow better preparation for emergency situations, save lives and make communities safer, stronger and more resilient. However, there are many elements that influence fire behaviour, making it difficult to accurately predict fire spread.

To help combat this, our researchers developed Spark, an open framework that takes our current knowledge of fire behaviour and combines it with state-of-the-art simulation science to produce predictions, statistics and visualisations of bushfire spread.

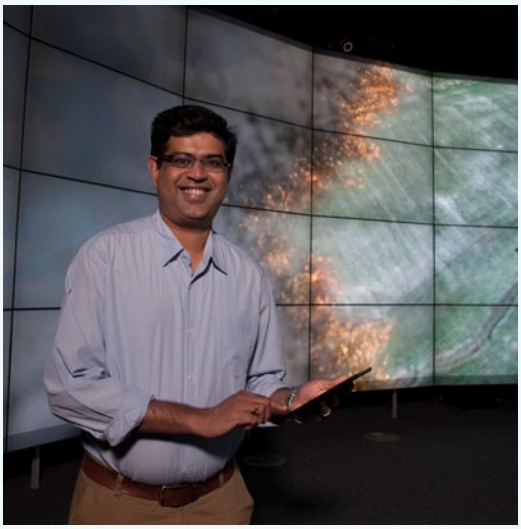
Spark can read meteorological data and use wind, temperature and humidity information directly within fire models. Geographic information, such as land slope, vegetation, and un-burnable areas such as roads and water bodies, can also be incorporated, each with their own defined fire spread rate. The platform also allows simulation of any number of distinct fire fronts, multi-front interaction, and coalescence as the fire evolves.

Spark can simulate hours of fire spread across a landscape in a matter of seconds. Due to its fast computational time and capabilities, it can be used across infrastructure planning, land management and fuel reduction burning, firefighting resource allocation and deployment, evacuation route planning, reconstructing historical fire events, ecological impacts and fire regime studies, and suppression strategy analysis.

Thousands of simulations can be run in parallel, across different spatial locations, or using different weather conditions. This allows Spark to provide information on when communities and assets will be reached by fire, and for users to create customised risk maps over large regions or conditions.

Spark is being used for scientific research into fire spread mechanisms, including new fire behaviour model testing, research into automatic fuel estimation from remote sensing data, investigations into wind and fuel variations, fundamental forms of fire shape, wind and terrain interaction, and to develop new spot fire models.

Spark has been trialled by New South Wales, Victoria, South Australia, Queensland and Tasmanian fire authorities, and we are in discussion with authorities in the United States, South America and Europe about potential international trials. Development continues with new features being considered, including planning modules for preparing for other emergencies, such as terrorist threats and chemical accidents, and incorporating virtual reality devices for users to be placed in an immersive simulated environment.



Senior Principal Research Scientist, Dr Mahesh Prakash, demonstrating how Spark takes current knowledge of fire behaviour and combines it with state-of-the-art simulation science to predict bushfire spread.

3 australianbusinessroundtable.com.au/assets/documents/White%20Paper%20Sections/4.%20The%20cost%20of%20natural%20disasters.pdf

Science excellence

The high quality of our research is central to the value we provide to the nation. It is the foundation that enables us to partner with industry, government and society to achieve impact for Australia.

Science excellence is one of the strategic pillars that guide us as we deliver on our purpose to solve the greatest challenges through innovative science and technology. The conduct of strong science not only indicates high-quality scientific capability within the organisation, it also drives profound real-world impact. Here are some recent examples of where our impact has been founded on excellent science areas.

Ningaloo Outlook

The Ningaloo Outlook was a strategic five-year $5.4 million partnership with BHP to increase our understanding of Ningaloo's reefs and iconic megafauna. The project had a broad range of impacts including collecting additional data to support the ongoing sustainable management of the reefs, STEM engagement in schools, extensive community engagement and the tracking of megafauna movement.

Work on this project was underpinned by our outstanding capability in the field of environment and ecology, where we are ranked 13th globally by total citations. Our outputs make more than twice the global average level of academic impact and represent 12 per cent of Australia's publications in the field. Read more about Ningaloo Outlook on page 56.

Graincast™

Another impactful project underpinned by science excellence is Graincast™, a breakthrough technology for forecasting grain yield. As part of our Digiscape Future Science Platform, we built the tool to provide estimates of crop area, near real-time forecasts of crop yield, and estimates of uncertainty for the agricultural value chain to make better – and new – decisions. In early 2020, we licensed exclusive global rights to the technology to Digital Agriculture Services (DAS), an Australian rural technology start-up, of which we are a founding equity partner.

The impact of this project was underpinned by our excellent capability in the fields of plant and animal science, and agricultural sciences. We are ranked 12th in the world by total citations for both fields; our agricultural publications are cited almost 50 per cent more than the global average, and in plant and animal science, almost 75 per cent more. We produce 14 per cent of Australian agricultural publication outputs and 12 per cent of plant and animal science publication output. Read more about Graincast™ on pages 29, 31, 46 and 51.

Fast radio bursts

An Australian-led research team using fast radio bursts identified by our ASKAP radio telescope solved a decades-long mystery: the detection of missing 'normal' matter in the Universe. Knowing the distances to enough fast radio bursts, and measuring the small frequency-dependent delays in their signals as they arrive at the telescope, allowed the team to determine the density of the Universe.

Our accomplishments were underpinned by our excellent capability in astronomy and space science. We are ranked 150th in the world by total citations, with our work receiving 76 per cent more citations than the global average and accounting for nearly a sixth of Australia's publications in the field. Read more about our use of fast radio bursts on page 91.

Research publications

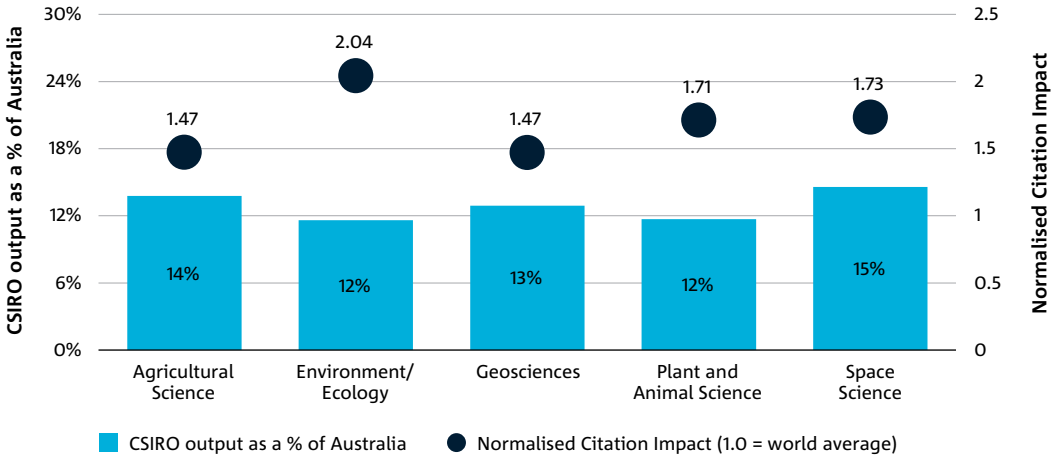
A standard way of evaluating scientific performance is by looking at the publications produced from research and how often they have been cited by other works. Our overall science excellence can be measured by looking at how frequently our work is cited and normalised for subject patterns, and the age of the material. This Normalised Citation Impact (NCI) is a standard indicator and allows for global comparison.

Top 0.1%

ranking globally in four fields for our publications

Our metrics show citation levels that are significantly higher than global average. Our NCI performance in the fields for which we deliver crucial impact remains strong; we are ranked in the top 0.1 per cent of institutions globally in the fields of Agricultural Science, Environment/Ecology, Geoscience, and Plant and Animal Science, based on total citations over the last 10 years. We have held this position in these four fields for 15 years – for as long as we have tracked this performance. More than half of our publications appear in these four fields. We also remain in the top one per cent of global institutions for our largest 15 of 22 scientific fields.

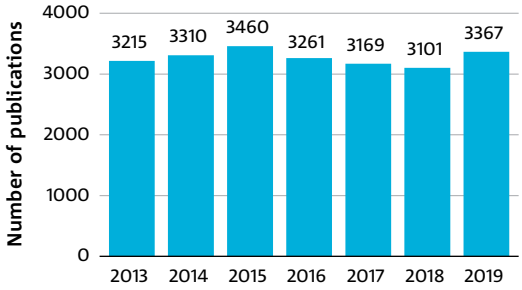
Figure 3.1: Our top five research fields and their citation impact



Source: InCites, Articles and Reviews, 2015–19

Figure 3.1 shows five of our major fields of focus and for each, how strong our publications are and how much we contribute to Australia's output. For these five fields, we author at least 10 per cent of the country's publications, indicating a core role in the nation's research activities. We are at least half again more cited than the global average in these fields, except Environment/Ecology, where we are twice as cited as the global average.

Figure 3.2: Our journal publication output



Source: Web of Science, Articles and Reviews, All Indices excluding ESCI

As shown in Figure 3.2, our publication output rose last year, from 3,101 to 3,367, the first increase after three consecutive declines.

The earlier decline was due to the decrease in our research staff in previous years, lagging that change because of the time it takes to conduct and publish research. This year's rise in output can be expected to continue as it reflects the gradual increase in staff after 2015. While the bulk of our publication output takes the form of peer-reviewed journal articles, we also produce substantial numbers of conference proceedings, along with some book and online materials. We also author and release numerous client and technical reports each year. See Table 3.3 on page 48 for further details of collaboration in publication.

We produce an annual Science Health and Excellence Report, which analyses our scientific performance using a range of indicators in more detail. Read the report on our website: www.csiro.au/en/About/Our-impact/Reporting-our-impact/Performance-reviews/Science-Excellence-for-Impact.

Climate-proofing the Northern Territory mango industry

Mango growers in the Northern Territory have new information to use when planning for the future thanks to an initiative of the National Environmental Science Program's Earth Systems and Climate Change Hub, which we host.

Mangoes are the Northern Territory's largest horticultural product. In 2018–19, nearly half of the national crop, which was worth $199 million, was produced in the Territory. Harvest timing and yield is closely linked to the initiation of mango flowering, which can be promoted by low night-time temperatures and inhibited by high day-time temperatures. Temperatures have already increased by around one degree Celsius since 1910 and could warm by up to around five degrees Celsius by the end of the century.[4] Understanding when the critical temperature thresholds are crossed for different cultivars is important information for growers – particularly those looking to invest in new plantings – and for the industry.

Working with the Northern Territory Department of Primary Industry and Resources, we combined projections of the future climate with what we know about the response of different mango cultivars to these temperature thresholds. Researchers were able to determine when the thresholds for six different mango varieties would be crossed in 12 growing regions across the Northern Territory and in Kununurra, Western Australia. As the century progresses under a high emissions scenario, some cultivars will be drastically impacted, with growing areas around Darwin particularly vulnerable to change.

While there are other factors to consider with regards to climate change and the sustainability of the mango industry in the Northern Territory, the results of this assessment flag that there may need to be significant changes for growers and the industry to maintain sustainable production in the future.

With these results, growers can identify appropriate on-farm adaptation responses that will serve to ensure continued production and viability. Adaptation options could include canopy management, transitioning cultivars, relocating orchards or orchard cooling. On a larger scale, the mango industry can identify ways to support growers to take the necessary responses and to ensure the strong mango market is maintained.

The success of this science was made possible through collaboration facilitated by the Hub, which has a focus on making climate change science accessible. The methodology underpinning the Hub's science engagement ensures that climate change data and information delivered to stakeholders is useful and used. As demonstrated in this project, the Hub's stakeholder engagement-driven activities have proven to be an effective way to deliver impact from our science.

Growing new cultivars that are better suited to the expected future climate in the Northern Territory is one way the mango industry will be able to adapt to a changing climate. Credit: Maddison Clonan, Northern Territory Department of Primary Industry and Resources.

4 The Climate Change in Australia projections for the Monsoonal North indicate warming of 0.6 to 1.8°C by 2090 under RCP2.6 and 2.8 to 5.1°C under RCP8.5.

Fire-resistant panels for ships

CBG Systems is a Tasmanian manufacturer of insulation for aluminium hulled vessels such as ferries and catamarans. They came to us for ideas on how to expand their insulation into other maritime vessels and increase their market share – fortunately, we were already working on a project that could be used with CBG's insulation to develop a new prototype.

Our Hybrid Inorganic Polymer System (HIPS) technology is a resin that acts as a ductile adhesive as well as a thermal protective coating within a composite system. The main application of the resin was intended as an adhesive, however HIPS can withstand temperatures of over 1000 degrees Celsius and remains stronger than fragile intumescent coatings generally used for fire protection under such conditions.

The HIPS technology was adapted to develop a multifunctional composite material that met marine fire protection regulations and achieved target weight reduction specifications. This new system became the basis of CBG's next generation RAC Plus panels, meeting all the same standards of their previous insulation system with wider applications than before.

CBG Systems negotiated an ongoing license with us for the HIPS technology to manufacture their new insulation at scale. This has opened up an ongoing relationship with a local manufacturer using our technology in their products.

We helped CBG Systems secure two grants to support the adaption of the HIPS technology. A separate Accelerating Commercialisation grant was secured by CBG Systems to help fund a state-of-the-art manufacturing facility in Hobart. Our lead researcher worked to assist CBG Systems with the new manufacturing process using the HIPS technology, to ensure CBG Systems was ready to manufacture their new insulation at scale.

CBG Systems created six new manufacturing jobs as a result of their new facility. Global demand has already seen orders for CBG Systems received from Spain and Denmark.

CGB Systems' collaboration with us has given a business with a 30-year history in insulation a new product range with wider application. Advanced manufacturing jobs have been created in Australia, and CBG Systems is exploring other applications for their new, co-developed insulation.

The RAC Plus panels are fully non-combustible and remain structurally strong after exposure to extreme heat. Credit: CGB Systems.

Using robotics to improve safety in complex environments

Ensuring the safety of people in high-risk environments is a critical challenge across many industries. Research shows that 17 Australians have been fatally injured in the construction and mining industries so far in 2020, representing 24 per cent of all recorded work-related deaths across the country.[5]

Our researchers have demonstrated that machine learning and robotics can play a crucial role in improving workers' safety. They are participating in the three-year DARPA Subterranean Challenge, funded by the United States' Defense Advanced Research Projects Agency. The challenge requires teams to develop and demonstrate technologies that can map, navigate and search three different underground courses, including the inside of a nuclear power plant.

The team of scientists showcased our world-leading expertise by pairing legged and tracked robots with novel Hovermap drone autonomy technology, which can operate in areas where GPS is not available. The team was able to rapidly explore and generate 3D maps of underground environments using LiDAR (Light Detection and Ranging) scanners, providing unprecedented situational awareness for use in time-critical scenarios, such as disaster response.

Using cutting-edge software that we developed, along with cameras and sensors, the robots generated a map of the underground structures and stayed in touch with the scientists through communication nodes designed to operate in harsh environments.

Participating in the challenge is helping to fast-track the development of these technologies, which have huge potential for improving safety and efficiency in a range of industries including mining, transport, building and construction, defence and agriculture.

It will enable us to build on our strong track record of translating robotics and autonomous systems research into real-world impact, such as with Hovermap. Hovermap completed the world's first fully autonomous beyond line-of-sight drone flight in an underground mine, 600 metres below the surface in Western Australia. The team that developed this technology spun out of Data61 into a start-up company, Emesent, which delivers efficiency, safety and operational insights directly to underground mining and other industries (read more about Emesent on page 24).

Atlas, an autonomous robot used in the DARPA Challenge to map unknown areas and communicate remotely.

5 www.safeworkaustralia.gov.au/statistics-and-research/statistics/fatalities/fatality-statistics

Future Science and Technology

Developed during 2019–20, our Future Science and Technology (Future S&T) plan provides guidance on the science, engineering and technology capabilities we will need to develop to deliver on our purpose. It acknowledges that research methods are shifting rapidly as digital disruption, non-classical-quantum sciences, and multidisciplinary and interdisciplinary science and technology accelerate the pace at which we can shape the future and solve our greatest challenges.

Future S&T has identified 10 cross-cutting capabilities (CCCs) to enable enhanced collaboration and inclusivity across our organisation, foster professional development and improve organisational capabilities to ensure our long-term sustainability and future impact.

Further to this, Future S&T has engaged widely with staff to capture insights on emerging, potentially transformative areas of research and development. These Emerging Horizons are areas for further exploration beyond our existing capabilities, which will be continually refreshed and expanded with investment through our existing pathways, such as postdoctoral positions or science leaders. Future S&T will also ensure that we keep pace with predicted changes in the use of laboratories and scientific equipment into the future, as we do more of our design and testing in computers before hands-on experimental work. We anticipate that practices will transition as we accelerate the adoption of robotics, artificial intelligence and machine learning to make the most effective use of laboratory space.

Future Science Platforms

To maintain our research at the cutting edge, our Future Science Platforms program is strengthening key cross-organisational capabilities to ensure our long-term sustainability and future impact. Read more about our Future Science Platforms on pages 28–31.

Encouraging or facilitating the application or utilisation of results

Commercialising our intellectual property

Intellectual property (IP), in its different forms, is the output of our research. Managing and protecting this IP is important for the path to impact for a significant proportion of our research and for the translation of our research into a commercial product.

For example, the IP for v2food played a role in the product's success in a competitive market. The IP strategy was designed to protect the product from being copied. v2food's first product, a burger patty, was launched as the Rebel Whopper in more than 440 Hungry Jacks stores around Australia in October. Read more about v2food on page 25.

In maintaining our portfolio of protected IP, at the end of June, we had 675 active patent families, 320 trademark families and 82 plant breeder's right (PBR) families, as detailed in Table 3.2. There was a consistent level of new patent, trademark and PBR filings during the financial year, which is a good indicator of investment into existing technology making its way through the pipeline, and it highlights our focus on global strategy.

As an indication of how much of our IP is in use, presently, 53 per cent of our patent portfolio is either subject to a research right, arose as a result of collaborative activity, was used as background IP in a collaboration or evaluation, or is the subject of a commercial licence.

Technology licences are used as key indicators of research and development uptake and adoption by customers and collaborators. The total number of active licences recorded at 30 June was 455, of which 300 have generated revenue.

300 technology licences generating revenue

The total number of active licences marginally increased in comparison to last year. However, our total number of revenue-generating licences has increased significantly. New IP licences, such as our Graincast™ technology licence to Digital Agriculture Services Pty Ltd, and multiple licences for Ontoserver software into healthcare settings in Australia and abroad are forecast to have a positive impact on Australian industry and contribute to the strength of our intellectual property commercialisation revenue stream.

Table 3.2: Our intellectual property portfolio

IP CATEGORY	SUB-CATEGORY	2017–18	2018–19	2019–20
Patents	Provisional applications	53	55	64
	Patent Cooperation Treaty applications and direct filings	69	53	48
	Patent families	686	679	675
	Granted	2,140	2,244	2,233
	Live cases	3,876	4,065	3,997
Trademarks	Australian	264	273	271
	Overseas	45	52	49
Plant Breeder's Rights	Australian	57	59	59
	Overseas	25	20	23
Registered designs	Australian	2	2	3
	Overseas	3	5	6

Quality patents and other IP rights continue to yield significant returns. In the last five years alone, IP has directly underwritten $45 million of revenue from WLAN, $22 million in new equity positions, plus more than $158 million in cash royalties and fees from other technologies.

Growing companies for impact

We partner with large and small companies who we believe are best placed to take new technologies to market and deliver positive outcomes for Australia.

In addition to the traditional model of licensing our technology to third party companies, we also take an ownership stake in companies that use our world-class technology or research and development capabilities where there is a business case and a compelling reason to do so.

There are several pathways we may take when we acquire an equity position in a company. We spin-out new, high-technology SMEs, where we recognise the value of a technology and bring together commercialisation resources, management teams and investors to create and support entirely new companies that create new jobs and value for industry. We also make our research and development capabilities or IP available to early-stage companies with limited resources.

In these situations, we assign our IP to the new company in exchange for an ownership stake or take shares in a company as payment for our IP and services. These arrangements can help a start-up company preserve their cash resources, which increases the likelihood that the company will successfully reach its goals and objectives.

At the end of June, we held investments in eight active listed companies, 25 unlisted companies and three early-stage venture funds (including the CSIRO Innovation Fund, managed by Main Sequence Ventures). The combined value of these holdings is disclosed in Note 2.1C on page 162 of our audited financial statements.

Mining industry disruptor's success backed by strong science and relationships

Backed by the financial acumen of RFC Ambrian, Adelaide-based disruptor, Chrysos Corporation, is using our cutting-edge material analysis technology to improve returns to gold mining companies.

Chief Executive Officer, Dirk Treasure, said Chrysos, which was founded in 2016, brought together a strong network of leading scientists, engineers, manufacturing specialists and commercialisation managers.

'The company model that was adopted when Chrysos was spun out meant that we were able to do what we do best – and that's commercialise the technology,' Mr Treasure said.

'We were able to take the science that was developed by CSIRO and continue developing it to a level that made the most commercial sense.'

Establishing collaborations and multidisciplinary research partnerships

Research collaboration

Beyond partnering with industry and government, we also collaborate extensively with universities and research institutions, both in Australia and internationally, in order to achieve impact.

Our collaboration in Australia's innovation ecosystem, at a range of scales, helps knowledge flow from ideas to testing concepts, to translation for impact for industries and communities.

University collaboration

Our collaborations with universities are multifaceted and occur at different scales for different purposes, ranging from an individual researcher to strategic whole-of-institution, impact-focused partnerships. Most of our collaborations with Australian universities occur in joint research projects and result in joint publications. At the same time, we contribute to training the next generation of STEM researchers by co-supervising postgraduate students with 30 universities – helping to build our own and the nation's talent pipeline.

Table 3.3 shows the numbers of jointly supervised higher education (research) students and joint authorship papers for the universities we most actively collaborate with. The table also illustrates on a research field basis the universities with which we had highest number of joint papers.

Over the past five years, 68 per cent of our publications were co-authored with domestic collaborators, including all research-active Australian universities, and 62 per cent included international co-authors. In the research fields of Plant and Animal Science, Agricultural Science and Environment/Ecology (all key areas of our science; read more on page 42), collaboration output with the Universities of Queensland, Western Australia and Tasmania were extensive. Collaborations in Chemistry and Materials Science were strong with the three universities in Victoria: Monash University, the University of Melbourne and RMIT University.

We have long-term partnerships with Victorian universities with a key strategic focus on working together to support the Victorian manufacturing sector. In Space Science, we collaborate with Curtin University, the University of Sydney and the University of Western Australia. More details of our co-authoring are available in our annual Science Health and Excellence Report published on our website.

Table 3.3: Highlighting our most active university collaborations

UNIVERSITY	NUMBER OF COLLABORATIVE PUBLICATIONS	CO-SUPERVISED STUDENTS	PLANT AND ANIMAL SCIENCE	AGRICULTURAL SCIENCE	GEOSCIENCES	ENVIRONMENT/ ECOLOGY	CHEMISTRY	MATERIALS SCIENCE	SPACE SCIENCE	ENGINEERING
University of Melbourne	1,361	26	–	–	–	–	119	93	–	–
University of Queensland	1,328	46	222	101	–	278	–	–	–	–
Australian National University	1,215	95	–	–	–	–	–	–	–	93
University of Western Australia	1,199	33	157	98	–	220	–	–	157	–
Monash University	1,129	75	–	–	–	–	229	215	–	–
University of New South Wales	1,044	75	–	–	–	–	–	–	–	79
University of Sydney	881	28	–	–	–	–	–	–	192	–
University of Tasmania	857	59	191	–	155	167	–	–	–	–
Curtin University	658	24	–	–	158	–	–	–	207	–
University of Adelaide	651	19	–	130	–	–	–	–	–	–
RMIT University	519	49	–	–	–	–	142	86	–	–

Benefit for the Basin

The Murray-Darling Basin is a national icon under stress in a changing climate.

Ensuring this Australian food bowl remains healthy and productive is vital for the communities, environment and industries relying on it. The Basin covers 14 per cent of Australia and is home to more than two million people. Its agriculture (both dryland and irrigated) accounts for almost 40 per cent by value of Australia's agricultural production.

The Basin is in one of the world's most variable climate regions, where catchment inflows in a wet year can be more than 20 times greater than the inflow in a dry year. It's a system facing profound future challenges to adapt to a drier, hotter climate.

To better manage water under this likely future, we need to know the key climate drivers across the Basin, and how they're likely to change due to global warming. We also need to understand where and when rains will fall, and what evaporation rates and water use can be expected.

We have delivered decades of world-leading research in the Basin. Water allocation and use in this important water resource is contentious, with many different water users and beneficiaries.

During average flow years there is tension around the various uses of water and through dry years, particularly in an extended drought, water allocation decisions are often contested. The challenges in the Basin also extend to the management of other natural assets beyond water.

The Basin is a complex social-ecological system facing many drivers of change, and an understanding of this is vital for informing its long-term management.

Acknowledging this complexity, we collaborate to provide the best scientific advice to those who depend on, or benefit from, the Basin.

Our lessons and scientific achievements from the Basin have been shared with water managers globally. We continue to provide science to support the best possible outcomes for communities, industries, and the Basin as a whole, now and into the future.

River Murray at Murtho, South Australia.

To complement our researcher collaboration, we contribute to training and developing Australia's research workforce by supervising more than 1,850 undergraduate and postgraduate university students each year. Some of our major collaborators in co-supervision include the Australian National University, Monash University, the University of New South Wales and the University of Tasmania. More details of our role and programs are available in Function 2.1 of this report on page 50.

Furthermore, 11 of our sites are co-located with universities. At these sites we often jointly fund and develop shared research infrastructure and equipment.

We assemble or participate in cross-institutional teams to bring together the right capability to achieve solutions and benefits for Australia, such as our work on the Great Barrier Reef. We manage and maintain significant national research infrastructure for access by national and global research teams.

We develop long-term partnerships with industry to support the development and commercialisation of new technology that will transform sectors, such as in our partnership with Nuseed and in Cooperative Research Centres. We also fill critical gaps in the system by developing bespoke ways to enable early stage companies to access our resources and know-how, as depicted in the Lindfield Collaboration Hub.

Collaboration in the Great Barrier Reef

The Great Barrier Reef (GBR) is an iconic world-heritage listed site of major importance to Australians, but a poor long-term outlook is projected from the impacts of climate change. In 2018, the Federal government funded a two-year $6 million feasibility study into a range of science and engineering-based interventions for reef restoration and adaptation. We contributed to the project to design the Reef Restoration and Adaptation Program (RRAP) led by the Australian Institute of Marine Science (AIMS) and with collaboration from James Cook University, the University of Queensland, Queensland University of Technology, and Southern Cross University.

Planning for the program has involved taking a coordinated systems approach to stakeholder mapping, public consultation and conceptually testing the feasibility of potential science-based interventions. In April, a report detailing the outcome from this critical planning work was provided to the Australian government.

The $250 million RRAP will seek to develop an innovative and world-leading toolkit of safe, acceptable interventions to help the reef resist, adapt to and recover from the impacts of climate change. The program will be funded in part from *The Reef Trust – Great Barrier Reef Foundation Partnership* six-year grant with additional contributions from the collaborating parties.

In addition to contributing great research capability to the feasibility study, we provided a broker to ensure internal coordination within our organisation and in turn strengthen inter-institutional collaboration. With this, the relationships and engagements, and the science being delivered are more harmonised, integrated and efficient.

Collaboration with Nuseed

We developed technology to produce omega-3 oils in canola. Since 2011, we've worked in partnership with the Grains Research and Development Corporation and subsequently Nuseed, an Australian company with global reach with its canola business. Together we've refined and translated this into an innovative canola crop and new paths to market. This collaboration is helping Nuseed achieve its vision to move from being part of a traditional siloed agricultural supply chain to delivering new technology-based end-to-end value chain.

The result is a sustainable source of healthy long-chain omega-3 oils equivalent to those found in fish oil. The new value chain combines plant-based innovation with coordinated farm and processing technologies to produce traceable proprietary oils. These oils will be used in aquaculture feedstocks and nutraceuticals for human nutrition. Global demand for healthy oils is growing fast and outstripping conventional supply. Omega-3 canola provides a new sustainable source that will reduce pressure on the world's fisheries and at the same time give Australian grain growers a new high-value crop.

Regulatory approval has been obtained in several countries to grow the crop and to use the oil products for specific purposes. Commercial-scale crop production has begun in Montana and North Dakota, in the United States of America, with the first oil already crushed this year. Initial trials with aquaculture companies have been very successful and supply contracts are expected to be confirmed during 2020. Australian grain production is planned in the coming years.

Graincast™: Australia's breakthrough grain yield forecasting technology

Managing Australia's annual grain harvest is a huge logistics challenge for farmers and agri-businesses. Handling grain in Australia, including planning for harvest, transport, storage and marketing, costs in the order of $1 billion each year. Even small improvements in efficiency could result in significant benefits for our 30,000 grain growers, grain handlers and the national economy.

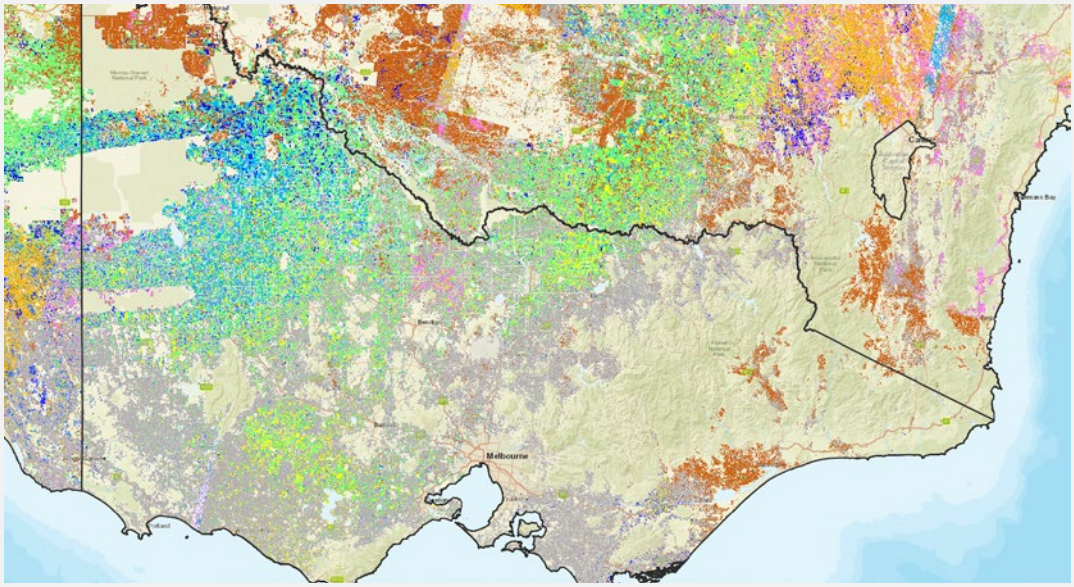
Each operator along the grains supply chain has a unique need for customised grains information, however, Australia doesn't have a comprehensive national system for forecasting yield and geo-locating crop areas with required accuracy at a locally relevant scale.

As part of our Digiscape Future Science Platform (read more on pages 29 and 31), we built a breakthrough, real-time grain forecasting, monitoring and crop identification technology, Graincast™, for the Australian grain growing industry. Graincast™ provides estimates of crop area, near real-time forecasts of crop yield, and estimates of uncertainty for the agricultural value chain to make better – and new – decisions.

Developing Graincast™ was technically complex and required a range of skill sets from agronomists to climate scientists, data and machine learning experts, satellite and remote sensing experts, software engineers and social scientists.

The Graincast™ smarts are packaged in multiple ways for different parts of the grain supply chain. There is a simple, free app, available at graincast.io for farmers to monitor their soil moisture and yield potential at the touch of a button. The Graincast™ app monitored 750 paddocks over the 2019 growing season and is being accessed by farmers as the 2020 growing season progresses.

Graincast™ also produces yield forecast maps at paddock, farm or regional scale for any part of the country for multiple grains. In early 2020, we licensed exclusive global rights to the technology to Digital Agriculture Services (DAS), an Australian rural technology start-up of which we are a founding equity partner. For the first time, farmers can now see their 2019 Graincast™ results integrated with a range of other publicly available agri, rural and climate risk insights at no cost on the DAS Rural Intelligence Platform™ at digitalagriculturereservices.com.



Graincast™ can identify crop type and forecast crop yield at any scale for any part of the country.

Cooperative Research Centres

The Cooperative Research Centres (CRCs) program supports collaborations between researchers, industry and the community to foster high-quality research and development. The program enables research teams to assemble across institutions, and industries to connect to inform research priorities and rapidly take up research outputs to maximise impact.

Since the CRC program commenced, the Australian Government has funded 230 CRCs and 28 were active in 2019–20. We are the single biggest research organisation involved in CRCs and have contributed to more than 150 CRCs over time; this year we participated in 17 CRCs. We also participated in 16 CRC Projects (CRC-Ps). These are smaller collaborations that operate on project timelines of up to three years and grants of up to $3 million. The total cash and in-kind contribution to CRCs and CRC-Ps this year was $18.4 million.

$18.4 million
contributed to CRCs and CRC-Ps.

This year, we became a member of SmartSat CRC. This is an important national initiative bringing together international and national partners. It aims to deliver smart satellite systems that are Australian designed and owned to provide real-time connectivity, surveillance, and sensing capability in space and over land and sea. The outcome of this research will be development of IP and specialist industry expertise that will create new businesses, export economic value and generate new high-tech jobs for Australians.

We also participated in the Blue Economy CRC, which is one of the largest CRCs the government has funded. Industry and researchers are tackling the growing global demand for high-value seafood products by using innovative offshore infrastructure powered by affordable, renewable energy. Aquaculture is the fastest growing food-producing sector in the world – Blue Economy CRC will manage our marine resources and drive advanced manufacturing and technologies to deliver benefits for Australia.

In March, the successful outcomes of Round 21 were announced, which will see us participate in two additional CRCs:

- CRC Transformation in Mining Economies, which will address the complex challenges underpinning mine closures and transforming mining economies to enable Australian regions and their communities to build a successful post-mine future.
- Reliable Affordable Clean Energy for 2030 Cooperative Research Centre, which will deliver better value for energy customers, reduced energy costs and emissions, and improve overall network reliability.

Cancer Therapeutics CRC collaboration produces drugs with the potential to save lives

Throughout 2019–20, we collaborated in the Cancer Therapeutics CRC, a Melbourne-based cancer research organisation at the forefront of discovery science dedicated to finding cures for cancers.

The CRC specialises in the small molecule approach to treating cancer by modulating (switching on or off) cancer causing-proteins in the body. This is a more targeted approach than using radiation or chemotherapy.

Through this collaboration, we contributed expertise in protein science – producing drug targets and characterising the interaction of small molecule drug prototypes with the drug targets.

The Cancer Therapeutics CRC expects three drugs to go into clinical trials within the next year – a result of our collaborative efforts with the Walter and Eliza Hall Institute of Medical Research, the Peter MacCallum Cancer Centre, universities and biotech companies.

These therapeutics have the potential to reduce suffering and save lives. They are also attracting investment and helping to create jobs and support growth, with four preclinical licensing deals executed.

Lindfield Collaboration Hub

The Lindfield Collaboration Hub is just one example of the unique opportunities we offer to start-ups and early stage SMEs. The hub improves access to our staff and facilities for development of specialist optical systems and electromechanical device manufacturing. Since 2016, with support from the NSW Government, 1,500 square metres of our site has been made available as affordable laboratories and offices. This is to facilitate collaboration for start-ups to take their ideas from science principles through prototyping, to proof of commercial viability. In these four years, 47 companies (with 350 staff) have been involved as tenants or participants in innovation programs associated with the Lindfield Collaboration Hub.

Tenants have access to a maker space, support staff and industry events including seminars, workshops and networking. Benefits include fee-based access to engineering workshops, characterisation facilities, staff and facilities at the co-located National Measurement Institute and the Connect@Lindfield program, a variant of the ON program for industry. This innovation program provides structured business model and commercialisation readiness testing, and it facilitates relationship building with the Australian research community.

Companies who have been part of the Lindfield Collaboration Hub have provided feedback during this year that these facilities are not available elsewhere and provide a critical pathway to success for early stage companies. Affordable access to suitable facilities has accelerated product development. Co-location with other early stage companies and our researchers has provided a forum for sharing and exploring research and development problems and ideas, identifying potential funding sources and better accessing technical information.

Providing products, and technical and advisory services

Advice for government

We provide research and technical input to government to assist in evidence-based policy and program development and decision-making. This includes briefings and reports in response to government requests for advice, sharing papers we developed, and input into consultation processes and parliamentary inquiries. If longer-term support is required, we may provide experts through a secondment to a government department or agency. For example, this year we provided a resource economist to assist the government's waste and recycling taskforce.

In November, the Australian Government released its artificial intelligence (AI) technology roadmap. The roadmap, which we developed, outlines the importance of action for Australia to capture the benefits of AI, estimated to be worth $22.17 trillion, to the global economy by 2030. It leveraged our data science and digital expertise and was developed for the Australian Government in consultation with industry, government and academia. It identified strategies to help develop a national AI capability to boost the productivity of Australian industry, create jobs and economic growth, and improve the quality of life for current and future generations.

Our Transport Network Strategic Investment Tool (TraNSIT) has revolutionised the way Australia's transport-related infrastructure investments are prioritised. It is used widely by all levels of government to inform our country's largest transport infrastructure projects and initiatives, reducing costs and increasing the resilience of our freight supply chains. TraNSIT was listed as a key contributing tool for the National Freight and Supply Chain Strategy, which was endorsed by the Transport and Infrastructure Council in August as a plan for integrated national action across all freight modes over the next 20 years and beyond.

In May, we published a Quantum Technology Roadmap, which shows that Australia's quantum technology sector could generate over $4 billion annually and facilitate 16,000 jobs by 2040. The roadmap identified short-term actions that can help to build on the nation's competitive advantages and capture this valuable opportunity. This roadmap was collaboratively developed, and we provided regular updates to Australia's Chief Scientist, Dr Alan Finkel AO, Australia's Chief Defence Scientist, Professor Tanya Monro, the Department of Industry, Science, Energy and Resources, and relevant stakeholders in state governments to inform policy development and decision making.

Assist government decision-making

We have significant expertise in developing tools to assist with decision-making, for example in modelling and data analytics. We regularly work with government to develop these tools that can be directly used by policy makers, or that can be made available to sectors of the community (such as farmers) by government as part of government programs.

The Australian e-Health Research Centre (AEHRC), our digital health research program and a joint venture we have with the Queensland Government, used its deep health knowledge and expertise to support state and federal governments with their responses to COVID-19. The AEHRC health system analytics team has worked with a number of state health departments on their forecasting models, which are being used to make decisions by health services. The AEHRC also developed an Australian COVID-19 dashboard and made it available to state and federal health agencies to provide timely and useful national and international data along with advanced modelling of the data for decision-making.

Throughout 2019, we visited all 56 of Australia's Natural Resource Management (NRM) regions with experts from the Bureau of Meteorology to explore how historical weather observations could provide insights into changes experienced in the region. The result of these consultations, combined with further data analysis by the Bureau, CSIRO and Farmlink, are localised climate guides for each NRM region, funded through the Commonwealth Government's Drought Assistance Package. The climate guides present historical weather and climate information from the last 30 years of observations, and in doing so, describe the current climate in the context of short- and long-term regional variability. The aim is to provide farmers and agribusinesses with agriculturally relevant climate information so that they can make the best decisions based on information from the past and the future.

Delivering government programs

In some cases, we run entire programs on behalf of government, where the programs require specialist expertise and connections that we can provide.

In March, the Department of Industry, Science, Energy and Resources appointed us as the national delivery partner of the Innovation Connections and Incubator Support elements of their Entrepreneurs' Programme. Through this program, for example, we supported Queensland company TAE Aerospace to commercialise our Guardian Mentor Remote wearable technology system and make it available to the global aerospace industry. We identified the University of Newcastle as having the right expertise and connected them with Norris, an Australian SME, to evaluate the energy efficiency of their cold wash-cycle commercial dishwasher to support marketing to existing and new customers. We also supported Yolngu Business Enterprises to develop the capability to control destructive ant infestations for mine site rehabilitation, environmental management and construction services in north-east Arnhem Land. More examples are published on our website and see page 81 for more information on the Innovation Connections program.

On behalf of the Department of Foreign Affairs and Trade, we are managing Aus4Innovation, an $11 million development assistance program that aims to strengthen Vietnam's innovation system, prepare for and embrace opportunities associated with Industry 4.0, and help shape Vietnam's innovation agenda in science and technology. The program is being undertaken in partnership with the Vietnamese Ministry of Science and Technology and is funded by the Australian Aid program. Aus4Innovation is about creating and using science, innovation and technology for economic, social and environmental benefit and through the Science Commercialisation Partnerships, we have delivered a number of workshops for local partners. The workshops focused on connecting research to market, building commercialisation capability, and scaling for sustainability and impact.

CSIRO Energise

Australia is in the midst of an energy transition.

Our energy use is changing. The way that people use, store and interact with energy is very different today, given changes in environmental conditions, advancements in technologies and socioeconomic situations.

Our energy research into low-emissions technologies, electricity grids and storage is guiding Australia towards a smart, secure and sustainable energy future. But a crucial component is understanding how Australians use energy.

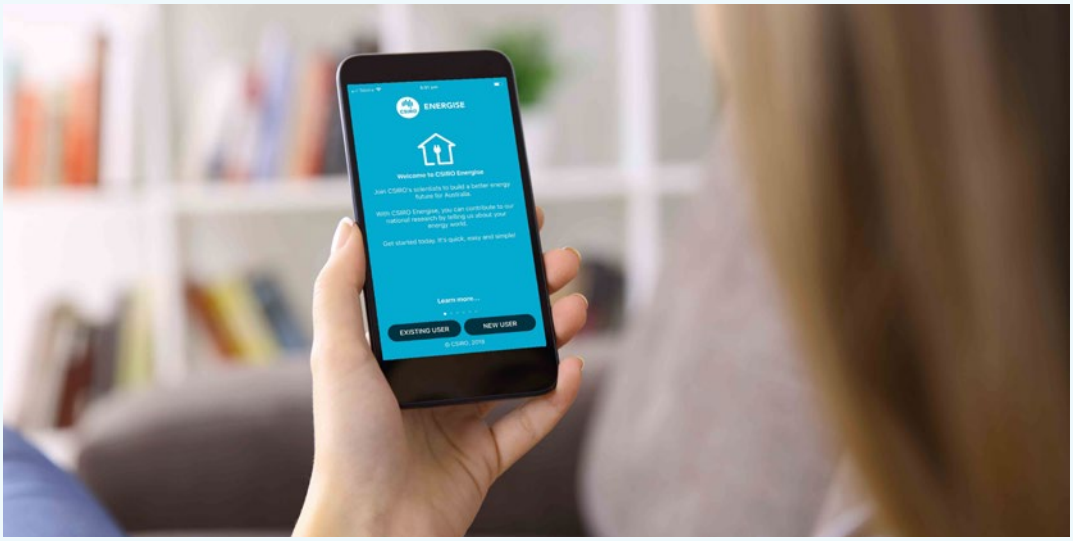
Previously, paper surveys were posted to a subset of Australians to collect information about how they use energy in their homes. This was time-consuming and expensive, and receiving responses from large numbers of households was very limiting.

To broaden the survey scope, our social scientists and energy researchers developed a mobile app that could be downloaded and used by anyone at any time. This meant we could achieve a greater representation of Australian respondents in terms of geographic location, household type, form of dwelling, gender and age. The ingenuity of the CSIRO Energise app also allowed surveys to be sent out regularly to accumulate data from the same households and in real time.

In this time, more than 60 surveys were sent out, and more than 3,800 people downloaded and used the app. We received large amounts of data about how different types of people across the nation use energy.

The data includes energy consumption patterns, demographics, building characteristics, appliance uptake and more. We're using this information to understand better the energy behaviours of Australians, which will help us to deliver more advanced energy science. The data has also been used in our National Energy Analytics and Research (NEAR) Program. NEAR collects, integrates and enhances information about Australia's energy use and then informs decision-makers and the public through a tailored web platform.

Another major outcome of the CSIRO Energise project was the associated social science research – we found that many Australians are interested in contributing to a more secure, affordable and sustainable energy future. App users indicated that they wanted to complete the surveys because of a desire to help and contribute. These altruistic motivations helped to determine survey frequency and feedback mechanisms, and informed the app's design and content. This in turned helped us to retain users. We also used the results to develop our communication and engagement strategies with our energy citizen scientists.



The CSIRO Energise app provided in-depth, regular and timely energy-use data from real Australian households to inform our energy research.

Research to support local community and managers of a World Heritage-listed coral reef

The Ningaloo Coast hosts one of the world's longest and most extensive fringing coral reef systems, along with globally significant abundances of large megafauna, like whale sharks. Its uniqueness led to inscription on the World Heritage list, and in recent years, Ningaloo has attracted hundreds of thousands of tourists, who bring tens of millions of dollars of revenue to the region. But Ningaloo's ecosystems, and their ability to support the tourism industry, are being challenged by pressures like global climate change, as well as ever-increasing human use. Successful navigation through these challenges relies on sound science to identify the pressures, the changes they create and the ways that we can mitigate them.

Ningaloo Outlook was a strategic five-year $5.4 million partnership with BHP, which involved a program of research to increase the understanding of Ningaloo's reefs and iconic megafauna.

Ningaloo Outlook also supported a PhD scholarship program and involved active participation by the remote community of Exmouth, including the local school. With school teachers, the team integrated real-world science into the Science, Technology, Engineering and Mathematics (STEM) curriculum through engaging, hands-on activities that reached over 450 students. The partnership has demonstrated the relevance of STEM careers and teachers have reported increased uptake in year 11 and 12 STEM subjects.

Surveys of deep reefs used autonomous underwater vehicles, together with experimental deployments of artificial substrates, to measure where and when coral larvae arrive and grow into juveniles. The research revealed clear patterns in the arrangement of the biota living on the seafloor, which remained consistent from year to year, as well as unique biodiversity, such as exceptionally high numbers of mushroom corals in one 'Goldilocks Zone'. Companion surveys of shallow reefs extended one of the Australia's longest coral reef datasets (2006–19) and revealed that Ningaloo's northern coral reefs are in relatively good condition – although there has been some localised coral decline caused by heatwaves and cyclones. The surveys also highlighted that the amount of marine debris (including plastics) is very low.

Megafauna tagged by Ningaloo Outlook researchers provided insights like the extensive movement of whale sharks, with tagged individuals transmitting from places as far afield as the Gulf of Carpentaria, Christmas Island and south-western Australia. The diving patterns yielded by recovered tags have allowed estimates of their risk to ship strikes – research that is informing how industry can adapt their practices to minimise this risk. Innovative use of a portable ultrasound demonstrated that turtles resident at Ningaloo tend to nest elsewhere. In contrast, turtles that nest at Ningaloo arrive from an area extending from Shark Bay to the Kimberley.

Ningaloo Outlook has provided vital information on the trends and condition of the region's natural assets, as well as insights into the movements of megafauna to and from Ningaloo. This information is provided to government and industry, as well as the broader community, who together will make critical decisions that affect Ningaloo in the future.

Shallow reef survey at Ningaloo. Credit: Ningaloo Outlook Shallow Reef Research Team/Dan Orr.

There are two rounds of funding; the first took place in October. The three projects announced were awarded $1.6 million and are focusing on global challenges including water pollution, overfishing and early breast cancer detection. Round two projects will be announced in late 2020.

Our efforts this year contributed to us delivering towards our outcomes (see Table 3.4):

- The application of research benefits to the Australian economy, society and environment.
- The provision of timely advice, information, and specific solutions inform and protect society and the environment.
- New knowledge and solutions are available to be used by academia, government and customers.
- Strong relationships with universities and other research organisations enhance Australia's innovation capacity.
- We are trusted as the national science agency and have a reputation for world-class pioneering research.

Table 3.4: Summary of our performance for conducting and facilitating the uptake of excellent scientific and technology solutions

PERFORMANCE MEASURES SOURCE: 2019–20 CORPORATE PLAN	TARGET	RESULT
Impact: value of benefits created for Australia		
Demonstrated value of benefits underpinned by an increasing annual portfolio of externally validated impact case studies capturing triple-bottom-line impacts	Evidence of maintained or increased impact	**Achieved**: substantial triple-bottom-line benefits have resulted from our work and are demonstrated by 25 impact case studies.
Customer satisfaction		
Customer Net Promoter Score (NPS) maintained with increased sample	NPS +40	The **survey was not conducted** due to COVID-19 disruptions to many of our customers.
Research is recognised as excellent, referenced and used by academia		
Normalised Citation Impact (NCI)	NCI 1.5	**Achieved**: NCI 1.5
Science and technology is adopted and creates value for industry		
Mixed methods quantitative assessment of equity portfolio; 3-year rolling average of revenue from intellectual property (i.e. royalties, licensing); spin-out companies established and the creation of new SMEs facilitated	Maintain or increase across each method	**Achieved**: SMEs and other companies created and grown, yielding substantial returns from commercialisation of CSIRO technology, outweighing a slight downturn in royalty proceeds.
Effective collaborative relationships with the research and development sector		
Demonstrated evidence of the value created from deep R&D collaborative relationships with mixed methods including joint publication, formal partnerships and qualitative assessment	Evidence of the value created in a collaboration from a mixed methods assessment	**Achieved**: multi-party collaboration in the Great Barrier Reef Restoration and Adaptation Program will contribute to preserving national heritage.
CSIRO is recognised as a trusted advisor		
Business Sentiment Survey: awareness of potential to work directly with CSIRO and knowledge of CSIRO	Increase year on year	The **survey was not conducted** due to COVID-19 disruptions to the business community.

Analysis of performance

Impact: value of benefits created for Australia

During 2019–20, we completed the targeted 25 impact case studies across our portfolio. These represent not only value delivered by our research activities, but also building our ability to assess impact from our national facilities, collections and services programs.

Here are some examples of studies completed during 2019–20.

Microencapsulation

We developed the MicroMAX® suite of food production technologies (1999–2019) for microencapsulation of bioactive nutrients to protect them from degradation during processing, storage and gastro-intestinal transit. This also helps with enabling the incorporation of some nutritious ingredients in the food items with sensory acceptability and masking undesirable flavours in some applications.

The benefits of MicroMAX® include, in the production process, improved efficiency and productivity, with a lower environmental footprint as longer shelf life of food items result in less food wastage. For the business, benefits identified are new services, products, jobs and market niches enabled by new technologies, with both domestic demand and export revenue from products based on the technology. Ultimately, it contributes to the health and wellbeing of the community through access to high nutritional value food products.

3D Situational Awareness (3DSA)

3DSA is a cost-effective situational awareness technology for factories and other industrial settings that provides a range of benefits including reducing the risk of collisions, injuries and property damage, improved workflow, and increased productivity in manufacturing operations and factory floors.

The ability of the 3DSA system to provide real-time information and record the movement happening in real time is where its greatest value lies. The system uses scalable and customisable security cameras to track movement and records information onto a database for advanced analytics of the flow of materials around a factory or distribution centre – where people walk, check in and out, and the movement of product and vehicles – that standard 2D safety LiDAR cannot detect. The 3DSA system is the only system currently available on the market to achieve this. The anticipated benefits to multiple industry sectors from increased labour productivity and cost savings from deployment are expected to be substantial.

The Centre for Australian National Biodiversity Research (CANBR)

The CANBR provides a point of truth for reliable, repeatable and verifiable plant specimens, improving accessibility of plant specimens and data. Access is maximised through the digitisation of plant specimens. CANBR conducts basic and applied collections-based research and generates new tools and methods for species identification.

The benefits of CANBR include enhanced biological security, improved biodiversity and adaptation to climate change, enriched human capital through collaboration between researchers and government agencies, and improvements in data accessibility through digitisation and the imaging of the collection in support of future research.

Consolidated analysis

Analysis of 120 impact case studies conducted over the past five years provided insights into the critical drivers of success and further understanding of the link between research excellence and impact. In summary, our analysis found that designing and producing excellent science is an important element in delivering impact, as long as other required factors are also in place, including:

- the ability to work and build trust with others
- clear and commonly understood research problems
- planning for impact
- identifying boundary spanners
- tracking what is critical to an impact pathway to help with decision making.

We also regularly commission an external assessment of the overall value we deliver to the nation, mainly drawing upon the impact case study findings. The most recent finding, published in June, estimates a 7.6:1 return on investment, an increase from 2018's result of 6:1.

Disruptive gold analysis technology from Chrysos expands into Kalgoorlie goldfields

Analytical services – worth more than $1 billion globally – are an essential part of the mining value chain, from exploring for new deposits through to running profitable extraction operations.

In an industry facing declining ore grades, rapid analytical technology has the potential to unlock substantial productivity gains in gold mining and production and open up a significant new market for real-time analysis services in onsite applications.

For example, gold processing plants may only recover between 65–85 per cent of gold present in mined rock. With some plants producing around $1 billion of gold each year, hundreds of millions of dollars' worth of gold may be going to waste. Even a modest five per cent improvement in recovery would be worth around half a billion dollars annually to the industry.

Chrysos has now deployed two more PhotonAssay gold analytical systems at the MinAnalytical laboratories in the Kalgoorlie goldfield in Western Australia.

We developed an automated solution that offers mineral analysis data in minutes. It is a reliable alternative to traditional chemical analysis methods, which can take days to deliver results.

The technique – based on gamma activation analysis – uses high powered x-rays to bombard rock samples and activate atoms of gold and other metals. A highly sensitive detector then picks up the unique atomic signatures from these elements to determine their concentrations.

In 2016, we partnered with a network of experienced investors and industry professionals to form Chrysos Corporation Limited (Chrysos) to quickly bring the technology to market.

Now trademarked as Chrysos PhotonAssay, the solution offers a rapid alternative to the conventional, 500-year-old fire assay technique, which involves sending samples off to a central laboratory, where they are heated up to 1200 degrees Celsius and generally destroyed.

Chrysos PhotonAssay is non-destructive and can deliver results in just a few minutes without generating any of the toxic waste products that are problematic in other assay systems. The technology provides an innovative solution to drive better and faster decision-making across the value chain.

Major mining services company Perenti (formerly Ausdrill) became the first to adopt the technology, offering Chrysos PhotonAssay at its MinAnalytical laboratory in Perth from mid-2018.

Chrysos' plans to bring the solution closer to mine sites for near real-time turnaround on assay results is now reaching fruition. In 2019, two more Chrysos PhotonAssay systems were commissioned in the MinAnalytical laboratories in the Kalgoorlie goldfield. MinAnalytical also reported that they are looking to roll out more units in Western Australia with an agreement that will see the drilling firm take on six additional machines over the next three years.

This year, we updated our approach for quantifying our return on investment. In past years, we compared all estimated benefits from a typical year of research to our annual operating budget. Our new approach is, for each year, to compare the benefits to the costs of research for a specific time period (recent years' actuals plus up to 10 years of projections). This will create, in effect, the equivalent of a moving average return on investment that places less emphasis on historical patterns and more emphasis on current value generation. The new method was developed by RTI International, an independent non-profit research institute. We believe this new approach delivers a more accurate representation of our value.

Customer satisfaction

Net Promoter Score (NPS) is a key performance metric of our performance analysis. It is industry standard, globally, and a measure of advocacy and loyalty. We have experienced continued customer satisfaction over the past four years, evidenced by our NPS increasing from +11 in 2018 to +45 in 2019, which exceeds targets. Our recent customer satisfaction performance indicates that we are listening to our customers and partnering with them in collaborative and commercially realistic ways.

We decided not to undertake a Customer Satisfaction Survey in 2020, out of consideration for the impact of the COVID-19 pandemic on our customers. Many of our customers are facing uncertain business and economic circumstances, and we continue to partner with them for impact and are actively supporting them in their recovery journey post-COVID-19.

Research is recognised as excellent, referenced and used by academia

Our citation performance is effectively stable; our NCI (excluding medical research) increased slightly from 1.48 to 1.50. This means our NCI is 50 per cent higher than the global average, based on publications produced from 2015–19, compared to 48 per cent for publications from 2014–18. It indicates that our science quality is stable relative to the world average. The sensitivity of the metric means that a more sustained upward trend would be required to represent a real improvement. We ranked eighth this year against the 40 publication-active Australian universities, compared to ninth using the same metric last year.

The NCI (excluding medical research) metric has now been adopted as it is more reflective of our research and our relative performance. However, it is slightly different to results published in previous years, which also included medical research in the NCI calculation. Using the previous calculation method yields an NCI of 1.49, unchanged since the result of 1.49 reported last year.

Science and technology is adopted and creates value for industry

Overall, the commercialisation of our outputs has created substantial value for industry this year, creating and growing companies and other ventures and the workforces they employ. A share of this growth is attributed to CSIRO, recognised as $81.4 million of realised and unrealised returns to CSIRO in 2019–20, an increase of 46 per cent compared to the previous year.

This result was largely due to a material appreciation in the value of a number of companies that had been spun-out by CSIRO in past years, representing the success and growth of these companies. Some of the companies that have made significant strides in deploying CSIRO technology include Chrysos (read more on pages 47 and 59), NextOre, v2food (read more on pages 25 and 46), and PolyNovo (read more on page 68). In 2019–20, we entered six new equity deals, double the historic rate, including three that facilitated the creation of new SMEs. Furthermore, as part of proactive portfolio management, $7.5 million worth of shares were sold for reinvestment of the proceeds.

Our renewed and more deliberate choices in structuring the pathway to market, in addition to the maturing of our portfolio, have resulted in a shift in the realisation of commercial returns. Whilst gains arise from increases in equity holdings, average returns for royalties and licensing revenues over the past three years, at $35.9 million per year, are slightly less than the $38.8 million average for the three years to 2019. The decline is primarily attributable to reduced royalties from agricultural products as drought impacts crop yields.

$35.9 million

per year in royalties and licensing fees

Collectively, these results represent great successes of our commercialisation strategies in enabling industry to adopt and create value from our research outputs and support.

Effective collaborative relationships with the research and development sector

We have made major contributions to Great Barrier Reef (GBR) research over the past two decades, primarily in the areas of agricultural production, natural resource management, and estuarine and marine sciences. This portfolio of research has involved multiple areas within CSIRO and included many other research organisations and stakeholders.

Together, we have achieved significant science, industry and policy outcomes and impacts, such as influencing strategic discussions around climate change, reef restoration and adaptation, as well as significantly increasing the acknowledgement of the role of, and contributions made, by Aboriginal and Torres Strait Islander people.

Critical to our success has been the coordination of our various and valuable inputs made by each partner. Since 2016, Dr Christian Roth has played a key role in synchronising our interactions with many organisations, ensuring scalable solutions are targeted at addressing this complex challenge.

An evaluation of the coordinator role found that the function made a positive and significant difference, especially strengthening engagement with key GBR stakeholders, facilitating and enriching relationships, connecting and integrating different fields of science and expertise, and improving integration and collaboration both within CSIRO and with other parties. Stakeholders reported that, without the role, the research would have continued to be fragmented, disjointed and inefficient.

This has enabled us to make a critical contribution to the Reef Restoration and Adaptation Program, led by the Australian Institute of Marine Sciences.

After the completion of the feasibility phase, in April the government announced a $150 million program that also includes the University of Queensland, Queensland University of Technology, James Cook University, Southern Cross University and the Great Barrier Reef Foundation.

Our ongoing ability to collaborate with multiple other parties, from within diverse parts of CSIRO, is essential to maximise the benefits of this program and contribute to the preservation of Australia's Great Barrier Reef.

CSIRO is recognised as a trusted advisor

We strive to be recognised as a trusted advisor for Australian industry and governments on behalf of society, providing solutions and advice based on scientific research. We seek the views of industry through an annual survey as an indicator of achieving this trusted advisor status.

We decided not to undertake a Business Survey in 2020, out of consideration for the impact of the COVID-19 pandemic on Australian businesses. As a proxy, we refer to the positive results of our survey of the general community, which show a total favourable trust score of 81 per cent, up two per cent from 2019, indicating that we are trusted by the community. More details are on page 115.

Protecting ecosystems from invasive weeds

Weeds pose a serious threat to biodiversity, agriculture, and human health and wellbeing. A series of cost-benefit analyses in 2006 revealed that for every dollar spent on biocontrol of weeds, agricultural industries and society benefited by $23.

Plants become weeds when they are introduced to a new country without natural enemies such as insects and disease-causing organisms like fungi and bacteria. This leads to their unchecked growth, which in turn affects the economic or ecological sustainability of an ecosystem.

Our scientists have been working on the biological control of weeds since the 1920s when they rid Australia of the prickly pear cactus by introducing an Argentinian moth. This is the practice of managing a weed by the deliberate use of one or more natural enemies (biocontrol agents) that suppress it.

In addition to managing invasive weeds in Australia, we also collaborate internationally to support scientific research and impact. For example, we've worked in partnership with the United States Department of Agriculture, Agricultural Research Service (USDA ARS) for over 30 years to discover, evaluate and develop natural and sustainable biological control agents for invasive weeds that are endemic to Australia and Southeast Asia but invasive to the United States.

Melaleuca is now much less invasive in Florida following implementation of biological control.

One of the significant impacts of this project was the discovery and development of Australian biological control agents, which are helping to manage the broad-leaved paperbark tree (*Melaleuca quinquenervia*) in Florida.

This tree covered 490,000 hectares of South Florida, turning native sawgrass marshes into damaging swamps. It was also a major threat to the environmentally sensitive Florida Everglades.

Four biological control agents were released and three established on melaleuca in Florida. They decreased the growth and reproductive capacity of melaleuca and increased seedling mortality. In some sites, the native plant community recovered following the biological control of melaleuca. With integrated management including biological control, melaleuca now covers just a tenth of the Florida land it once did.

The control of melaleuca benefits ecotourism, sport fishing and hunting, agriculture, and ecosystems generally. For land managers, the major benefit is that biological control complements mechanical and chemical control by preventing regrowth following treatment.

Our partnership with USDA ARS has been extended to 2025, which will allow us to continue scientifically collaborating and sharing knowledge with the United States, Australia and research partners in the Asia-Pacific region. We're aiming to deliver further scientific impact over the next five years in our novel approaches to managing invasive weeds.

Function 1.2: Connect to global science, technology and innovation to access new opportunities for Australian innovation

Our key activities for Function 1.2 contributed to our strategic focus areas by:

- supporting the Team Australia program
- assisting with gaining access to global markets
- capturing global investment
- promoting global best practice models.

We delivered on this function by:

- accelerating the overall rates of international engagement, operations and collaboration where there is a higher potential impact value return to Australia than available domestically
- prioritising key regions for sustained presence and development where there is clear intersection with our impact objectives and sustainable business opportunities.

Accelerating the overall rates of international engagement, operations and collaboration

Australia's and our ability to deliver against multidisciplinary challenges today and into the future requires connection to global science, technology and innovation. Our Global Strategy aims to accelerate our international engagement, operations and collaboration to deliver national benefit.

Many of today's challenges, such as climate change, global economic stability or access to energy resources, are complex, interconnected and have a global reach. Our scientists have been successfully collaborating with organisations across the globe for 100 years to solve these challenges facing people, the environment and society.

Levels of global engagements and activity have consistently grown, enabling demonstrated benefit through four key areas: enhancing our global scientific standing through global partnerships; connecting the domestic innovation system to the global innovation system; attracting foreign investment to Australia; and supporting Australia's foreign policy agenda.

At the centre of our international focus is partnerships, and in 2019–20 we worked with 378 international customers and collaborators across more than 50 countries. Our work conducted internationally ranges from fundamental research to high-value strategic partnerships to address today's challenges. Our partnerships and collaborations provide us access to leading-edge scientific capability, advanced infrastructure and leveraged investment, allowing us to capture the greatest value from our innovations.

Active global strategic partnerships

Over the past five years, we have grown our Memorandum of Understanding (MOU) agreements with international institutions from 35 to now 159 (139 active), with 19 signed in 2019–20. The latest MOUs cover areas of science such as agriculture and food, astronomy and space, data and digital, land and water, manufacturing, minerals, and oceans and atmosphere. Agreements this year were with 12 countries: China, Fiji, Germany, India, Ireland, Japan, Mauritius, New Zealand, Papua New Guinea, South Korea, United Kingdom and Vietnam.

MOUs have underpinned the increase in the number of our strategic partnerships, with an additional five formed in the last 12 months, totalling 21, growing our science engagement with global partners (see Table 3.5). This resulted in a transition from researcher to researcher engagements to organisational partnerships, enabling increased access to talent and complementary science capability and capacity. These partnerships allow us to enhance our international projects, whilst also developing in-country capability and capacity to support delivery offshore.

19 new international MOUs and **5** new strategic partnerships

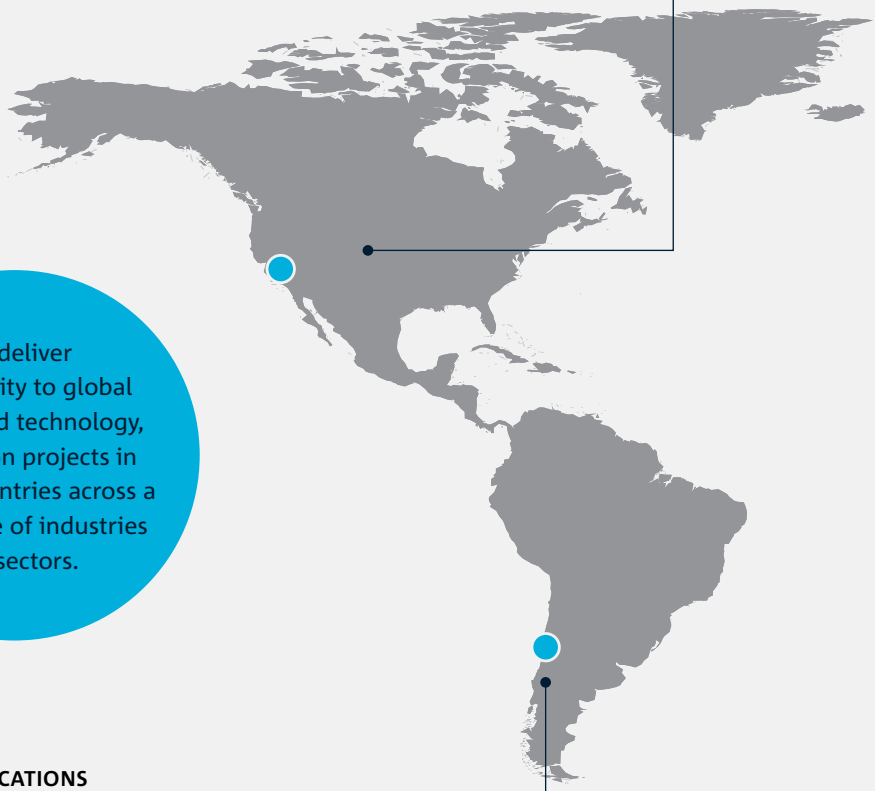
Our global reach

Since 1926, we've sought to make a difference, to solve problems that matter to Australia and the world, and to generate positive impact for today and tomorrow. In 2019–20 we've continued this legacy. Here are some examples of our international impacts.

USA

A new, more sensitive blood test for post-surgical bowel cancer recurrence that we developed launched in the USA.

752 15



We deliver connectivity to global science and technology, working on projects in over 50 countries across a wide-range of industries and sectors.

JOINT PUBLICATIONS

MOUs

CSIRO OFFICE

CSIRO LABORATORY

EMBASSY REPRESENTATION

Chile

We applied Earth observations data to model water and coastal, land-use and agricultural productivity.

47 3

View our locations on page 121.

France

We work with the Centre National de la Recherche Scientifique to support increased research and development collaboration in science areas such as radioastronomy, biodiversity conservation and ecosystem management.

293 3

India and Bangladesh

We work with Australian and local partners to explore and understand how agricultural intensification affects disadvantaged rural communities in West Bengal and Southern Bangladesh.

106 6

Republic of Korea

Together with Korea Institute of Civil Engineering and Building Technology, we collaborate on science areas including water management, energy, carbon reduction, building life cycle assessments and carbon footprint.

63 7

Vietnam

Together with the Ministry of Science and Technology, we collaborate on a range of joint research activities in agriculture, food, health, biosecurity, energy, astronomy and more.

26 2

Singapore

We are key partners in the Innovations in Food for Precision Health program to support consumers in both countries to make healthier food, diet and lifestyle choices.

51 2

Indonesia

We participate in multiple projects across plastic waste, including the development of an Indonesia-Australia Systemic Innovation Lab on Marine Plastic Waste.

28 3

Table 3.5: Global engagement

	2015–16	2016–17	2017–18	2018–19	2019–20	TOTAL
Active global strategic partnerships	10	1	1	4	5	21
Number of new MOUs signed	33	33	43	31	19	159
Number of expired MOUs	2	5	5	8	13	33

These strategic partnerships are also an important mechanism to support science diplomacy in key regions and reinforce our commitment to supporting Australia's foreign policy agenda, which is evidenced by our extensive program of diplomatic support activities in each region. This is highlighted through the strategic partnership with the Department of Foreign Affairs and Trade, where we have delivered and supported multiple programs across the Asia-Pacific Region. Most recently, we're supporting the development of the relationship between Australian and Vietnam, through managing the Aus4Innovation Program. More information can be found on page 54.

Team Australia

An important part of our Global Strategy is shaped around the work we do to support the Team Australia program. Together with the Department of Foreign Affairs and Trade, Austrade and the Department of Industry, Science, Energy and Resources, we work to build a stronger nation that protects Australia's interests internationally and contributes to global stability and economic growth. Our partnerships are key to delivering greater impact in areas that address complex, multidisciplinary regional challenges.

For example, with marine plastic waste a key bilateral issue of concern for Australia and Indonesia, the Federal Government has agreed to establish an Indonesia-Australia Systemic Innovation Lab on Marine Plastic Waste. This $1.6 million initiative that we are leading in Australia will strengthen our research collaboration to help identify new approaches in tackling marine plastic waste across our region. The Lab will bring together key stakeholders to create cross-sector partnerships and world-first projects to drive the transition to a zero marine plastic waste economy.

Linking to global markets

Creating opportunities for SMEs and the domestic innovation ecosystem to access global markets is critical to our Global Strategy, and partnerships in many regions have been formed to increase market reach and competitiveness.

SVG Ventures-THRIVE, based in Silicon Valley, invests in early- and growth-stage AgTech companies, connecting entrepreneurs to established companies and managing the THRIVE Accelerator program. We formed a three-year partnership with SVG Ventures-THRIVE to bring the most promising Australian start-ups to Silicon Valley and showcase their projects to United States investors and corporate partners for funding and commercialisation. In 2020, two start-up teams were awarded seed funding and participated in the accelerator, which is the first time Australian start-ups have been selected into the program.

Value return to Australia

Our international engagements often involve funding and capability investment from partners, which may not otherwise be available domestically. This global investment into major regional programs generates a higher potential value return to Australia and its emerging industries through innovative science and technology developments.

We are currently exploring how we can best support the scale-up of Australia's emerging hydrogen industry; Australia is uniquely positioned to drive forward clean hydrogen energy due to its extensive renewable energy resources and infrastructure. In 2019–20, we partnered with Nanyang Technological University, Singapore, and provided seed funding to explore the development of a Joint Renewable Hydrogen Technology and Demonstration Test Bed.

The proposed Renewable Hydrogen Test Bed would provide capability, facility and demonstration services to accelerate the creation of viable energy technology pathways based on renewable hydrogen systems. This work is strongly aligned to the future direction of the two countries' bi-lateral relationship, with both Prime Ministers agreeing to conclude a Memorandum of Understanding this year to drive cooperation through projects and initiatives in developing hydrogen markets, supply chains and standards, Carbon Capture, Utilisation and Storage, and renewable electricity trade.

Prioritising key regions for sustained presence and development

To drive international engagement, we have established several overseas locations. Currently, we have two international offices located in Silicon Valley, the United States of America, and Santiago, Chile, with one laboratory in Montpellier, France. We also have people based in the Australian Embassies in Singapore, Vietnam and Indonesia.

We recently featured on the world stage as a key contributor to the COVID-19 vaccine (read more on page 22), but our reputation as a world-leading research organisation is prevalent across various fields. In 2019, we were recognised for our contributions to the United Nations Sustainable Development Goals. We were awarded the inaugural 2019 GEO Sustainable Development Goals Award for Innovation.

Our robust land degradation mapping method, adopted by the United Nations, is being used by more than 140 countries around the world to track and compare their progress in addressing land degradation, contributing to a unified, global view where previously there had been no consistent measure for reporting on factors like over-grazing, drought and contamination. The solution uses Earth observation technology, generated by satellite imaging, to map land degradation over time, and drew on a network of more than 80 expert contributors and reviewers to develop global standards and tools.

Our efforts this year contributed to us delivering towards our outcomes (see Table 3.6):

- We are recognised as being part of Team Australia in global markets' access to world-class capability and talent
- Linkages for our Australian SMEs and domestic university partners to global markets
- Increased value creation for our innovations and services.

Table 3.6: Summary of our performance for accessing new opportunities for Australian innovation

PERFORMANCE MEASURES SOURCE: 2019–20 CORPORATE PLAN	TARGET	RESULT
National benefits of international projects and activities		
Demonstrated value of benefits underpinned by an increasing annual portfolio of impact case studies on global activities with specific assessment of the value created and national benefit	Evidence from at least 2 case studies	**Achieved**: substantial triple-bottom-line benefits have resulted from our work and are demonstrated by 3 impact case studies completed.

Analysis of performance

In 2019–20, we undertook three impact case studies that demonstrated the value and benefit delivered to Australia through our global activities, particularly through supporting foreign policy agendas and enhancing the value of our innovation.

Applied Research and Innovation Systems in Agriculture (ARISA)

ARISA was an $8 million program that we delivered for the Australian Department of Foreign Affairs and Trade, under the Australia-Indonesia Partnership for Rural Development. It supported the Government of Indonesia's development strategy to accelerate poverty reduction through inclusive economic growth. The program focused on the commercial application of innovation in agriculture, bringing together agribusiness and research institutes to make farming innovations more accessible for smallholder farming households in eastern Indonesia. That case study shows that by the end of 2018, ARISA had increased the net incomes of over 11,000 households by an average of 117 per cent. International collaborations such as ARISA, strengthen our role as a trusted advisor supporting Australian Government priorities to deliver on international programs that assist Australia's foreign policy agenda.

Five-hundred-metre Aperture Spherical radio Telescope (FAST)

FAST, in Guizhou Province, China, is the largest single dish radio telescope in the world following its completion in 2016. We were contracted by FAST to develop and supply the 19-beam receiver, with ongoing scientific collaboration under the research Memorandum of Understanding we had with the National Astronomical Observatories of China. FAST will help to enhance our understanding of the interstellar medium lifecycle, cosmology, galaxy evolution, star formation and exoplanets. Global collaboration is an integral part of our strategy as it maps out our delivery of science, technology and innovation to new customers and markets, while also delivering benefit back to Australia. In this case, benefits included financial returns for the supply of the equipment and access to observation data.

PolyNovo

PolyNovo, a biomedical SME, has demonstrated access and penetration of international markets by an Australian SME commercialising technology founded on our research and which we supported during its commercialisation. Through this process, PolyNovo has grown to employ more than 20 people, listed on the Australian Stock Exchange in September, and is now worth over $1.5 billion. The non-toxic polymers developed by our team in the 2000s have resulted in NovoSorb, a biodegradable material that can be used to aid the repair of bone fractures and damaged cartilage, and in skin grafts, particularly for treating wounds and burns. This case study demonstrates our role in originating and supporting the technology to enable the growth and success of an Australian SME on a global scale.

We're bringing conservation into the innovation era

With Australia's biodiversity in steep decline, our researchers are leading efforts to protect our precious species. We're creating tools and technology to save millions of the world's species that face extinction in the coming decades.

'There isn't enough money to preserve all the 'at risk' species,' explained Dr Iadine Chadès, one of our principal research scientists. 'Sadly, we can't protect everything.'

Our scientists are using Artificial intelligence (AI) and advances in data analysis to protect biodiversity. AI lets scientists do more with less by finding patterns and analysing complex data. Computer systems can assess millions of images, learning to recognise species. They can then monitor and count species from these images. AI can also provide recommendations for decision-makers.

We're collaborating with the New South Wales Government's Saving our Species program, using AI to optimally monitor and adaptively manage around 1,000 threatened species – a difficult endeavour due to the cryptic nature of threatened species. We've created a world-leading tool, which provides a single, integrated approach to identifying a priority set of projects that would secure as many species as possible.

In the Northern Territory, we're using new technology to look after an ancient landscape. In Kakadu National Park, magpie geese, whose numbers have dwindled, are returning with the help of ethical AI and Indigenous knowledge. Magpie geese are a key indicator of 'healthy country' for Bininj Traditional Owners, who have hunted, fished and lived on this land for at least 65,000 years. But a weed called para grass is choking floodplains and the magpie geese's habitat.

The challenge is immense: Kakadu National Park is one-third of the size of Tasmania. On the Nardab floodplains, Traditional Owners and Park rangers need to know the best way to control the weed – what combination of burning or spraying works best, and where priority areas of management should be – to focus these efforts.

Enter ethical AI. Our scientists are working with Bininj Traditional Owners, Rangers, Microsoft, Parks Australia, and the National Environmental Science Program to create new Indigenous-led technology. Rangers use drones to monitor geese and para grass. Aerial photos are analysed with help from AI, and results are displayed on an interactive Healthy Country Dashboard that we co-created using Bininj seasonal calendars to monitor and manage these wetlands.

'We know it's working because when we walk away, the rangers are still using the information collected from drones and on-ground monitoring to manage these wetlands,' reflected principal research scientist Dr Cathy Robinson. There are already reports of results on the ground – the wetlands are flourishing, and thousands of magpie geese have come home to roost.

The eastern Pygmy Possum is a small marsupial that is listed as vulnerable to extinction in New South Wales. Credit: Phil Spark

Magpie goose.

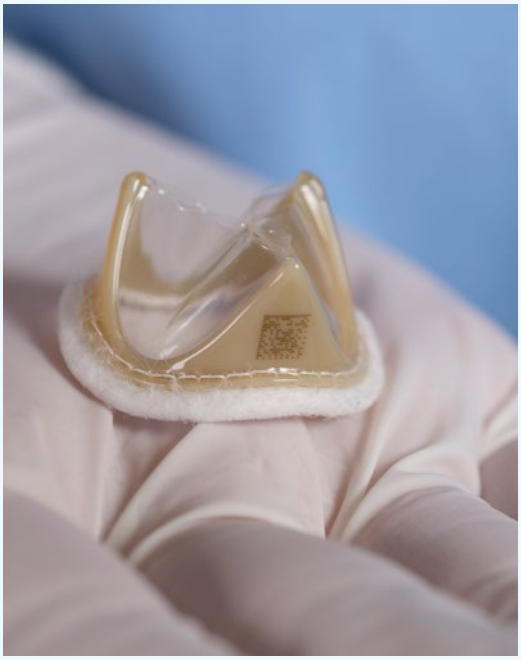
Foldax heart valve

The World Health Organisation estimates heart valve disease affects around 30 million people in the general population of industrialised countries.

Aortic valve disease is a congenital or age-related condition where the valve between the main pumping chamber of the heart and the body's main artery stops functioning properly.

There are currently two popular valve replacement options. The first, and most commonly implanted, is a tissue valve that is obtained from animal tissue sources – most commonly from cows and pigs, but the manufacturing yields are low and struggle to meet demand.

The second is a mechanical valve, but these are not suitable for smaller people like children. Mechanical valves require lifelong drug treatments to prevent blood clotting and are prone to rejection.



The next generation Tria heart valves are robotically manufactured at volume, providing the highest level of quality and precision and allowing for future patient customisation.

We drew on our long history of polymer work – developing polymer bank notes, long-term extended wear contact lenses, and other biomedical applications such as Elast-Eon™ used in cardiac pacemakers.

We used this experience to help United States' manufacturer, Foldax, create their Tria heart valve out of our biopolymer material, LifePolymer™. The Tria heart valve is the first polymer option on the market, eliminating the use of animal tissue in the manufacturing process. The LifePolymer™ also removes the need for anti-blood clot medication and can work for decades without the risk of calcification.

The new Tria heart valve is designed to mimic the natural heart valve. This bridges the benefits of the natural function of the animal tissue heart valves with the scalability of manufacturing synthetic materials to meet demand.

Our partnership has enabled Foldax to produce the Tria heart valve and reach patients around the world.

The LifePolymer™ also has further applications beyond heart valves. Other potential uses are being explored, such as a coating for stents, vascular grafts, and synthetic membranes for ear drum ruptures.

In June, MedTech Breakthrough, an independent market intelligence organisation that recognises top companies, technologies and products in the global health and medical technology market, selected the heart valve technology as the winner of its Medical Device Engineering Breakthrough Award.

Function 1.3: Manage funding directed to industrial scientific research activities, commercialisation of technologies and assistance to industry through research collaboration and capacity building

Our key activities for Function 1.3 contributed to our strategic focus areas by the:

- CSIRO Innovation Fund
- Science and Industry Endowment Fund (SIEF).

We delivered on this function by:

- CSIRO Innovation Fund, managed by Main Sequence Ventures, investment in start-up and spin-out companies, existing SMEs engaged in translation of research, and company formation opportunities to support business growth and a culture of innovation and entrepreneurship in Australia. Read more about the Innovation Fund on page 24.
- SIEF grants to science and scientists for the purposes of assisting Australian industry, furthering the interests of the Australian community and contributing to solving national challenges. Read more about SIEF on page 193.

Our efforts this year contributed to us delivering towards our outcome (see Table 3.7):

- Australian industries maintain and improve their competitiveness through the application of new technologies and solutions.

Table 3.7: Summary of our performance for managing funding directed to industrial scientific research activities

PERFORMANCE MEASURES SOURCE: 2019–20 CORPORATE PLAN	TARGET	RESULT
Strategic investments by SIEF in scientific research to address national challenges for Australia		
Technologies receiving ongoing commercialisation support from venture capital or industry sources one year after completion of the SIEF Experimental Development Program	Evidence of ongoing support and impact as measured through case studies	**Achieved**: Hydrogen Generation project completed – has ongoing commercialisation support from industry.
SIEF NSW Generation STEM program participant awareness of STEM careers and pathways in NSW	7% increase on the 2018–19 baseline	**Not achieved**: program behind schedule and result not yet demonstrated.
Impact evidence in narratives and evaluations demonstrating SIEF-funded challenges are creating new Australian technology-based industries and/or applied technology platforms that can reach global scale	Evidence of impact as measured through case studies	**Achieved**: Boat to Plate project completed – technology has high potential for impact and to reach global scale.

Analysis of performance

The SIEF Experimental Development Program

The Hydrogen Generation project provided financial support to develop a solution to convert ammonia to high-purity hydrogen at, or near, the point of use.

The support from SIEF was instrumental in realising the value-proposition of this work and facilitated the translation of knowledge to a commercial solution. The technology was scaled-up and demonstrated its potential as the critical last step in ammonia-based hydrogen distribution. The success of the project led to a collaboration with Fortescue Metals Group Ltd under a five-year agreement to fund and support our technologies, including the next stage of this work where we will build a pilot-scale generator capable of producing hydrogen at approximately 200 kilograms per day.

The Federal Government has recognised the role of hydrogen in a clean energy industry and launched the National Hydrogen Strategy to turn Australia's hydrogen industry into a global export by 2030. With the support of SIEF, the Hydrogen Generation Experimental Development Project is contributing to the Australian national objectives and assisting Australian industry. Read more on pages 196 and 197.

Generation STEM program

Generation STEM is a 10-year initiative to attract, support and retain New South Wales (NSW) students in STEM education and skilled careers.

The first program, the STEM Community Partnerships Program, was launched in mid-2019 and has progressed as planned since then. During 2019–20, two Western Sydney councils signed up for three years and one for a six-month pilot – a total of 21 schools and 293 students. Even though the 2020 program has been significantly impacted by COVID-19, seven schools in two councils are taking part this year.

However, as a consequence of earlier delays, the Generation STEM program's overall progress and scale to date is less than originally intended. Therefore, the outcomes have not yet been realised and sufficient data is not yet available to determine an accurate measure of change. Data collected to date will be used to establish a baseline for the Community Partnerships Program for the future.

As Generation STEM gains momentum, we hope to accelerate STEM literacy and career opportunities for students through higher levels of engagement with industry and local government, and an increased number of work-ready students transitioning into the local STEM workforce.

Creating new Australian technology-based industries

The SIEF-funded Boat to Plate project developed a prototype automated species identification system, embedded within a tagging and data management system, that addresses the traceability of seafood throughout the supply chain. The innovative product offers a convenient, cost- and time-effective solution for seafood producers to monitor and manage their products. Implementing the technology will lead to enhanced seafood supply chain management, traceability and food security for industry, wholesalers and retailers that purchase Australian seafood products.

Traceability, sustainability and supply chain integrity are becoming increasingly important as consumers demand to know the provenance of their food, and if it has been sustainably harvested. Food producers and suppliers want to guarantee that their product meets consumer expectations and that the integrity of their supply chain is protected. The Australian Government wants to protect the integrity of domestic products in the global market and maintain its reputation for high-quality food products.

Boat to Plate presents an opportunity to generate billions of dollars of cost-savings associated with market inefficiencies and seafood wastage. The technology also offers significant potential for global application. It is anticipated that it will be commercialised, as industry has shown significant interest in the prototype. Read more on pages 197 and 199.

CSIRO's GISERA: delivering independent science

Ten years ago, the Queensland Government approved the third major coal seam gas (CSG) to liquefied natural development gas (LNG) proposal in the Surat Basin, giving the go-ahead for a major new resource export industry and jobs growth opportunity for Queensland and Australia.

As major Australian and international companies accelerated the pace of drilling wells and constructing pipelines, gas processing facilities and LNG export terminals, new concerns emerged about a significant knowledge gap.

Communities and government were concerned the rapid pace of development outstripped the ability to understand and manage potential impacts on the environment, communities, resources such as water, and established industries such as agriculture.

At the same time, CSG industry proponents recognised that social acceptance for continued development was related to trust, and that trust was affected by the availability of independent, peer-reviewed scientific studies into issues of concern to landholders and local communities.

Gas Industry Social and Environmental Research Alliance (GISERA) was established in 2011 to meet this urgent need for independent, peer-reviewed and publicly available research into the social and environmental impacts of Queensland's CSG industry.

Drawing on a combination of funding from CSIRO, industry and governments, over the past decade GISERA has used an innovative governance model to conduct more than 50 research projects costing around $36 million and involving hundreds of our scientists and research specialists.

The research focused on the impacts of onshore gas development in seven key areas of interest to local communities: surface and groundwater; agricultural land management; greenhouse gases and air quality; social and economic issues; health impacts; terrestrial biodiversity; and the marine environment.

The key to GISERA's success is its governance model, which includes clear safeguards in the partner agreement around our ability to publish independent, peer-reviewed scientific research, and regional research advisory committees that determine where project funds are spent and are majority controlled by independent and community members.

This success is reflected in the Australian Government Productivity Commission Resources Sector Regulation report (draft, March 2020), which states that GISERA has made a 'positive contribution by providing information and research that is conducted independently from the regulators and proponents of resources projects'.

From its original Queensland focus, GISERA is now a national organisation, with research projects underway in Queensland, New South Wales, South Australia and the Northern Territory. We've partnered with Australia Pacific LNG, QGC, Santos, Origin Energy and Pangaea Resources. Plans are in place to begin research in Western Australia.

Our Research Technician James Harnwell calibrates atmospheric sensing equipment at a coal seam gas well.

Navigating the underground with ExScan

Underground mines, particularly coal mines, are inherently high-risk environments. Methane gas, which naturally seeps from coal seams, is volatile and highly explosive, presenting a major hazard to workers' health and safety and mine productivity. As a single spark can ignite an explosion, any equipment used in underground coal mines must be certified as safe for that environment.

Building upon the global success of our LASC longwall automation technology, we invented ExScan, a laser-scanning system that provides real-time data for enhanced navigation and 3D mapping capability in underground mines.

Designed specifically for use in explosion risk zones, the ExScan laser-scanning hardware and electronics are housed within a novel explosion-proof casing, certified to international standards for use in hazardous underground environments. Any spark that could ever arise from the electronics has no way of contacting the potentially volatile mine environment to ignite an explosion.

Inside this container, the patented ExScan system includes a powerful sensing platform that can be deployed in remote and automated mining applications.

The laser scanner and associated software can generate real-time 3D maps of tunnels, walls and cavities underground, where the Global Positioning System (GPS) does not penetrate.

The 3D maps ExScan creates can then be used for locating, steering and navigating equipment and vehicles.

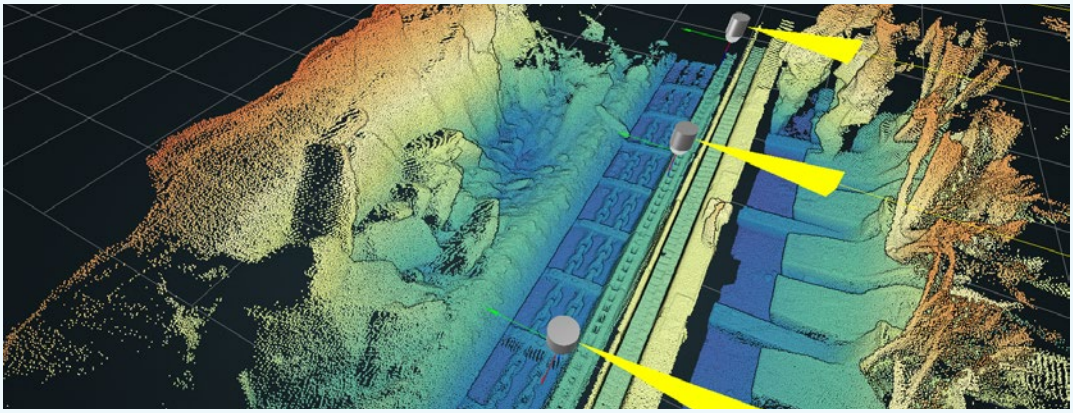
The scanners can be mounted in any orientation, even upside down and on moving machinery and vehicles, which means they can be used to map whole mines, and potentially for vehicle navigation.

This year, Glencore, one of the world's largest mining companies, used ExScan to successfully resolve coal flow blockages on the conveyor system under the coal shearing equipment at its Oaky Creek North Mine in Central Queensland.

The real-time 3D mapping capability of ExScan visualised the issues and helped align and steer the shearer equipment, ensuring workers were kept safe and mine productivity was preserved.

Glencore now has over 60 ExScan units in use underground. The technology is currently being used in six Australian mines and has attracted significant global interest, particularly from the Chinese coal industry.

ExScan is transforming underground working. It's providing a pathway to mining equipment automation, removing workers from the dangers of the coal face, and allowing longwall operations to be managed remotely from a control centre safely above the ground.



ExScan is a laser-scanning system that provides real-time data for 3D mapping and enhanced navigation in underground mines, designed to operate safely in explosion risk environments.

Objective 2:

Mobilise and develop the best talent for the benefit of Australia

Our second objective is addressed by a single function:

FUNCTION		ACHIEVEMENTS	PERFORMANCE MEASURES AND ANALYSIS
2.1	Promote STEM capability development and education.	Pages 76–82	Pages 82–83

Function 2.1: Promote STEM capability, development and education

Our key activities for Function 2.1 contributed to our strategic focus areas through:

- Education and Outreach
- SME Connect
- CSIRO Publishing.

We delivered on this function by:

- providing opportunities for students and teachers to develop and improve STEM skills including access to mentors
- offering education and outreach activities to increase knowledge of STEM and its application to students, parents, teachers and the Australian community
- publishing a variety of content including journals, books and magazines to support an increased knowledge of science and its application
- working with SMEs to develop capability both within industry and the research sector to support innovation in SMEs.

As Australia's innovation catalyst, we have a responsibility to develop Australia's scientific and research capability, ensuring Australians continue to solve the greatest challenges through innovative science and technology.

We're passionate about inspiring and equipping the next generation of researchers in the innovation system – from school students to early career researchers.

Through our education and outreach programs, we help increase science, technology, engineering and mathematics (STEM) knowledge and skills.

In cooperation with Australian and overseas research institutions, we train future researchers and innovation system workers by providing opportunities for undergraduate and postgraduate students to undertake impactful research.

Beyond supporting students, we also offer research positions in our CSIRO Early Research Career (CERC) program, which includes further development opportunities to fast-track the research careers of recent doctoral (PhD) graduates.

We also have programs to facilitate and improve the communication of research with the community and to build the capability of business, particularly SMEs, to engage with the research sector.

Improving STEM skills and knowledge

We deliver high-quality, engaging STEM learning experiences for school students, teachers, researchers and the community to equip all Australian students with the STEM skills they need to enter the workforce. Through our outreach programs, we promote the importance and application of our research to the community and increase Australia's STEM literacy.

School programs for students and teachers

We deliver more than 16 STEM education programs and have education specialists in each capital city and in three regional centres. This year, almost 200,000 people took part in our community events; more than 192,479 primary and secondary students took part in STEM education programs; and more than 5,426 teachers participated in professional learning programs. Engaging primary and secondary school students in education programs continued to increase in recent years; participation numbers increased from 133,135 in 2017 to 192,479 in 2020.

>192,000
school students in STEM education programs

The STEM Professionals in Schools program partners STEM professionals with primary and secondary teachers around the country. At 30 June, 1,311 partnerships were operating in 899 schools – an increase on 844 partnerships reported last year. Of these, 29 per cent were in regional and remote schools.

In recent years, we have been trialling online programs to increase participation and accessibility, including a virtual laboratory based on our food and nutrition research where students have access to our research datasets. Our Digital Careers program, which runs a suite of online Bebras computational thinking challenge programs, aims to increase student participation and interest in information, communication and technology courses and careers. This year, 140,455 students took part in the Bebras programs.

In 2019–20, we piloted a Virtual Work Experience program where 57 students worked in teams remotely from their supervisor (and for most teams, remotely from each other). The program has been a game changer for regional students who would otherwise not have had access to meaningful STEM work experience and with what we have learnt, this year we also trialled virtual sessions with schools rather than face-to-face sessions. Our award-winning PULSE@Parkes program attracted 160 students and 25 teachers from 19 schools.

Two of our STEM education programs specifically aim to increase the participation and achievement of Aboriginal and Torres Strait Islander students in STEM in school and through to employment. In 2019–20, the BHP Foundation Indigenous STEM Education program worked with 212 teachers, 74 teacher assistants, and 1,323 Aboriginal and Torres Strait Islander students in 57 schools and 23 communities. Read more about our partnership with Indigenous communities on page 78.

In its second year of operation, 49 high school students, 70 university students, 102 teachers, 12 Indigenous education workers and 20 universities took part in the Young Indigenous Women's STEM Academy, which encourages young Indigenous women to participate in STEM at school, higher education and into employment.

Outreach to increase knowledge

The Canberra Deep Space Communication Complex and Parkes school programs attracted 5,813 and 1,203 school students respectively. These centres are purpose-built to showcase our research in an entertaining way that demystifies and educates people of all ages about research and innovation.

Another way we shared our science with school students is at the CSIRO Discovery Centre in Canberra, and at visitor centres at observatories near Parkes, Narrabri and the Canberra Deep Space Communication Complex (CDSCC). Table 3.8 details visitor numbers at our outreach centres.

Visitor numbers were lower this year because we had to close our centres to comply with COVID-19 pandemic measures. CDSCC was closed from mid-March and between late January to early February due to bushfires. Parkes was closed from mid-March, and ATCA (Narrabri) closed at the end of March.

Table 3.8: Science outreach: visitor centres

CENTRE	2015–16	2016–17	2017–18	2018–19	2019–20
CSIRO Discovery Centre	18,477[6]	26,332	27,622	32,122	23,269
Parkes radio telescope	95,212	83,851	105,085	112,224	100,013
Canberra Deep Space Communication Complex	67,378	70,753	69,279	68,581	47,814
Australia Telescope Compact Array, Narrabri	11,511	10,965	12,081	10,363	7,434

6 Visitor numbers were lower as the Centre was closed for renovations for part of the year.

Making an impact in partnership with Indigenous communities across Australia

Since 2014, we have delivered the Indigenous STEM Education Program with funding from the BHP Foundation. The program lifts Australia's science capacity and capability by demonstrating how we value Aboriginal and Torres Strait Islander communities and their extensive scientific and cultural knowledge. We recognise that Indigenous peoples are Australia's first and continuing scientists, technologists, engineers and mathematicians.

The program's impact has been rapid. In just five years, it has increased student engagement and academic results particularly among Aboriginal and Torres Strait Islander students and low-achieving, non-Indigenous students taking part in inquiry programs based on Indigenous STEM knowledge (44 per cent and 59 per cent of these students improved their academic achievement respectively). The program has increased teacher capacity – including embedding a two-way science practice that engages students in classroom and on-country learning activities. It has increased the likelihood of STEM careers: for Year 10 Indigenous students attending the Aboriginal Summer School for Excellence in Technology and Science, 74 per cent now plan to have a STEM career (up from 51 per cent before attending summer school).

We also developed resources to support current and future Aboriginal and Torres Strait Islander students and communities. *Two-Way Science: An Integrated Learning Program for Aboriginal Desert Schools* connects the cultural knowledge of the local community with western science and the Australian curriculum.

Our monitoring and program evaluation reported increases in student engagement, academic achievement and community capability. Students have also reported improved confidence, aspiration and setting goals for higher education and future careers, particularly in STEM. For some participants the program has changed their lives.

Since 2015, the program has engaged over 21,000 Aboriginal and Torres Strait Islander students, 1,441 teachers and assistant teachers, and worked with 181 schools in metropolitan, regional and remote communities in each state and territory. As a strength-based program, we use community partnerships as a core structure for the co-design of our curriculum and student programs. The program is a national leader in delivering an Indigenous STEM curriculum and Indigenous STEM student career development and support.

Education and Outreach team member, Torres Webb (far right) with students from the ASSETS camp in Adelaide 2020.

Tertiary student programs

We give undergraduate and postgraduate students the opportunity to collaborate with researchers to help them develop their skills and meet the increasing demand for Australia's STEM capability. Through collaborative efforts with universities, we are supporting tertiary students with their career progression and providing opportunities to innovate and generate new theoretical perspectives. Our programs include industrial traineeships, vacation studentships, postgraduate studentships and opportunities for Aboriginal and Torres Strait Islander peoples.

Supervised students have a CSIRO staff member appointed by the university as a co-supervisor for their research project. Some of these students are also sponsored and receive a full or top-up scholarship, funded by CSIRO, to pursue a research project leading to the award of a PhD or master's degree.

In the 12 months to 31 May, we supported 1,877 undergraduate and postgraduate students through our programs, represented in Table 3.9. The number of students fluctuates within a year and across years, as students start and finish programs at different times of the year.

Table 3.10 provides a breakdown of the number of students that we supervised, or both supervised and sponsored. These numbers represent a point in time at 31 May 2020, as distinct from the total number of students over the course of the whole year.

Table 3.9: Our students over the past year

TYPE OF ENGAGEMENT	2017–18	2018–19	2019–20
Tertiary level			
Undergraduate students	633	529	485
Postgraduate students	1,438	1,456	1,392
Total	**2,071**	**1,985**	**1,877**

Table 3.10: Our supervised and sponsored students at 31 May each year

	2016	2017	2018	2019	2020
Sponsored and supervised postgraduates					
PhD	280	416	418	390	451
Masters	36	27	12	7	7
Subtotal	316	443	430	397	458
Supervised postgraduates (not sponsored)					
PhD	319	257	398	422	337
Masters	96	88	147	137	84
Subtotal	415	345	545	559	421
Subtotal postgraduates	**731**	**788**	**975**	**956**	**879**
Undergraduates					
Industrial trainees	–	–	100	100	56
Honours students	89	84	74	54	48
Subtotal	–	–	174	154	104
Total tertiary students	**–**	**–**	**1,149**	**1,110**	**983**

University of Tasmania PhD Program in Quantitative Marine Science

For 16 years, we have partnered with the University of Tasmania (UTAS) to deliver a PhD program in quantitative marine science (QMS). The program addresses a key need of industry and research institutions for marine scientists with high level mathematical and computational skills.

Scholars who enter the program, a key feature of which is specific marine science PhD coursework, have an enhanced PhD experience with access to hundreds of marine scientists working across two institutions. This includes access to our experts in marine physical, biological and chemical sciences and oceanographic science disciplines.

QMS alumni have become professional scientists in Australia and internationally and make significant contributions in their fields. Over the past 10 years, two-thirds of graduates have stayed in or returned to Australia to work in marine sciences, in most cases at CSIRO or UTAS.

Alumna and CSIRO transdisciplinary researcher and knowledge broker Dr Jess Melbourne-Thomas is a global leader on the impacts of climate change on marine ecosystems. In 2020, Dr Melbourne-Thomas was named Tasmanian Australian of the Year, acknowledging her impact in this field.

Industry PhD

In a unique and distinctive offering for postgraduate students, we bring together both an industry and a university partner to offer our Industry PhD (iPhD) program. This industry-focused applied research training program produces the next generation of work-ready research and innovation leaders in Australia. For more details see our website: www.csiro.au/en/Careers/Studentships/Industry-PhD.

We piloted the program with the University of New South Wales in 2018 and have since expanded to another five universities: University of Adelaide, University of Western Australia, Curtin University, Edith Cowan University and Murdoch University.

Students have now commenced in the program at four universities and expressions of interest are being run throughout 2020 to find new industry projects for students to start across all six universities in 2021.

Developing early career researchers

CSIRO Early Research Career Postdoctoral Fellows

Our CSIRO Early Research Career (CERC) Postdoctoral Fellowship program develops the next generation of leaders of the innovation system. These Fellowships enhance the person's research capability so that they are better able to pursue a career in research at CSIRO or beyond. We provide a differentiated learning and development program for our CERC Postdoctoral Fellows, with specially developed programs tailored to facilitate their career advancement.

Table 3.11 shows the number of CERC Postdoctoral Fellows at 30 June each year. As Fellows have concluded their terms and new Fellows have been appointed during the year, a total of 362 different Fellows have been employed throughout the year. Recruitment of new positions is being boosted in the second half of 2020, after the number of Fellows completing their terms exceeded new appointments during 2019–20, resulting in a decline in numbers by the end of the year.

362 CERC Postdoctoral Fellows during 2019–20

Table 3.11: CERC Postdoctoral Fellows as at 30 June

	2016	2017	2018	2019	2020
CERC Postdoctoral Fellows	227	249	309	319	264

Publishing and supporting an increased knowledge of science and its application

CSIRO Publishing operates as an editorially independent science publisher for authors and customers in Australia and overseas. Our publishing program of books, journals and magazines covers a wide range of scientific disciplines, and we are Australia's only endemic, scholarly science publisher with a significant digital capability. We champion the value and integrity of science and its outputs to the wider community. Our products and services deliver impact for our authors and customers.

Writing is an essential skill for scientists. Without it their research remains unknown and is unlikely to have an impact. CSIRO Publishing, through its Scientific Writing Workshops, has been training our scientists, universities and government agencies to write for more than 10 years. In 2019, more than 500 scientists and research students were upskilled through these workshops in writing journal papers, reports and grant proposals – ensuring their work was recognised, published and achieved maximum impact.

With the onset of COVID-19, these face-to-face workshops were no longer possible. We needed to make a rapid pivot towards providing our writing, training and support programs online. While learning outcomes are the same, to achieve them through an online learning environment meant completely redesigning the format, content and activities of each program. This was achieved in record time and has resulted in a new guided program called Start Writing! that helps scientists working from home to complete their papers and reports in two weeks.

The writing workshops are now presented as modular, online learning programs with highly interactive webinars, practical writing and editing activities, and regular feedback sessions. Customers are delighted, and already two universities, a state government agency and one of our international research partners are using the programs to train their researchers in an essential skill for communicating their research and demonstrating the importance of their work.

Working with SMEs to develop capability and support innovation

Our SME Connect team supports collaboration between Australian industry and publicly funded research institutions by bringing SMEs together with Australia's best researchers and facilities. We work with SMEs across Australia to support and enable innovation through funding, expertise and resources.

In 2019–20, SME Connect facilitated 205 research projects nationally for 188 companies, injecting more than $20 million into the research and development of these projects. Of these projects, 173 were delivered by 25 Australian research organisations, including 21 universities and CSIRO, and 32 were grants for recent graduates to work on in-house research projects for SMEs.

205 research projects facilitated by SME Connect

SME Connect delivered three programs this year: Innovation Connections, funded by the Australian Government as part of the Department of Industry, Science, Energy and Resources' Entrepreneurs' Program; SIEF Ross Metcalf STEM+ Business Fellowship program, funded by the Science and Industry Endowment Fund (SIEF); and CSIRO Kick-Start, a strategically funded activity.

Innovation Connections

Innovation Connections assists businesses to understand their research needs and connect with the research sector. It also provides dollar-matched funding for research and development projects with universities and research organisations. Incubator Support provides funding to help start-ups develop capabilities to succeed in international markets.

We were appointed the national delivery partner for Innovation Connections and Incubator Support, part of the Entrepreneurs' Programme. To deliver this program, we will be working with Ai Group, the New South Wales Business Chamber, Business South Australia, Deloitte, i4 Connect and Darwin Innovation Hub. We will receive DISER funding to employ 20 facilitators in Perth, Adelaide, Melbourne, Hobart, Canberra, Wollongong, Sydney, Central Coast, Newcastle, Gold Coast, Brisbane and Townsville.

CSIRO Kick-Start

To support start-ups and small businesses in Australia to develop, refine, and enhance their innovations, CSIRO Kick-Start provides dollar-matched funding to conduct research with us, use our facilities, and facilitate collaboration between the business and our research staff. The intention of CSIRO Kick-Start is to help start-ups and small businesses to access affordable, high-quality research and development expertise though subsidised research. This has enabled participating SMEs to make the next business step, which has led to new investments and capital raising – a first, new or expanded product or service for new customers. The program is reported as being well-executed and an important way to introduce our research capabilities to up-and-coming Australian businesses, providing a well-regarded entry point to long-term client relationships.

'CSIRO Kick-Start is essential for small businesses in Australia to access the wealth of expertise and facilities in CSIRO. The association with CSIRO gives credibility to the results from the project. Biohawk is very thankful for the grant and for the work done by the CSIRO team.' Cliff Hawkins, Chief Scientific Advisor, Biohawk.

SIEF Ross Metcalf STEM+ BusinesswwFellowship

In November, we launched the SIEF Ross Metcalf STEM+ Business Fellowship program at the STEM+ Business annual workshop in Melbourne. The new program will support at least 10 new two to three-year STEM+ Business projects to be delivered by early career researchers to innovative Australian businesses. Read more about the SIEF Ross Metcalf STEM+ Business Fellowships on page 194.

Our efforts this year contributed to us delivering towards our outcomes (see Table 3.12):

- Australia's science capacity is increased, which helps the nation to remain innovative and competitive in science
- increased awareness and understanding of science and its potential benefits to the community and industry
- increased industry participation in CSIRO education and outreach activities.

Table 3.12: Summary of our performance for developing national science talent

PERFORMANCE MEASURES SOURCE: 2019–20 CORPORATE PLAN	TARGET	RESULT
Help lift Australia's science capacity and capability		
CSIRO's contribution to help lift Australia's science capacity and capability through STEM funded, developed and delivery of education programs	Evidence of contribution to scientific literacy	**Achieved**: Program evaluations demonstrated positive outcomes.

Analysis of performance

We implement the CSIRO Impact Framework to measure the impact of our programs. Here are some examples from 2019–20.

Virtual Work Experience program

The evaluation report for the Virtual Work Experience program demonstrated a significant contribution to scientific literacy. Students gained:

- an insight into STEM skills and careers, which influenced their subject selection, and confirmed career pathway choices
- opportunities to undertake STEM-based work experience, particularly advantageous for students from regional and remote Australia
- valuable teamwork, communication, negotiation and resilience skills
- high levels of satisfaction from their work experience.

The results demonstrate that this program has contributed positively to developing future science capability and has improved students' STEM skills and their understanding of scientific literacy.

Indigenous STEM Education program

In just five years, this program has increased the participation, achievements and aspirations of Aboriginal and Torres Strait Islander students in STEM subjects at school, and into tertiary education and employment.

The key findings of the latest evaluation report demonstrated an improvement in:

- student engagement and academic results, particularly among Aboriginal and Torres Strait Islander students and low-achieving, non-Indigenous students (44 per cent and 59 per cent of these students improved their academic achievements)
- teacher capacity – we embedded a two-way science practice that engaged students in the classroom and during on-country learning activities
- the likelihood of STEM careers (74 per cent of Year 10 Indigenous students plan to have a STEM career after they attended the Aboriginal Summer School for Excellence in Technology and Science, compared to 51 per cent before attending summer school)
- the connection to Indigenous science through resources developed to support current and future Aboriginal and Torres Strait Islander students and communities such as *Two-Way Science: An Integrated Learning Program for Aboriginal Desert Schools,* which supported Indigenous schools and communities to develop integrated learning programs that connect the cultural knowledge of the local community with western science and the Australian curriculum.

These examples clearly show the important role our education and outreach programs play in supporting and promoting the importance and application of our research to the community and increasing Australia's STEM literacy.

Celebrating 50 years since Apollo 11

On 21 July 1969 (Australian Eastern Standard Time), humankind made 'one giant leap' by taking its first steps on the Moon. Australia played an important role in helping the United States National Aeronautics and Space Administration (NASA) share the technological feat with 600 million people around the world, cementing our nation's place in one of humanity's greatest achievements.

Television signals from the Moon were received by NASA's tracking stations at Goldstone in California and Honeysuckle Creek near Canberra, and our own Parkes radio telescope. At first, NASA switched between signals received by Goldstone and Honeysuckle Creek, the latter capturing the first footstep on the Moon. Eight minutes and 51 seconds into the broadcast the NASA controller selected signals coming from Parkes and stayed with them for the next two-and-a-half-hours.

In 2019, to mark the 50th anniversary of the Apollo 11 Moon landing, we honoured the Australians who took part, engaged people in the current work of the local space sector, and inspired future generations of STEM students.

Our 64-metre Parkes telescope, shown here at the time of the Apollo 11 Moon landing in 1969, is used primarily for radio astronomy but is also used to help NASA track spacecraft on occasions.

We held open days at the Canberra Deep Space Communication Complex, which we operate for NASA and where the Honeysuckle Creek antenna now resides, and at our Parkes radio telescope. Together, these events attracted 24,000 people including the United States Ambassador to Australia, the Deputy Prime Minister, our Minister and other key stakeholders.

We created an immersive virtual reality experience at the CSIRO Discovery Centre in Canberra, many sponsored Apollo 11 exhibitions at Questacon and the Powerhouse Museum, and collaborated with Geoscience Australia on the Canberra 'Moon Rock' trail.

We worked closely with the new Australian Space Agency and the US Embassy in Australia, with the Royal Australian Mint on the packaging and promotion of commemorative coins, the National Film and Sound Archive on a donation of the only official copy of the Apollo 11 Moon landing footage held outside the US, and the Department of Foreign Affairs and Trade on sharing information with Australia's diplomatic offices overseas.

Our communication campaign reached and inspired millions of people by working with Australia's leading metropolitan and regional media groups: News Corp, Australian Community Media and the ABC. We also hosted a media briefing on Apollo 11 and the future of Australia's space industry with the Australian Science Media Centre. News coverage mentioning CSIRO reached a combined audience of 55.5 million people in Australia.

Objective 3:

Manage national research infrastructure for the nation

Our third objective is addressed by a single function:

FUNCTION		ACHIEVEMENTS	PERFORMANCE MEASURES AND ANALYSIS
3.1	Ensure utilisation of national facilities and collections.	Pages 86–97	Pages 99–100

Function 3.1: Ensure utilisation of national facilities and collections

Our key activities for Function 3.1 contributed to our strategic focus areas via the:

- Australian Animal Health Laboratory
- Australia Telescope National Facility
- Marine National Facility
- Pawsey Supercomputing Centre
- National Research Collections Australia
- Atlas of Living Australia.

We delivered on this function by:

- hosting world-class, science-ready research facilities and biological collections available for use by the national and international science community across government, academia and industry
- advising on the identification of facility needs and the design and creation of new national infrastructure.

We host world-class national research infrastructure on behalf of the Australian Government to provide the scientific community with access to specialist infrastructure to assist in the delivery of research in the national interest. Our national research facilities and national biological collections are provided to researchers across Australia and their international collaborators through merit-based assessment. This includes landmark research platforms, specialist laboratories, scientific and testing equipment, supercomputers and digital capability, and other specialist research facilities and expertise.

The national research infrastructure receives funding from the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS) program, state governments and commonwealth and state departments, and partnership arrangements specific to the infrastructure. Significant funding is from our appropriation.

Advisory committees for each national facility or collection guide their specific strategic development and access arrangements. In addition to scientific and applied research, activities also include school student and tertiary education programs, practical training, and access to research data and publications. The national research facilities and collections are also potentially available for use through commercial arrangements.

In 2019–20, the Australian Animal Health Laboratory (AAHL) broadened its role in protecting Australia from animal diseases to also include human disease prevention. To recognise this broader role, AAHL was renamed the Australian Centre for Disease Preparedness, and it is playing a significant national and international role in the research and development for vaccines and potential treatments for COVID-19.

The COVID-19 pandemic impacted other national research infrastructure. Marine National Facility voyages were cancelled from March and rescheduled where possible to future voyage programs; other facilities had lesser or no disruptions.

In addition to our national research infrastructure as part of the NCRIS program, we also invest – often in collaboration with others – in other world-class infrastructure that addresses national challenges. For example, a collection of ice cores from Antarctica containing trapped air dating back thousands of years, and a more than 40-year air archive from the Cape Grim Baseline Air Pollution Station in north-west Tasmania. Analyses from these collections provide evidence of the change in the Earth's atmospheric composition over time and are invaluable in understanding climate and the increasing levels of greenhouse gases. These facilities are used by our scientists and collaborators as well as the science community as part of national and international science programs.

In 2019–20, we invested in the recently launched satellite NovaSAR-1. This national facility provides extremely high-resolution images of Earth from space, which will lead to new remote sensing research, training, and data analytics that will help us manage the Earth's resources. Researchers will be able to access the facility in the new financial year. We also started operating the European Space Agency's spacecraft tracking station at New Norcia, Western Australia.

Developing saltwater scientists

For research vessel *Investigator's* final voyage of 2019, we launched the Indigenous Time at Sea Scholarship (ITSS), a new program to increase opportunities for Aboriginal and Torres Strait Islander students to lead and participate in sea country and marine research.

It reflects our commitment to increase involvement and opportunities for Aboriginal and Torres Strait Islander people within the organisation and in scientific research.

For the participants, it provides practical at-sea experience and connects them with experienced researchers and other like-minded students. It also creates a community for collaborating and sharing scientific and cultural knowledge and experience.

The inaugural ITSS 10-day voyage travelled in December from Darwin, Northern Territory, to Fremantle, Western Australia, and was led by Chief Scientist, Dr Alain Protat, from the Bureau of Meteorology.

The first two participants of the scholarship program were Tiahni Adamson from the University of Adelaide, who has connections to Thursday Island and Larrakia country, and Sophie Gilbey, a proud Alyawarr woman from Flinders University. Program coordinator, Hannah McCleary, who is a proud Palawa woman, a student at the University of Tasmania, and the first Indigenous Cadet at the Marine National Facility, joined the students on the journey.

Tiahni and Sophie participated in a range of voyage research as the vessel travelled along Australia's west coast. They helped to manage the Continuous Plankton Recorder deployment program, studied the atmosphere and weather with the Bureau of Meteorology, investigated microplastics in the ocean, and conducted seabird and marine mammal surveys.

'I confirmed my deep love for marine sciences and being at sea, and how important it is to work in a field that I am deeply passionate about,' Tiahni said. 'After I finished the scholarship program, I received a two-year, full-time traineeship at Primary Industries and Regions South Australia as a Fisheries Compliance Officer.'

'I was invited to present at a Caring for Country symposium, something I never would have considered or have had the confidence to do before,' Sophie said. 'The ITSS program gave me that opportunity and I'm extremely grateful.'

'These experiences have changed my life and my future for the better,' Hannah said. 'They've made a deep impact on my cultural appreciation and understanding, my love of learning, and have shown me the power of knowledge. I've met brothers and sisters from across Australia, been introduced to the diversity of study within science and other educational disciplines, and now I'm helping to provide these opportunities for other students just like me.'

The ITSS program will run annually and is open to all Aboriginal and Torres Strait Islander students enrolled in an undergraduate or postgraduate degree at an Australian university.

Inaugural ITSS students Sophie Gilbey (left) and Tiahni Adamson (right) with ITSS Coordinator Hannah McCleary.

Diseases don't respect borders

The Australian Centre for Disease Preparedness (ACDP), formerly the Australian Animal Health Laboratory, has long played an important role to help safeguard Australia and our region from diseases affecting animals and people.

The social and economic impacts of disease outbreaks can be devastating, as we've seen from the outbreak of COVID-19. In the case of African swine fever, in countries with small-holder pig farming, livelihoods may be destroyed. If Australia has an outbreak, industry experts predict African swine fever could cost our economy $50 billion, putting thousands of jobs at risk. To prevent diseases like African swine fever spreading to Australia, ACDP is building biosecurity capacity with our south-east Asian neighbours.

Our international programs provide training to improve disease diagnosis and emergency outbreak response. We provide technical laboratory support, applied research, collaborative surveillance activities and proficiency testing programs. Proficiency testing, sometimes known as external quality assessment, is used to examine lab processes and determine the level of accuracy that participant laboratories can achieve when conducting diagnostic tests.

The programs strengthen the capability of the diagnostic services within participating countries and contribute to early disease detection, particularly diseases of zoonotic and economic relevance to the region. These are complemented by backstopping missions, where our scientists travel to participating laboratories to discuss proficiency testing results, provide technical advice, assess diagnostic laboratory spaces and practices, and advise on biosafety, quality assurance and documentation systems. These missions are critical to assist, advise and troubleshoot identified problems that global partnering labs may be having, and build trust and confidence between laboratories and scientists.

Proficiency testing participation is growing across terrestrial and aquatic diseases. Last year, the program included 87 laboratories across 30 countries, an increase from 29 laboratories across 14 countries in 2016.

Regional laboratories are providing growing investment in these projects, which ensure that diagnostic results obtained throughout the Asia-Pacific region can be reliably used by governments and biosafety councils to appropriately resource and manage biosecurity risks nationally and internationally.

Through improved threat assessment and virus management, our support reduces the risk of diseases circulating in our neighbouring countries, and as a result, assists Australia's pre-border biosecurity.

Indonesian virologist, Sri Handayani Irianingsih, one of the many scientists from across the region who received training from top biosafety experts. Credit: Jessica Davis, ABC.

Australian Centre for Disease Preparedness

The Australian Centre for Disease Preparedness is Australia's highest-level biocontainment laboratory. It houses expert scientific and operational support staff who work together to protect our region from the world's most devastating diseases. The Centre provides disease preparedness, prevention and outbreak response capability by delivering prominent science, diagnostic response and training that address the diseases that threaten Australia, www.csiro.au/Research/Facilities/ACDP.

The Centre draws expertise from across CSIRO to understand how humans, animals and environments interconnect in disease development. In 2019–20, the Centre has been a key partner in our One-Health approach to disease prevention and management.

The Centre delivers services to a range of stakeholders. It undertakes projects for the Australian Government, particularly the Department of Agriculture, Water and the Environment and the Department of Foreign Affairs and Trade (DFAT), to identify, monitor and respond to emerging diseases that threaten Australia's trade, market competitiveness, and animal and public health. Support from DFAT provides opportunities for longer-term engagement and greater support for biosafety in the Asian region.

To build capability in preclinical trials in animal models, the Centre is working towards implementing the Organization for Economic Cooperation and Development principles of Good Laboratory Practice (GLP). Attaining GLP accreditation will increase the appeal for Australian and international entities who want access to the Centre's infrastructure and services. These principles have been implemented in pre-clinical testing of two COVID-19 vaccine candidates. Read more about our involvement in COVID-19 research on page 22.

To ensure the best practices in bio-risk management, the Centre participated in the international Biosafety Level 4 Zoonotic Laboratory Network and the Five Eyes Research and Development COVID-19 network. This is critical to safety, enables us to share knowledge and results, speeds up critical research and avoids duplication of efforts.

Responding to the COVID-19 pandemic, the Centre undertook strict measures to protect the health and productivity of its workforce while prioritising the delivery of COVID-19 related work. This impacted the volume of new and existing projects executed this financial year. The Centre continues to receive requests from organisations proposing ancillary COVID-19 research, which are managed through the Centre's access process.

The Centre worked closely with our health and biosecurity and manufacturing researchers to deliver a pipeline of preclinical animal studies and customer experience at the Centre. This included collaborating with the Coalition for Epidemic Preparedness Innovations to create a new rapid response platform for developing and testing new vaccines against previously unknown pathogens, aiming to reduce the development time from years to weeks.

In response to COVID-19, the Australian Government announced $10 million in new funding for our virus and vaccine work and confirmed support for the $220 million facility upgrade. The refit works ensure we continue to meet evolving regulatory compliance standards to remain fit-for-purpose into the future.

Centers for Disease Control and Prevention's One Health approach.

Australia Telescope National Facility

The Australia Telescope National Facility (ATNF) operates radio telescopes for use by astronomers around the world to improve our understanding of the Universe.

In 2019–20, 132 papers were published in refereed journals using data from our telescopes, which revealed discoveries such as the detection of the missing 'ordinary' matter in the Universe, pinpointing the locations of fast radio bursts and rapid follow-up of short-lived astronomical phenomena.

Astronomers completed the first astronomy surveys with the Australian Square Kilometre Array Pathfinder (ASKAP), our newest telescope, and are now examining the data. These surveys are a crucial part of demonstrating the capabilities of the ASKAP and the data processing that occurs at the Pawsey Supercomputing Centre. Read more about Pawsey on page 95.

ASKAP is situated at the world's premier radio quiet site, our Murchison Radio-astronomy Observatory (MRO). The MRO will soon be home to a telescope of the international Square Kilometre Array (SKA) project, in which we have a technical leadership role for Australia and are planning to partner with the international SKA Observatory to operate the SKA telescope in Australia.

We also operate NASA's Canberra Deep Space Communication Complex (CDSCC) at Tidbinbilla and manage Australian astronomers' access to the CDSCC antennas. This year we started operating the European Space Agency's (ESA) tracking station at New Norcia, near Perth.

We also prepared for Australia's scientists to access the NovaSAR satellite as a national facility. After commissioning, an internal trial, and an export review by the Department of Defence, NovaSAR will operate as a national facility available to the Australian research community based on scientific merit. The facility was planned to be ready by June, however the impact of COVID-19 working arrangements has caused a short delay, and we expect it to be ready in the new financial year.

Telescope and space-tracking operations continued despite COVID-19, with appropriate measures in place to protect our staff. However, our visitor centres at Parkes, ATCA and the CDSCC were closed.

We received more than 200 access proposals requesting more than twice the available observing time. Around 60 per cent of astronomers that used our telescopes were from overseas, including the United States, the United Kingdom, Germany and Italy. Time on our telescopes can also be purchased. The National Astronomical Observatories of China used Parkes to follow-up pulsars found with its Five-hundred-metre Aperture Spherical Telescope.

An independent steering committee advises the CSIRO Board and the ATNF Director on the Facility's strategic development, performance and allocation of time on the telescopes.

ASKAP is located at the MRO. We acknowledge the Wajarri Yamatji as the Traditional Owners of the MRO site.

Closing in on fast radio bursts

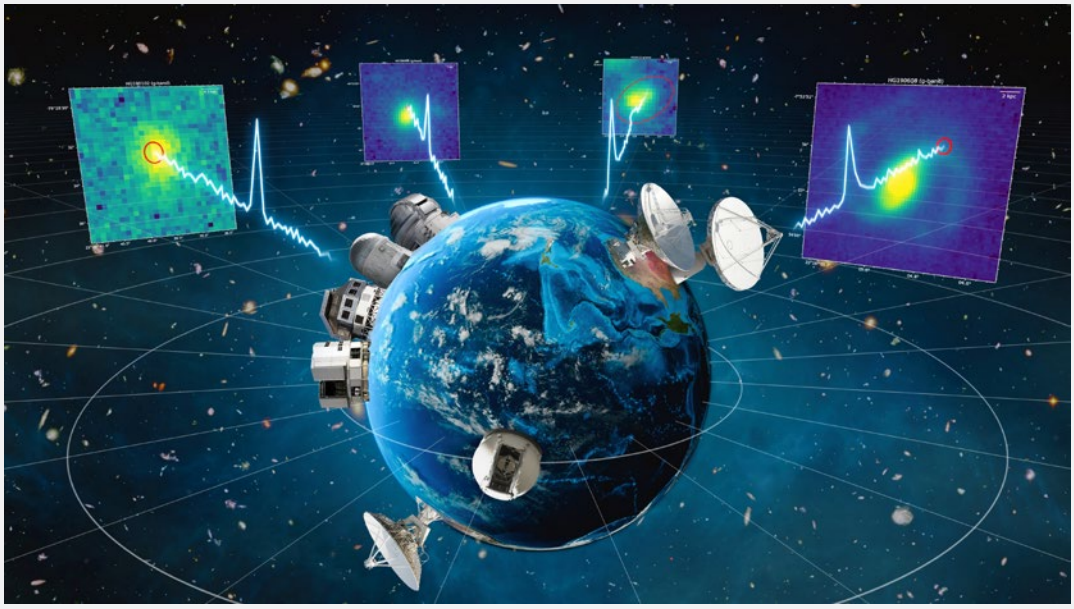
One of the greatest mysteries occupying astronomers is what causes fast radio bursts. These massive bursts of energy – each equivalent to more energy than our Sun emits in 80 years – last just milliseconds. International research teams are now racing to uncover what causes these brief and powerful events, which were first discovered in 2007 in archival data collected by our Parkes radio telescope.

Our new ASKAP radio telescope, part of the Australia Telescope National Facility, is being used to survey the skies for these transient phenomena.

To aid this search our engineers developed a customised instrument that can record the telescope's data stream when a burst is detected. This can be used to determine the burst's origin with high precision. An Australian-led team including astronomers from CSIRO, Swinburne University of Technology and the Curtin University node of the International Centre for Radio Astronomy Research has now used ASKAP to locate the origin of six bursts to their home galaxies.

This year, having pinpointed the location of the bursts, the team used instruments including our Australia Telescope Compact Array and other international telescopes to zoom in on the precise locations of the bursts. This revealed that bursts came from the outskirts of their home galaxies, ruling out supermassive black holes and several more extreme theories to explain their origins.

While we don't yet know what causes fast radio bursts, the ability to study a large number and determine their exact location is a big leap towards solving this mystery.



Our ASKAP radio telescope, along with other international radio and optical telescopes, has been used to determine the precise locations of fast radio bursts. Credit: CSIRO/S.Moorfield.

Marine National Facility

The Marine National Facility (MNF) provides dedicated marine research capability for Australian researchers and their international collaborators to enable work in Australia's vast and largely unexplored marine estate and adjoining waters. The MNF delivers excellent research in the national interest that supports government, industry and other stakeholders to make evidence-based decisions to enhance the long-term viability and prosperity of the marine environment, industries and communities.

The MNF's multidisciplinary research vessel *Investigator* can be at sea for up to 60 days, accommodates a science team of 40 participants, and can cover 10,000 nautical miles per voyage, operating anywhere from the Antarctic ice edge to the tropics.

In 2019–20, the MNF was scheduled to deliver 303 days of merit-based research. A total of 214 days at sea were successfully delivered in the first eight months before the COVID-19 pandemic disrupted the schedule.

From July to February, seven voyages comprising four primary, two transit and one technical voyage were completed. In addition, the first, five-yearly mandatory dry dock maintenance period for *Investigator* was completed in July.

The science projects delivered by *Investigator* included:

- investigating the evolution of the Australian tectonic plate through study of seamount chains in the Coral Sea
- maintaining the East Australian Current mooring array located off Brisbane, which forms part of the Integrated Marine Observing System
- mapping Wessels Marine Park, located off the Northern Territory coast, in a collaborative project with Traditional Owners
- collecting ocean and atmospheric data from our far northern waters to improve weather and climate models
- investigating the origin of seafloor terrain in the Indian Ocean to assist in the management, protection and expansion of Australia's marine estate
- launching the Indigenous Time at Sea Scholarship (ITSS) to increase the opportunities for Aboriginal and Torres Strait Islander STEM students to participate in research and the management of the marine environment.

The impact of the COVID-19 pandemic led to at-sea operations of *Investigator* being suspended in March and all voyages planned for the remainder of 2019–20 were cancelled. The MNF worked closely with those affected to identify options for rescheduling their research projects. Where possible, cancelled voyages have been rescheduled for 2020–21 or subsequent years. In addition, while in port, research was undertaken using *Investigator's* state-of-the-art instruments to collect valuable data about Hobart's complex atmospheric environment.

An independent Steering Committee advises the CSIRO Board and the MNF Director on the Facility's strategic development, performance and allocation of sea time.

Epic ocean voyage to extend Australia's maritime territory

In January, research vessel *Investigator* departed Perth for a two-month voyage to push the boundaries of vessel endurance and Australia's marine jurisdiction. On board was an international science team of 57 people including researchers from 13 institutions and 11 countries: Australia, Canada, China, Denmark, Germany, Italy, Poland, Singapore, Turkey, the United Kingdom and the United States of America.

Led by Professor Mike Coffin from the Institute for Marine and Antarctic Studies, the main objective of the voyage was to acquire data and samples to establish whether a region of seafloor the size of Switzerland qualifies to be included in Australia's marine territory.

By voyage end, the team had mapped more than 100,000 square kilometres of seafloor, much of it for the first time, and set new endurance records for both vessel distance travelled (10,077 nautical miles) and days at sea (57 days).

The voyage set out to increase our understanding of the ancient rifting, break-up and separation of tectonic plates in the Indian Ocean that split a giant oceanic plateau into two major seafloor features: Broken Ridge and the Kerguelen Plateau. These features are now over 2,700 kilometres apart after separating around 43 million years ago.

Previously, the geological origin of William's Ridge, a seafloor feature adjacent to the Kerguelen Plateau (which includes Australia's Territory of Heard Island and McDonald Islands), was considered unresolved and had not been included as part of Australia's marine territory.

In addition to mapping the seafloor in this region, researchers acquired sub-bottom profile, gravity and magnetics data. They also collected critical seismic reflection data using *Investigator's* new multichannel seismic reflection system, which images sub-seafloor structure and stratigraphy. This small-scale, high-resolution system was funded by Geoscience Australia and commissioned immediately prior to the voyage, adding a valuable additional scientific capability for use by Australia's marine research community.

The entire length of William's Ridge was mapped, defining both its continuity with the Kerguelen Plateau and its south-eastern limit for the first time. This information, along with results from post-voyage analyses of the rock samples that were collected, will be used to address criteria for a future submission to the United Nations Commission on the Limits of the Continental Shelf.

If judged eligible, it could add 40,000 square kilometres to the continental shelf recognised as part of Australia's marine territory.

The voyage also demonstrated the Marine National Facility's ongoing commitment to training Australia's next generation of marine researchers. Sixteen students from five Australian universities participated, including the youngest ever voyage participant at 19 years old. The benefits of the experience and mentoring received by students during these voyages is long-lasting and a critical investment for Australia's future marine industries.

The voyage science team included sixteen students from five Australian universities, supporting generational knowledge transfer from experienced scientists and representing an important investment in Australia's future marine research capability. Credit: David Dieckfoss.

Improving chronic pain relief treatment

One in five Australians lives with chronic pain, which is routinely felt in the absence of an external stimulus. To provide effective relief, researchers are now turning to neurotoxins produced by venomous animals to develop alternative treatments.

Researchers from RMIT University are investigating the toxins found in marine cone snails *Conus regius* and *Conus aulicus* for pain relief. The challenge is to modify the toxins' peptide structures and tune how strongly they attach to a range of different receptors in the nervous system so that they attach only to very specific targets. If their binding is selective to only a specific pain receptor, their action can be controlled to achieve pain relief without toxic side effects.

This chemical modification and fine-tuning require an understanding of exactly how the 'molecular handshake' occurs between the peptides and various receptors in the nervous system.

Using the Pawsey Supercomputing Centre's systems, the researchers are running molecular models and simulations to identify the specific binding interactions that define the handshake between the conotoxin peptides and their known receptor targets.

Models of the peptide and receptor in the cell membrane, along with the surrounding water molecules and ions, are created and then molecular dynamics simulations are run to explore how they move and interact. A typical model contains about 300,000 atoms, and atomic movements are tracked for hundreds to thousands of nanoseconds to replicate the interactions that are likely to happen in nature. Supercomputing facilities are essential to managing the extremely large number of computations involved in exploring the full range of molecular movements.

By understanding the binding mechanism through simulation, the RMIT team is optimising structural modifications for more selective or stronger binding. These results are shared with researchers at the Illawarra Health and Medical Research Institute, who create and test promising peptide variants to measure the strength and selectivity of their action. Their real-life results confirm the most promising variations to explore further in the next round of molecular modelling.

This iterative approach is creating novel conotoxin peptides with characteristics more suitable for therapeutic testing, with a stable oral analgesic for chronic pain the goal.

Researchers from RMIT University are using the Pawsey Supercomputing Centre to optimise treatments for chronic pain. Credit: iStock.

Pawsey Supercomputing Centre

The Pawsey Supercomputing Centre provides world-class infrastructure and expertise in supercomputing, data and visualisation services that enable Australia's researchers to solve large-scale data problems and obtain critical knowledge into the challenges facing our nation.

Pawsey is one of only two Tier 1 High-Performance Computing and Data facilities available in Australia and is an unincorporated joint venture between CSIRO and four Western Australian universities: Curtin University, Edith Cowan University, Murdoch University, and the University of Western Australia.

In 2019–20, Pawsey achieved significant results in science domains including radio astronomy (providing essential computing power to analyse data from the ASKAP and Murchison Widefield Array telescopes and the SKA), space, energy and resources, engineering, bioinformatics and health science.

The Australian and international research community accessed Pawsey to undertake COVID-19 research during the height of the global pandemic, with a joint Pawsey and the National Computational Infrastructure call for researchers to access the advanced computing and data services of each centre to accelerate research projects directly responding to the pandemic.

Pawsey also enabled researchers to: develop more effective and less addictive oral analgesics for chronic pain from venomous animal toxin; pioneer virtual tools to create a method to rapidly and accurately detect coronary artery disease; develop a diagnostic test to keep grape vines clear of viruses that can reduce fruit quality by up to 70 per cent; use artificial intelligence and machine learning to determine the surface age of planets; and create some of the deepest images produced of the sky over wide areas. Read more about the work Pawsey enables at pawsey.org.au/case-studies. Demand for Pawsey facilities exceeded the available allocation this year.

In 2018, the Commonwealth Government announced a $70 million upgrade of the infrastructure with deliverables staged across four years to ensure Pawsey remains a cutting-edge supercomputing facility. New Nimbus Cloud infrastructure became available to users in May, and the procurement of the Murchison Widefield Array compute cluster was awarded in February – this new cluster will be available from mid-2020, providing users with enhanced graphics processing unit capabilities to power artificial intelligence, computational work, machine learning workflows and data analytics. We expect the upgrade and the performance benchmarking of the new infrastructure will be completed by mid-2022. The current status of the upgrade, is available at pawsey.org.au/about-us/capital-refresh/.

Using bees and honey to monitor environmental change

Climate change, bushfires and loss of habitat are threatening the survival of many plant species. Detecting and monitoring changes to vegetation is important for long-term conservation of individual threatened species and entire ecosystems.

Traditional plant biomonitoring programs are time-consuming and costly, requiring trained staff to carry out extensive field surveys. An alternative is to use pollinating insects for biomonitoring. Pollinators like European honey bees (*Apis mellifera*) are experts at surveying flowering plants. When they visit plants to collect pollen and nectar, they bring DNA evidence of neighbouring plant communities back to their hives. We can easily collect these DNA records from a range of sources, including bees, pollen traps and honey.

DNA metabarcoding is a high-throughput genomic method that enables fast, accurate identification of species from environmental samples, including pollen or honey.

Honey bees can be used to detect and monitor rare native plant species in areas of critical importance.

Species identifications are based on expertly identified plant specimens in reference collections, including the Australian National Herbarium, which houses more than one million plant specimens. Reference collections are a vital resource for future research and for understanding our biodiversity. They provide the data for ground truthing large scale biomonitoring programs.

Through the Environomics Future Science Platform, we have compared the use of pollen DNA metabarcoding to survey flowering plants with the results from a traditional field survey (read more on pages 29 and 31).

The Australian Capital Territory Beekeepers Association manages hives of European honeybees at Jerrabomberra Wetlands, an urban reserve in Canberra. We carried out a field survey at this site and identified 44 plant species. With the assistance of beekeepers, we then used bees to survey the flowering plant species present.

We tested three different pollen DNA sampling methods, including catching individual bees, setting up pollen traps, and collecting honey directly from hives. Using pollen DNA metabarcoding we detected 133 plant species from the combined sampling methods. Honey was the best source of species information, followed by pollen traps and individual bees.

We are now using this new technology to monitor changes to vegetation in highly threatened areas such as Kosciuszko National Park, where a unique alpine plant community occurs.

We are also using the Australian National Herbarium collection to identify and generate DNA barcodes for rare and endemic Australian species. This will expand the potential for pollen DNA metabarcoding to be deployed to monitor rare native plant species in large areas of national parks and nature reserves.

National Research Collections Australia

National Research Collections Australia are the most taxonomically and geographically comprehensive specimen-based representation of Australia's unique natural heritage.

There are six national collections including insects, plants, fish, mammals, birds and reptiles, algae and tree seeds. Together these collections contain over 15 million specimens, tissue samples, sound recordings, images, DNA sequences and environmental data, that document and characterise Australia's diverse and changing environment back to 1770.

In 2019–20, we commenced design of a new purpose-built facility to open in 2024 at our Canberra site, to include state-of-the-art archival collection halls, and research and digitisation laboratories. The ongoing digitisation of the specimens and the addition of new layers of data from genomic and phenotypic analysis using new equipment has made lab work faster and cheaper.

We commenced an upgrade of our data systems, which will deliver a new whole-of-collections data management system. This will increase our ability to manage the rapidly growing digital data from the collections and provide it to the research community, citizen scientists and the public through the Atlas of Living Australia.

Our initiatives are contributing to the national challenges of biosecurity, environmental monitoring, human health, future industries and biomedical research.

This year, our datasets were used in machine learning to develop an artificial intelligence-based mobile phone app for species identification for biosecurity purposes. Our collections were explored for bio-active molecules to develop new pharmaceuticals to treat human diseases, and our specimens were surveyed for DNA profiles to be used as reference data sets for environmental studies. Our two living specimen collections (algal and tree seed) also provided Australian industry with reference strains and breeding material and supplied expertise and advice to SMEs and regional partners in developing countries.

Atlas of Living Australia

The Atlas of Living Australia (ALA) is our national biodiversity database platform. It's a collaborative, open, digital platform that harmonises Australian biodiversity data making it accessible and re-useable. The ALA is a critical tool for biodiversity scientists, policy makers, land managers, educators and students. As the Australian node of the Global Biodiversity Information Facility, it ensures Australia's biodiversity data are accessible to the world through www.gbif.org/.

In 2019–20, the ALA delivered over 87 million biodiversity occurrence records to 40,000 registered users to support innovative science. In addition, the ALA infrastructure supported major national and state data programs including the March release of the Index of Marine Surveys for Assessments with the Western Australia Government, and the planning, monitoring, and evaluation tool for natural resource management grants with the Department of Agriculture, Water and Environment. These partnerships play an important role in supporting our stakeholders to collect, manage and deliver trusted biodiversity data to the ALA. Finally, our partnership with the global iNaturalist network led to the launch of the Australian node, which provides a critical new capability to support Australia's biodiversity community through crowd-sourced, cutting-edge species identification capability. Find out more at inaturalist.ala.org.au.

Quality data key to improving biodiversity

Global collaboration is key to improving the quality of data in our national biodiversity database, the Atlas of Living Australia (ALA), and we've joined forces with global social platform, iNaturalist.

The ALA holds over 87 million biodiversity occurrence records from national collections, research organisations, government agencies, community groups and individual citizen observations. Open access to such a large and comprehensive dataset helps to create a detailed picture of Australia's biodiversity and enables scientists, policy makers, land managers, and industry to work more efficiently.

iNaturalist is one of the world's most popular nature apps for recording and identifying species observation. We have become a member of the global iNaturalist network and launched the localised gateway, iNaturalist Australia, in October. The Australian iNaturalist community has over 200,000 observers and 8,700 identifiers who have collectively contributed over one million observations.

The key to iNaturalist's success is the unique combination of a passionate community and state-of-the-art machine learning technology to help people with species identification. Novice naturalists who need help with species identification benefit from iNaturalist's image recognition software and the expertise of the community – within hours of uploading an image, a novice can receive confirmation on species identification. People with expertise in a particular taxon can help identify observations, share their expertise and contribute to a global conversation. This drives two outcomes: connecting people with nature and producing scientifically valid data.

Open data policy reaps benefits for all kinds of scientific biodiversity research – taxonomy, ecology and artificial intelligence. Open source software development facilitates innovation and infrastructure sustainability.

iNaturalist Australia has benefited Australia – it's improved the quality of our national biodiversity data and encouraged greater participation in biodiversity science. During the recent bushfire season, iNaturalist was used by research groups, including the University of New South Wales Centre for Ecosystem Science, to help collect data on species recovery after bushfire.

Our collaborations with large international networks like iNaturalist, the Living Atlases and the Global Biodiversity Information Facility are based on a shared approach to open source software and open data policy. These offer us the benefits of knowledge sharing and risk mitigation across all our platforms and communities.

iNaturalist Australia is available at: inaturalist.ala.org.au.

iNaturalist is one of the world's most popular nature apps for recording and sharing species observations. Credit: iNaturalist

Our efforts this year contributed to us delivering towards our outcome (see Table 3.13):

- World-class facilities and collections are available to be accessed and used effectively by the research community and public.

Table 3.13: Summary of our performance for managing national research infrastructure

PERFORMANCE MEASURES SOURCE: 2019–20 CORPORATE PLAN	TARGET	RESULT
World-class facilities and collections are made available for access by the research community and used effectively		
ACDP: Compliance with Australian legislation and regulations, and International Organization for Standardization accreditations	Maintain or exceed compliance	**Achieved**: Up-to-date and compliant with all current audits
Facilities and collections achieve a threshold rate of successful usage, with lost time minimised	Achieve or exceed usage rates: *(Source: 2019–20 Portfolio Budget Statement)*	Results for each facility detailed below
ATNF: successful astronomical observations[7]	Minimum of 70% successful astronomical observations	**Achieved**: 76.9%
ATNF: time lost during astronomical observations and operations[8]	Maximum 5% time lost during scheduled astronomical observations	**Achieved**: 2.3%
Pawsey: supercomputer core-hour use	90% core hours on Pawsey supercomputer facility	**Achieved**: 93.7%
National Collections: outward loans of collections[9]	70% outward loans of collections (averaged over 5 years)	**Achieved**: 70%
MNF: successful marine research days delivered[10]	Minimum of 90% successful research days delivered on MNF and maximum of 10% of time lost during scheduled MNF operations	**Not achieved**: 71% of days delivered before voyages suspended by pandemic measures

7 This data is for April–September 2019 and October 2019 – March 2020 observing semesters for Parkes and ATCA.
8 Supercomputer core-hour use represents the percentage of core hours available on the Pawsey Cray XC-40 supercomputer Magnus that are used by research projects awarded an allocation on Magnus during 2019–20.
9 The target recognises that preparing loans requires significant time investment and some requests may not be possible to comply with international conventions and legislation.
10 This data is for July–March as operations at sea were not permitted from March due to COVID-19.

Analysis of performance

In 2019–20, we continued our strong record of providing researchers with access to specialist infrastructure for research in Australia's interest. Not only were all but one standard performance measures achieved (and this was due to COVID-19 safety measures) but the remit and activities of two of the facilities was broadened to account for challenges posed by COVID-19.

Australian Centre for Disease Preparedness

ACDP is a vital part of Australia's biosecurity infrastructure. Its significantly increased role in human disease prevention, notably relating to zoonotic diseases and researching vaccines and potential treatments for COVID-19, was recognised in April by changing the name from AAHL to ACDP. ACDP continues to maintain or exceed the regulatory requirements certified by the Department of Agriculture, Water and the Environment, the Office of the Gene Technology Regulator, the Department of Health's Security Sensitive Biological Agents legislation, and all relevant International Organization for Standardization accreditation. It is imperative that ACDP meets regulatory standards so that Australia continues to have its frontline, high-containment facility for research into highly infectious agents in the world, biosecurity, and protecting Australia's multi-billion-dollar livestock and aquaculture industries.

Australia Telescope National Facility

As all of the ATNF's telescopes can be operated remotely from our Sydney headquarters or virtually from elsewhere in the world, the ATNF continued to carry on 'business-as-usual' throughout the COVID-19 restrictions. It maintained its excellent performance standard for observations and achieved results similar to previous years. This enabled high-level impact radio astronomy research to continue with researchers improving our knowledge of the Universe by investigating the evolution of galaxies, magnetic fields, black holes and the use of pulsars.

Pawsey Supercomputing Centre

The ongoing strong demand for Pawsey's supercomputing facilities, and the requirement for continued excellence in operating the facility to ensure supercomputing availability increased, with advanced computing and data services used for COVID-19 related analyses. The outcome of 97.3 per cent for supercomputer core hour use is above the target and continues the positive trend of previous years, indicating the continued high level of use of Pawsey's supercomputer. The facilities, expertise and infrastructure at Pawsey enable advanced research in astronomy and geoscience and other high-end science relying on supercomputing.

National Research Collections Australia

The National Research Collections Australia continue to meet the target for outward loans, enabling scientists affiliated with research institutions to access our specimens without travelling to our sites. Travel can be difficult and costly, particularly for international researchers. Specimens are lent at no cost to other national and international institutions to support research into Australia's unique biodiversity. The Collections help researchers deliver their research as well as contribute to national and international conservation of biodiversity.

Marine National Facility

The MNF has historically achieved or exceeded the target for successfully delivering sea days. The 2019–20 voyage schedule planned to deliver 303 days at sea, and the MNF was 100 per cent on track in March with all 214 planned sea days successfully delivered with no lost sea days. That research provided key information to government, industry and other stakeholders to support decision-making related to fisheries management, geological resources, regional and global climate, and marine operations.

However, COVID-19 prevented further voyages after March. The remaining 89 days of planned research days have been rescheduled to future years. Although *Investigator*'s sea operations were suspended from March onwards, this did not mean that the science was shut down. We continued to provide researchers with access to the ship's advanced atmospheric instruments to monitor emissions and pollutants in the Hobart area.

Winning genetics put Australian Atlantic salmon industry on front foot

An ongoing 16-year research collaboration that is improving the genetics of Atlantic salmon has been pivotal to helping the Australian industry grow more than 350 per cent in the last two decades and develop into Australia's largest seafood sector.

Rough seas can be the least of the concerns faced by Australian salmon producers, with disease, early maturation and warming water impacting harvests and product quality. Responding to these pressures, a world-leading Atlantic salmon selective breeding program was established.

Since 2004, we've partnered with Salmon Enterprises of Tasmania (Saltas) – a salmon hatchery and breeding centre that is jointly owned by ASX-listed companies Tassal and Huon Aquaculture – to improve the sustainability of the industry and the quality of the Atlantic salmon delivered to plates across Australia.

This multidisciplinary research included our agriculture and food, oceans and atmosphere, and data science researchers.

The research has delivered Atlantic salmon stock that grows 35 per cent faster than the founder stock and are 37 per cent more resistant to amoebic gill disease, an infection that can suffocate fish and costs the industry $20 million per annum to treat. These gains continue to accumulate at four to five per cent every year.

New technology has been integrated and the program has evolved in pursuit of greater gains. Adoption of genomic selection technology, introduced in 2015, has resulted in a step change in future gains and allowed greater flexibility in responding to future challenges, such as the need to select for improved performance in warmer waters.

The resultant increases in revenue and savings in disease treatment costs have helped the industry grow by 351 per cent from around $215.4 million in 2001 to $756 million in 2016–17. An economic study in 2016 found that the salmon breeding program has contributed $169.3 million in value since its establishment, with a benefit-cost ratio of approximately $27 for each dollar invested.

The Atlantic salmon selective breeding program is an outstanding example of how our world-leading science has partnered with industry to help it grow – in this case increasing employment in Tasmania – to address challenges, and deliver products that are recognised globally as adding to Australia's reputation for quality.

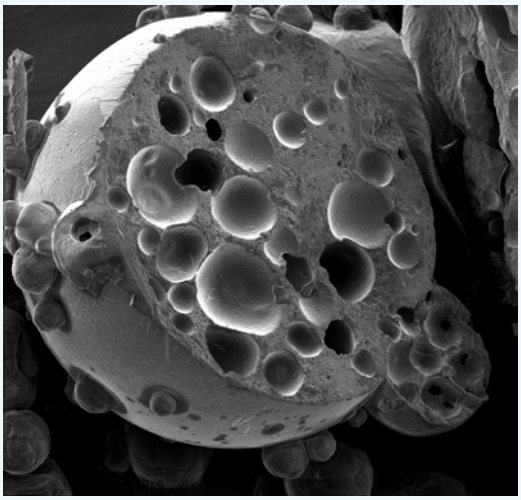
The scientific value and impact generated by this work was recognised with the 2019 CSIRO Chairman's Medal for Science Excellence (read more on page 9).

Our expertise in genetics has helped to significantly grow the market size of the Australian Atlantic salmon industry.

CannPal Animal Therapeutics

CannPal Animal Therapeutics (CannPal) is an ASX-listed animal health company that develops evidence-based, plant-derived therapeutic products to promote better health and wellbeing for companion animals. With the emergence of an ageing pet population, and associated age-related diseases, there is little in the way of new and natural therapeutics to help provide relief for conditions such as osteoarthritis. Current treatments are often dated or repurposed human drugs, which can come with many undesirable side effects in animals.

CannPal identified a gap in the market for natural, plant-derived animal therapies that are safe and effective for promoting better health and wellbeing for companion animals, focusing on compounds derived from cannabis.



An electron micrograph of MicroMAX® particles.

Plant-derived active ingredients are very sensitive to light, air and stomach acids. By the time they have been extracted from the plant and processed into a delivery format suitable for pets, most of the bioactive compounds have started to degrade.

CannPal engaged our researchers to help progress a new plant-derived joint health formulated product for dogs into a more suitable format. The project aimed to improve the stability of the formulation and to ease its incorporation into a therapeutic pet supplement. This would ideally result in a newly formulated therapeutic product for dogs, to promote better absorption and efficacy with improved bioavailability.

Our scientists at the Werribee Food Innovation Centre used their patented microencapsulation technology MicroMAX®, originally developed for stabilising omega-3 fatty acids and other bioactives in food products. This provides oxidative stability and an enhanced delivery of active ingredients to the gastrointestinal tract, often resulting in greater shelf life for products. Our scientists investigated the optimum formulation and processing conditions to convert CannPal's formulation into a stable powdered ingredient with MicroMAX®.

Initial research was facilitated and co-funded through CSIRO Kick-Start, which helps start-ups and SMEs to access our research and development opportunities. Since the project concluded, CannPal has continued to work with us to optimise and scale-up the process and entered into a licensing agreement with us for use of our MicroMAX® technology.

Objective 4:

Ensure the sustainability of CSIRO

Our fourth objective is addressed by two functions:

FUNCTION		ACHIEVEMENTS	PERFORMANCE MEASURES AND ANALYSIS
4.1	Ensure a vibrant, safe and positive culture in CSIRO.	Pages 104–110	Pages 110–111
4.2	Ensure CSIRO has sustainable operations, sites and infrastructure.	Pages 112–117	Page 117

Function 4.1: Ensure a vibrant, safe and positive culture in CSIRO

Our key activities for Function 4.1 contributed to our strategic focus areas via:

- health and safety
- people and digital practices
- workforce planning and talent management
- CSIRO culture.

We delivered on this function by:

- supporting our people to thrive and to value their health, safety and wellbeing
- understanding our future workforce needs and ensuring we have the right capabilities (including leadership) at the right time
- shifting the needle on all elements of our cultural vision and continuing to invest in our leaders
- attracting, developing and retaining the nation's best and brightest to solve complex, emergent challenges for Australia's prosperity into the future.

Our people thrive and value their health, safety and wellbeing

Health, safety and wellbeing

Our commitment to the safety and wellbeing of our people is driven by our Health, Safety and Environmental (HSE) Sustainability Policy. This year, we updated the policy to reflect our commitment to enhancing the safety and wellbeing of our people, and to embed a link to our values to drive a positive and proactive safety culture.

The second annual HS-Me Day was held in September, where we stopped our work activities to focus on health, safety and wellbeing, particularly hazard identification and making time to connect. Feedback from our people indicated they are more confident in identifying, reporting and logging hazards, have a greater awareness of online wellbeing resources, and understand how to fit wellbeing into their day.

Many unprecedented events have occurred over the past 12 months, from bushfires, to smoke blanketing, to hailstorms and the COVID-19 pandemic – all of which required a rapid organisational response. Our teams responded swiftly to these events to navigate the associated risks to keep our people safe.

We activated a Situation Management Team in January to respond to COVID-19 and to focus on safety and business continuity across Australia and globally. We minimised the impact of the pandemic on our people and continued to deliver projects by transitioning the majority of the workforce to remote working. We prioritised our support to the Australian Centre for Disease Preparedness, as well as our manufacturing, and health and biosecurity researchers undertaking COVID-19-related work. We also worked with state governments to ensure our sites could be accessed.

We focused on the holistic wellbeing of our people by delivering mental health first aid training. Unfortunately, this initiative is currently on hold due to the pandemic and will commence again soon. As part of our Thrive initiative and in partnership with the Black Dog Institute, we implemented webinars and workshops tailored to leaders, human resources, health and safety professionals, and general staff members. We developed and delivered resources to help our people cope with the rapidly changing situation as the pandemic evolved. We launched a campaign to encourage our people to move more and sit less, which raised awareness of the risks of sedentary behaviours and reduced the likelihood of injuries. The Global Challenge, run by Virgin Pulse, was a key component of this campaign and we made it available to all our people.

We invested in a digital HSE solution to streamline and simplify information, processes and systems, and to enable a seamless user experience.

Safety performance

During the year, we carried out a review of the definitions and processes used to calculate our statistics. This review highlighted that the definition and methodology used to determine the Medical Treatment Injuries (MTI) frequency rate was inconsistent with industry practice, which resulted in overstating the performance metric. We became aware that while reporting incidents from employees, affiliates and contractors, only hours from employees were reported. Going forward, contractor incidents will be removed from frequency rates and a conservative estimate of affiliate hours will be used until a more robust system is in place to collect data. A revised definition has been approved to enable benchmarking against industry and other government agencies, in line with industry best practice.

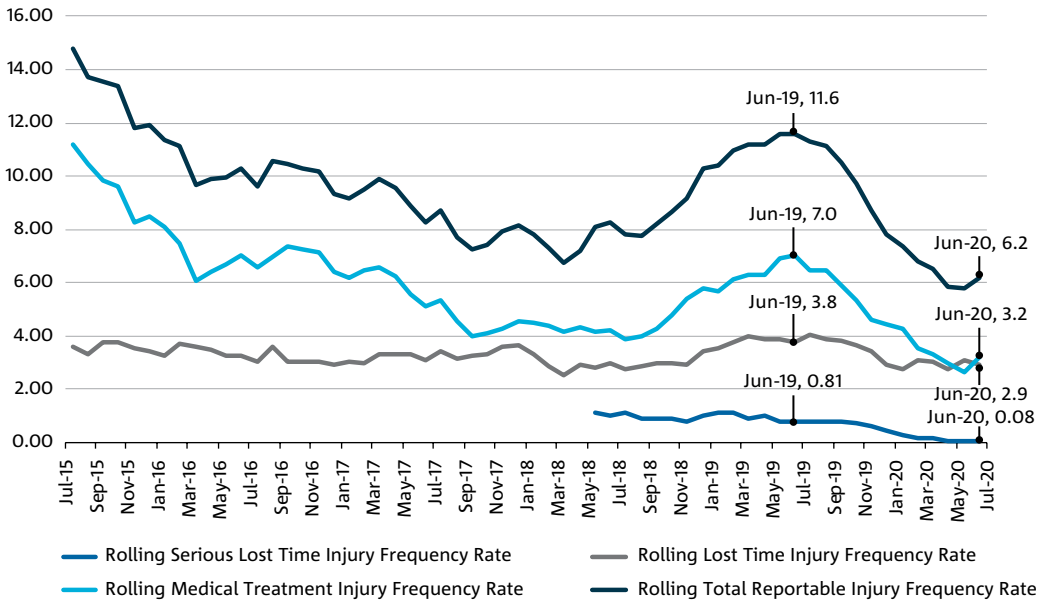
This revision of the MTI definition has resulted in a correction of the MTI frequency rate, from 7.0 in 2018–19 to 3.2 in 2019–20 and a correction of the Total Recordable Injury Frequency Rate from 11.6 to 6.2. Our Serious Lost Time Injuries frequency rate has fallen from 0.83 in 2018–19 to 0.08 under the revised definition in 2019–20, as depicted in Figure 3.3. Our people are encouraged to report discomfort early, so that early intervention is effective.

We provided a wealth of information and resources to assist people setting up at home to achieve best possible ergonomics with what people had available to them. We are responding further to this new way of working and are putting in place additional resources to ensure that our people are able to work safely, whether at home or onsite.

Regulatory notifiable incidents reported to Comcare and other regulators increased from 10 to 15 this year, including four serious injuries and 11 dangerous incidents. Six of these incidents were electrical. As a result, we developed an Electrical Safety Action Plan and updated our Electrical Safety Procedure to align with workplace health and safety legislation. Two other incidents prompted rapid action to rectify gaps in local processes and these lessons learned were shared with our senior leaders. We continue to have a good relationship with our regulator and take the opportunity to improve from every notifiable incident.

The Safety Contact program was broadened throughout our leadership teams, which resulted in more than 2,000 safety conversations during the year. We observed a marked increase in discussions on hazard topics around psychosocial and work environment occurring from February, showing that leaders responded to the rapidly changing environment.

Figure 3.3: Our recordable injury frequency rates



Our future workforce and leaders

Succession and talent development

This year we took a more transparent and robust approach to succession planning, including targeted development planning and interventions designed to increase the talent pipeline for leadership roles. We reviewed talent pipelines and identified potential successors for executive leadership roles, and we identified appropriate development activities for successors.

In addition, we introduced a process to identify future organisational leaders to invest in and accelerate their readiness to take on roles of greater scope, complexity, and ambiguity.

Learning and leadership development: people and digital practices

We delivered over 48,000 hours of learning to our people in 2019–20. Some highlights include:

Digital Academy: Learning reached 1,396 people and delivered over 13,000 hours of learning with six core offerings that lifted our data science and digital literacy capabilities.

COVID-19 prompted our virtual learning and leadership development curriculum to expand. The Experienced Leader Program was delivered virtually for the first time, demonstrating agility and building virtual leadership capability in leaders across the organisation.

The COVID-19 Leaders Hub and Leading Remotely program was established, providing resources and capability building to support leaders to lead their teams virtually. This program has three themes: Be Well to Lead Well; Maintaining Team Connections; and Getting Things Done.

Our award-winning, frontline leadership program, Ready to Lead, continued to grow this year – 162 participants completing the program and 85 participants enrolled in the current sessions.

Our culture

Culture strategy and forward planning

We identified several priority areas to improve how we work collectively, manage change and build adaptiveness. These 'cultural levers' will help us to empower and build leadership capability, foster agility and create effective networks for our people.

We continued to support initiatives focused on building engagement and mutual trust with our people, including all staff webinars, senior leader-led round tables and site visits. More than 2,300 people attended our state-wide CSIRO Connect events in 2019, which helped to build a shared sense of purpose around our strategic direction and the work that we do and ensuring that everyone feels included and valued.

Organisational values

Developing our organisational values was a key priority this year. We engaged with our people at our Connect events, which helped us identify the important themes that resonated with our people and that we needed for our strategic success.

We agreed on four key values in March: People first; Further together; Making it real; and Trusted.

These are detailed on page 17 in Part 2.
We're continuing to work on improving staff awareness and embedding the values across our people lifecycle.

Diversity and inclusion

Truly equitable workplaces offer opportunity, understanding and mutual benefit across any organisation. By creating a genuinely inclusive culture where everyone feels a sense of belonging, our people will be enabled to realise their full potential. To deliver on our purpose and drive innovation, we remain committed to looking at all facets of our pipeline and experience, and taking decisive, positively directed action to ensure our workplace is inclusive and equitable for everyone. Our framework is our Diversity and Inclusion Strategy 2019–22, which has a deep focus on gender, Indigenous Australians, disability and cultural diversity.

Our two major programs to advance gender equity are Science in Australia Gender Equity (SAGE) and Male Champions of Change (MCC). Our Chief Executive continues to champion gender equity outcomes via the MCC STEM Group, which complements the evidence-based, long-term focus of SAGE. Achieving SAGE Bronze accreditation was a monumental achievement, and we have built on this breakthrough by implementing our five-year SAGE Bronze Action Plan with an aspiration towards SAGE Silver.

During 2019–20, we made exceptional progress to address cultural, systemic and pipeline barriers to gender equity in STEM. Fifty-one per cent of our SAGE actions are complete, and we reached 62 per cent of the milestones of our five-year plan. Another 41 per cent of actions are in progress. Some of these are long term, extended commitments that are in progress for future impact. We delivered a further 13 actions via MCC Group Action Plans, including addressing everyday sexism in the workplace.

This year, we delivered our workplace response to Domestic Family Violence and Abuse. We developed easily accessible information and trained domestic and family violence and abuse contact officers and human resources staff to support our people when they need it most. The work to embed and extend these programs demonstrates continued and genuine commitment to gender equity.

In June, we were awarded Gold Employer Status in the 2020 Australian Workplace Equality Index, which recognised our commitment to equality for lesbian, gay, bisexual, transgender/gender diverse, intersex and queer (LGBTIQ+) inclusiveness.

Prioritising and engaging with the LGBTIQ+ community highlights this commitment and creates a feeling of belonging for all our people. We prioritised activities that raised the visibility of LGBTIQ+ employees, participated in annual celebrations including the Sydney Gay and Lesbian Mardi Gras Parade and Wear it Purple Day, and drove systemic changes in policy and reporting to improve acceptance and comfort within the workplace.

More than 50 of our scientists and employees marched in the 2020 Sydney Gay and Lesbian Mardi Gras Parade to demonstrate our commitment to LGBTIQ+ inclusion.

Using an evidence-based approach with data from the Australian Bureau of Statistics, we developed discipline-specific benchmarking across the organisation to better understand our current and projected performance to develop more targeted actions for the future.

To ensure people of all genders feel supported and empowered, we provide mentoring and shadowing opportunities irrespective of gender. We also know that gender roles extend beyond the workplace to family life and societal expectation. With that in mind, we developed online versions of our leadership and development programs to facilitate attendance for our people who are unable to travel for caring or other reasons.

For International Women's Day, we launched a digital exhibition across our social, digital and internal channels to celebrate our women. To ensure the role models we promote are gender balanced and culturally diverse, our internal and external communication strategies have diversity checkpoints, which are aligned with our diversity aspirations and values where everyone sees themselves, their potential, and their value.

Our Chief Executive and Chief Scientist regularly emphasise the importance of diversity via blogs and speaking platforms, and the initiatives implemented to date reinforce an inclusive workplace culture that fosters a sense of belonging for all our people.

Indigenous engagement

We recognise that sustainable and respectful relationships with the Aboriginal and Torres Strait Islander community are integral towards our vision of supporting Indigenous science excellence.

Our second Innovate Reconciliation Action Plan (RAP) reaffirms our commitment to strengthening genuine relationships with the Aboriginal and Torres Strait Islander community. This year we continued to progress all 62 actions, including a few first-time achievements across our science, partnerships, capability development, employment, procurement, and education and engagement.

In support of our RAP, we aim to achieve greater Indigenous participation and are actively pursuing further opportunities to incorporate supplier diversity within the organisation through promoting the Australian Government Indigenous Procurement Policy. Over the last year, we have contributed to the Commonwealth Government's target with a total expenditure of $8.7 million with Aboriginal and Torres Strait Islander-owned enterprises.

Our cultural capability framework continues to nurture the internal capabilities of our people. At 30 June, 79 per cent of our people had completed the online Aboriginal and Torres Strait Islander cultural awareness learning module. We embedded cultural protocol initiatives at our owned sites and we recognised all significant dates in the Aboriginal and Torres Strait Islander calendar, including operating a CSIRO stall at the largest NAIDOC event in Brisbane in July.

In May, we delivered a national campaign for National Reconciliation Week through a virtual online program of events that enabled all our people to participate during COVID-19. We learnt about our shared histories, cultures and achievements, explored how each of us can contribute to achieving reconciliation in Australia, and improved our understanding of the world's oldest living and continuing cultures.

We recognise that our journey towards true and genuine reconciliation requires us to rethink how we can support Indigenous-led science and solutions that benefit all Australians. In 2019, we invested in the Indigenous Science Program and identified how we can develop a CSIRO-wide program that embraces the co-development of science excellence, which will make a difference for all Australians.

Our external relationships with the Aboriginal and Torres Strait Islander community grew as we strive to build genuine partnerships in the sector. In July, we presented at the National Australian Institute of Aboriginal and Torres Strait Islander Studies Research Conference. In August, we sponsored the 2019 Garma Festival. Led by our Chief Scientist, Dr Cathy Foley AO PSM, we supported the largest CSIRO delegation of people to attend and participate in Australia's largest Aboriginal-led cultural exchange.

We maintained and fostered our relationships with Aboriginal and Torres Strait Islander leaders and experts that advise us on how best to meet the needs of Aboriginal and Torres Strait Islander communities. The Indigenous Strategic Advisory Council met three times this year to provide strategic advice and guidance to our executive leadership team. Our external Aboriginal and Torres Strait Islander partners and subject matter experts provided advice through our representative advisory groups: the Indigenous Science Program Independent Reference Group; the Indigenous Innovation Alliance committee; the Indigenous STEM Education Project Steering Committees; and our Business Unit Strategic Advisory Committees.

Our Indigenous-led science highlights included collaborating with the Ngadju people to re-engage Indigenous cultural burning knowledge as part of the management of Western Australia's Great Western Woodlands. We also partnered with Northern Australia Indigenous Land Management Alliance, Mimal Land Management Aboriginal Corporation, Aak Puul Ngangtam Ltd and Normanby Land Management to fund a $4 million project that will use the world's largest satellite herd-tracking program to manage more than 1,000 feral buffalo and cattle roaming northern Australia.

Indigenous employment

We invested more than $1 million in the Indigenous Capability Development Project (ICDP) to provide pathways for our Aboriginal and Torres Strait Islander STEM students. Through this project, we established relationships with universities in six of Australia's states and territories and created funding support for Aboriginal and Torres Strait Islander students in STEM to contribute to our future workforce.

We developed a talent management framework to provide greater awareness of career development and growth opportunities. We also created a unique support network of Aboriginal and Torres Strait Islander peers to provide culturally sensitive support to our people.

We retained one-third of our cohort, provided professional development funding, and our representation of Aboriginal and Torres Strait Islander peoples peaked at 2.1 per cent during the ICDP project.

Our efforts this year contributed to us delivering towards our outcomes (see Table 3.14):

- Our staff are engaged and empowered in their work.
- Our innovation culture and operations enhance the wellbeing of our staff.
- Our workforce is inclusive, harnessing the full potential of our people.

Table 3.14: Summary of our performance for enabling a healthy and sustainable organisation

PERFORMANCE MEASURES SOURCE: 2019–20 CORPORATE PLAN	TARGET	RESULT
Staff safety, health and wellbeing		
Staff Survey: staff wellbeing responses	70% positive	**Achieved**: 70% positive
Hazard reporting (number of hazards recorded by staff in the health, safety and environment system)	720 reports	**Not achieved**: 576 reports, due to very low reporting March–June
Cultural health		
Staff Survey: Sustainable Engagement Score	80% positive	**Achieved**: 84% positive
Diversity in leadership: proportion of female leaders (as defined by organisation role)	33% female	**Achieved**: 36% female

Analysis of performance

Staff safety, health and wellbeing

Staff wellbeing

This year we were unable to conduct our regular, comprehensive staff survey due to disruptions from COVID-19, however we completed short and focused pulse surveys in April and May. More than 3,000 people responded to the latest survey and nearly 70 per cent responded favourably to their wellbeing status. This result is a significant four per cent improvement in comparison to the wellbeing indicator reported in 2018, and a two per cent improvement on the 2019 result. In spite of COVID-19 disruptions, this is considered a significant achievement and a result of our regular programs that focused on improving our people's wellbeing.

Hazard reporting

We were well on track to meet our target of 720 hazard reports until March, where, in response to COVID-19, our people worked from home where it was not essential for them to be on site. From March–May, hazard reporting was very low. We reported 576 hazards, which was far in excess of the 2018–19 result of 300.

Cultural health

Sustainable engagement

Our people's engagement is an overall measure of an employee's connection to their organisation and is closely correlated with productivity and performance. This year, in our pulse survey, we achieved 84 per cent positive responses to the questions representing engagement, exceeding our target of 80 per cent. This continues our significantly positive trajectory over the past five years, up from past results of 78 per cent in 2018 and 68 per cent in 2016 and 2014.

It indicates progress in our initiatives focused on building engagement and mutual trust with our people. This has been especially important in our responses to the bushfire and COVID-19 crises.

We put our people first and actively supported the transition to working safely from home or on our sites where necessary. We held regular forums to keep connected with our people both on operational changes and on our research contributions to the national responses. In our survey, 95 per cent of our people reported that they are proud to be associated with CSIRO.

Prior to these disruptions, our initiatives included all-staff webinars, senior leader-led round table discussions and site visits. We held Connect workshop events to build a shared sense of purpose around our strategic direction and the work that we do, and to ensure that everyone feels included and valued.

Diversity in leadership

Achieving gender equity is critical for us to deliver innovative solutions and achieve impact – leveraging diverse perspectives from a wider talent pool allows us to draw on different experiences and approaches to expand our thinking and creativity. Recently, there has been growing concern about the under-representation of women in leadership across industry. Latest Australian Bureau of Statistics data shows that women comprise 47.4 per cent of all employed persons and hold 31.5 per cent of key management personnel roles in Australia (Workplace Gender Equality Agency 2020, Data Explorer). We recognise the importance and need to embed diversity and inclusion at all levels of leadership, and we're committed to implementing our Diversity and Inclusion Strategy and increasing our female leaders.

During 2019–20, our proportion of women in leadership positions increased from 35 per cent to 36 per cent, which exceeds this year's target of 33 per cent and shows we are on track to reach our strategic goal of 37 per cent by 2023–24. This result demonstrates clear impact from our participation in gender equity initiatives, such as SAGE and MCC, and our commitment to our Diversity and Inclusion Strategy. To help with succession planning, we also strengthened the diversity of our future leadership pipeline and achieved gender-balance in our leadership development programs. This is a great result; however, we will continue to monitor and support this trajectory to avoid regressing during potentially uncertain times next year.

Function 4.2: Ensure CSIRO has sustainable operations, sites and infrastructure

Our key activities for Function 4.2 contributed to our strategic focus areas via:

- property
- communication
- security
- finance
- platforms and systems.

We delivered on this function by:

- our finance, governance, information management, property and corporate affairs services supporting the research and innovation activities, protecting our brand, and strengthening our reputation with key stakeholders.

Property

We manage a significant proportion of Australia's state-of-the-art science infrastructure and biological collections as well as a complex portfolio that includes 55 domestic sites, three international facilities, and more than 950 buildings. These sites and facilities enable our scientists to solve the greatest challenges through innovative science and technology.

Our property strategy has evolved significantly in the past decade. It serves to provide high-quality facilities; develop dynamic work environments and collaboration hubs, to meet legislative and compliance obligations, and to contain repairs and maintenance costs across ageing infrastructure in many locations.

Our 2019–29 Property Strategy provides a framework that articulates investment and divestment principles for decision-making to ensure our property portfolio provides fit-for-purpose infrastructure that is efficient, affordable and sustainable. It is structured to accommodate future changes that will impact our operating environment such as the implementation of the Future Science and Technology plan, emerging priorities and other customer-focused initiatives.

It also incorporates lessons learnt from the Australian National Audit Office (ANAO) findings on the implementation of 2012 Property Investment Plan, including Board-endorsed performance targets.

The 2012 Property Investment Plan has reduced our footprint by 10 per cent to date. Activities in the current Implementation Plan will see a further 6.7 per cent reduction in footprint.

Unfortunately, the timing of the ANAO audit did not align with the delivery of major consolidation projects, and benefits will be realised in 2021 onwards.

Property Strategy implementation progress

The 2019–20 annual implementation plan, which complements the 2019–29 Property Strategy was impacted due to unexpected events including bushfires, hail damage and COVID-19, which led to a review of the strategy.

Our progress:

- We planned and scoped the Australian Centre for Disease Preparedness part-life refurbishment program at Geelong. Design is progressing on track and within budget.
- A new national collections facility to house (in the first phase) the national wildlife collection was delayed due to issues with finalising the National Collaborative Research Infrastructure Strategy contract and identifying the facility's location at our Black Mountain site.
- The divestment of Ginninderra experienced delays in the sale process due to the withdrawal of an unsolicited bid in November, however preparations for on-market sale in 2020 have progressed well.
- In June, we finalised the sale of our Highett site.
- In April, the Board approved a revised Annual Implementation Plan for 2020–21.

Environmental performance

As a world-leader in sustainability research, we have a responsibility to minimise our environmental footprint through efficient operations, reducing our water, energy and resource consumption, and supporting the sustainable behaviour of more than 5,000 people.

Meeting our carbon reduction targets

In June, we concluded our Carbon Strategy 2013–20, successfully reducing our scope 1 and 2 emissions by more than five per cent against our year 2000 baseline.

In 2019–20, we reduced these emissions seven per cent compared to last year, and 14 per cent below the average of the previous five years.

We met our 2020 target to generate five megawatts (MW) of onsite renewable energy by installing solar panels at Black Mountain (1,113kW), Clayton (1,187 kW), Kensington (175kW), Newcastle (216kW), Pullenvale (760kW), Waite (404kW) and Waterford (245kW). This brings our total to 13,000 panels across 10 sites.

Unfortunately, a severe hailstorm in January caused significant damage to most of the panels at Black Mountain, which we are replacing.

Late in the year, we signed a new power purchase agreement to supply the sites we manage in Victoria, New South Wales and the Australian Capital Territory with renewable energy from July 2020 onwards. This will significantly reduce our electricity-based emissions over the next 10 years.

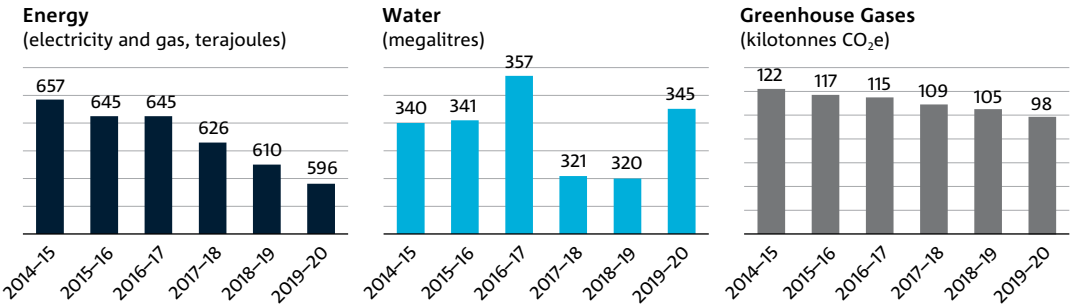
Resource consumption and emissions

Our electricity and gas energy consumption decreased by two per cent[11], compared to last year and six per cent below the average of the previous five years. Our reductions during the year can be attributed to our extensive photovoltaic installations, small emissions reduction programs across our facilities, site consolidation processes, and changes to state-level electricity emission factors. Reduced site activity due to COVID-19 also impacted our site-based resource consumption, however, the full net impact is difficult to quantify at this stage.

Over the five-year period, we have continuously looked at ways to reduce our energy consumption through large multi-site programs such as extensive LED lighting upgrades, replacing energy intensive equipment and improving our building analytics. During this time, we also implemented a substantial program of submetering across our sites to provide greater insight into the breakdown of resource use within our facilities. Data from this program continues to inform and support the assessment of potential resource efficiency projects.

We continue to reduce the impact of our fleet vehicles by gradually phasing out petrol vehicles with low emissions vehicles, such as electric and hybrid cars. To date, we have 48 hybrid vehicles and 11 electric vehicles.

Figure 3.4: CSIRO energy and water consumption, and greenhouse gas emissions



11 2019–20 also includes energy use associated with our information technology servers at an offsite facility that has not been previously included.

Table 3.15: Our energy, air travel and water intensities

PERFORMANCE MEASURE	INDICATOR(S)	2015–16	2016–17	2017–18	2018–19	2019–20
Energy	Purchased energy (electricity and gas) consumer per employee (GJ/FTE)[12]	131	129	121	114	115
Air travel	Million air kilometres travelled (km)	117	110	114	123	84
	Air travel per employee (km/FTE)	24.19	19.64	21.87	22.97	16.63
Relative mains water use	Amount of total water use per employee (kilolitres/FTE)	72	71	62	59	68
Waste diversion rate	Amount of total waste by weight diverted from landfill (%)	50	69	46	49[13]	38[14]

Helping algae grow more efficiently

In addition to the extensive LED lighting upgrades across our facilities, our people identified an opportunity to upgrade the fluorescent lighting in an algal growth room at our Hobart site. Approximately 100 light boxes containing 1–10 fluorescent tubes were upgraded to modern LEDs. Revised data indicates we have achieved a reduction of more than 15 per cent in energy and emissions.

Managing our waste

Our waste diversion rate decreased during the year by 12 per cent due to a reduction in overall waste generated. We continue to look at ways to improve our waste management processes.

During the year, we worked with onsite cafe operators at Lindfield, Kensington, Clayton, Black Mountain and Hobart to achieve a higher standard of waste minimisation. This includes gradually phasing out single-use plastic packaging in favour of reusable cups and bowls.

Many of our people participated in Plastic Free July events across 23 of our sites, which resulted in multiple staff-led initiatives to reduce single-use plastics in their workplaces.

Sustainable facilities

We continue to implement building improvements across our facilities through our long-term property maintenance program, including proactively seeking ways to reduce resource consumption within our science infrastructure. This has included large chiller upgrades to the largest building at our Clayton facility and several air handling system improvements at our Kensington and Lindfield facilities.

During the year, we also conducted a detailed energy audit at our Waite site in South Australia, where we identified the potential to save 130 MW of energy and $166,000 in costs. Additionally, we investigated our top 10 energy consuming sites and identified the potential to reduce our emissions by a further 9.3 per cent through building tuning, heat recovery and better demand control.

We look for collaborative opportunities between our research and facilities teams that enable us to deploy research concepts in our buildings. Our Data Clearing House research project currently monitors 17,000 data points at specific buildings at our Newcastle, Black Mountain and Clayton sites through two tailored dashboards. Additionally, our building fault diagnostic and detection tool at Black Mountain helped us optimise our energy consumption, which saved 228 tonnes of emissions this year.

12 GJ/FTE is gigajoules per full-time equivalent (staff). FTE refers to CSIRO Officers at 30 June.
13 Adjusted to account for amended tonnages.
14 This year, we had several one-off waste collections that were diverted from landfill, affecting diversion rates.

Ecologically sustainable development

We integrate environmental responsibility into our operations, and minimise our environmental footprint through building infrastructure, behaviour change, and preventing, minimising and controlling pollution.

Our Planning and Performance Framework includes impact evaluations and reviews to assess the environmental, economic and social outcomes from our work. Our operational and scientific procedures ensure that our research and site activities help to minimise our environmental impact. For example, through our Property Strategy, new building proposals or modifications to existing facilities undergo internal reviews to ensure safety, regulatory and environmental issues are addressed. This includes considering activities that fall under the *Environment Protection and Biodiversity Conservation Act 1999*, including protecting cultural and heritage-listed properties and buildings.

Managing our heritage

We recognise our responsibility to conserve the Commonwealth and national heritage values of the places we own or control, and we manage these values under the *Environment Protection and Biodiversity Conservation Act 1999*. Our Heritage Strategy for CSIRO Land and Buildings 2016–26 outlines our objectives and responsibilities and has been endorsed by the Australian Heritage Commission.

As part of the CSIRO Heritage Program for 2019–20, we procured a Heritage Assessment Report for two CSIRO sites. These reports will be finalised in 2020.

We will provide an update to the Department of Agriculture, Water and the Environment prior to December. The update will include Heritage Assessment Reports and finalised Heritage Management Plans, expenditure spent on heritage-listed facilities and a revised timeframe for other sites to be reviewed.

All Heritage Management Plans and information on other Commonwealth heritage-listed sites are available at www.csiro.au/Heritage.

Communication

We are well-known and trusted by the Australian community. We measure our reputation through an external community survey; these insights guide our communication and engagement activities to better communicate the impact of Australia's national science agency.

This year public awareness of CSIRO remained high at 88 per cent and positive sentiment is at an all-time high at 69 per cent.

Our Corporate Affairs Strategy continues to strengthen our reputation by creating relevant and accessible opportunities to engage our community and customers, and to encourage industry to work with us.

Business and community engagement activities across the year included our second appearance at the annual Sydney Gay and Lesbian Mardi Gras Parade, the first ever virtual ON Accelerator Demo Night, the first Young Indigenous Women's STEM Academy camps and D61+Live.

We also delivered our first Virtual Work Experience program, where Northern Territory high school students remotely operated telescopes at Parkes and worked on real datasets with researchers. We launched citizen science activities for bushfire recovery and supported storytelling from teachers on RV *Investigator* for the Educator on Board program.

A major celebration of scientific endeavour and Australia's role was the 50th anniversary of the Apollo 11 mission, which garnered national interest and profile.

We were an important and trusted source of information for many Australians with evidence-based content on bushfires and the COVID-19 pandemic.

Security

The safety and security of our people, property and systems is of paramount importance. Over the last 12 months, we have updated and developed a number of new and improved procedures and principles as part of the implementation of the Enterprise Security Framework. Specific procedures related to overseas travel, personnel security pre-employment checks and strengthened principles and procedures related to access control and security incidents will enable us to continually develop a robust security regime.

Current initiatives include development of a comprehensive strategic framework including mechanisms to protect against foreign interference and development of strategic partnerships with government clients to protect sensitive projects. The improved security regime within the organisation will ensure our sustainability by improving the protection of our people, assets and information.

Read more about our security measures and our Security Committee on page 128.

Finance

In June, the Board approved an asset management review as part of the Four-Year Capital Action Plan.

We reviewed our organisation's assets, including management practices, to improve the sustainable management of our scientific equipment, system and infrastructure assets. The review set out an information base, amended decision frameworks, and a strategic approach to risk management through our investment, maintenance and asset management. In response to the review findings, we developed an action plan with immediate, medium- and long-term horizons.

Platforms and systems

Enhancing the science agenda

A multi-year program to deliver multi-cloud service, for use in our research, is underway. Technical implementation of assured public cloud services is progressing well, alongside continued investment in our private high-performance cloud and data infrastructure. We are exploring strategic partnering opportunities with a number of hyperscale cloud and technology partners to support delivery of this program.

Supporting business process

We continue to support the digitisation of corporate processes across several initiatives and Enterprise Support Service functions. One of this year's key activities was the cross-functional, 'Build' project, which includes the systematisation and digitisation of financial management processes to make our processes sound, efficient and transparent. It will also increase our overall financial maturity and sustainability. We delivered a roadmap for systematising and digitising several processes and activities, digitising our budgeting processes. We also made significant progress towards digitising organisational forecasting and cross-functional management reporting.

Through this program of work, we introduced a new Procure-to-Pay system to streamline and enhance security for our credit card transactions. We invested in our business development tools and extended our customer relationship management capability. We are establishing a digital HSE Management System that facilitates safe work practices for individuals. It integrates with existing systems and databases, provides easy access to key HSE information, enables key processes to be managed and monitored, and provides standardised reporting across the organisation. Once this activity is complete, further corporate business process will be reviewed for digitisation, including redeveloping our website.

Transforming service delivery

As part of our information and management technology service strategic program, we are rolling out new office software that enables our people to access files, share documents and collaborate with colleagues in a secure online environment from anywhere at any time and on any device. Office 365 is the first step towards in-place records management and improving the security of our collaborations with external partners.

Office 365 provides up-to-date, industry recognised social collaboration and office productivity tools. The project integrates Microsoft's cloud-based services with our operating environment, supporting our vision of collaboration and increased productivity. As at 30 June, we have delivered phases one to three of the project: we migrated to Exchange Online; delivered Office productivity tools including OneDrive and OneNote; and implemented collaboration tools such as Microsoft Teams and Yammer. Phase four is planned for next year and will include further cyber security enhancements and mobile device management.

Embedding security into all information management technology services

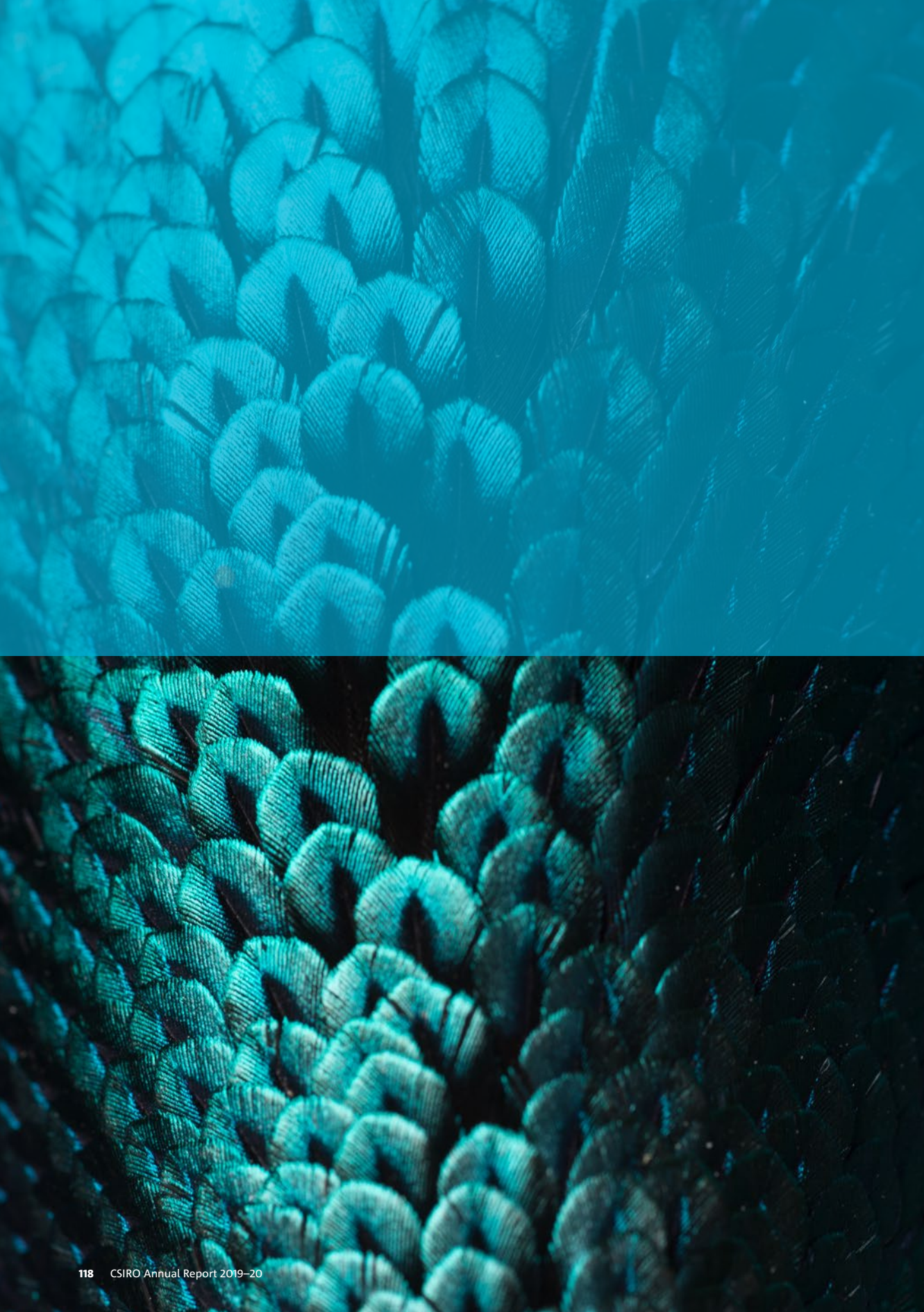
Due to our ever-increasing cyber security risks, we prioritised and fast-tracked the Essential Eight mitigation strategies developed by the Australian Signals Directorate's Australian Cyber Security Centre. This will allow us to promptly action urgent or emerging unacceptable cyber risks, while addressing the longer-term goal of embedding operational best practice and compliance against the Essential Eight.

Our efforts this year contributed to us delivering towards our outcome (see Table 3.16):

- We have efficient and sustainable operations and are able to move quickly to address opportunities, thus maintaining our capacity to innovate for Australia.

Table 3.16: Summary of our performance for conducting and facilitating the uptake of excellent scientific and technology solutions

PERFORMANCE MEASURES SOURCE: 2019–20 CORPORATE PLAN	TARGET	RESULT
Efficient and sustainable operations		
Customer Net Promoter Score (NPS) maintained with increased sample	NPS +40	The **survey was not conducted** due to COVID-19 disruptions to many of our customers.
Business Sentiment Survey: awareness of potential to work directly with CSIRO and knowledge of CSIRO	Increase year on year	The **survey was not conducted** due to COVID-19 disruptions to the business community.



Part 4

Our organisation

Our people

Our dedicated and passionate people are our greatest asset. They are committed to unlocking a better future for all Australians and are critical to our success.

Our scientists and researchers are renowned experts in their fields, world-leaders and trusted advisors to industry, government and academia. We have people working across the entire spectrum of research, science and commercialisation, as well as support services.

We also engage consultancy services when necessary (read more on page 135).

Staff numbers

At 30 June 2020, we employed 5,319 people across every state and territory and overseas, the equivalent of 5,065 full-time employees. The majority of our people – 3,316, or 62 per cent – were classified within the research function (see Table 4.1).

Headcount and full-time equivalent figures refer to our salaried staff (permanent, term contract and casual). They do not include people employed through other mechanisms such as affiliates, labour-hire and joint venture staff. The apparent reduction in headcount and full-time equivalent staff from 2018–19 to 2019–20 can largely be attributed to a change in our preferred mechanism for engaging short-term staff (from casual and term contract, to labour-hire), as well as term contracts coming to an end in line with the completion of projects.

Read more about our staff numbers including details by state and gender at Appendix A.

Table 4.1: Staff numbers (headcount) by functional area

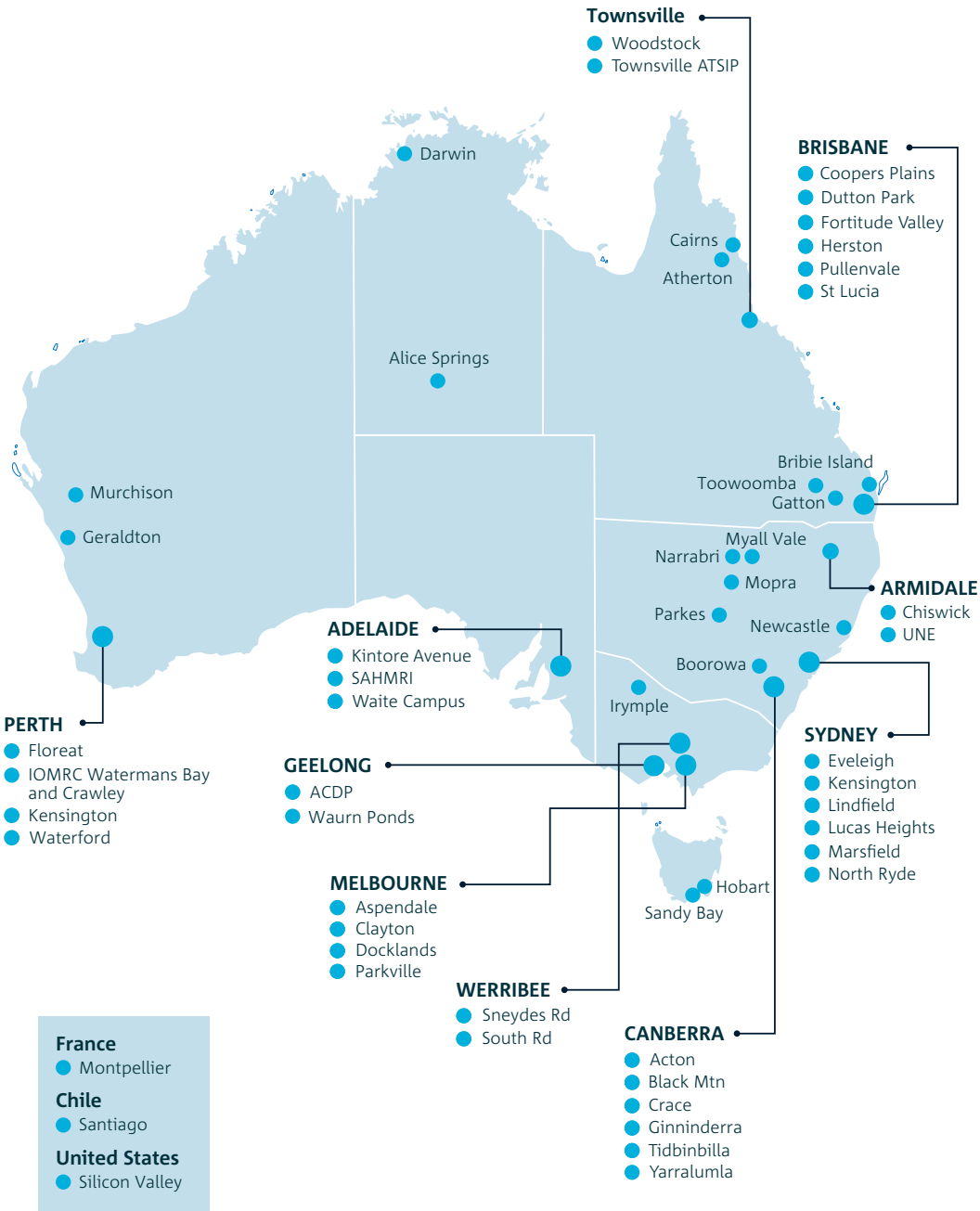
FUNCTIONAL AREA	2015–16	% FEMALE 2015–16	2016–17	% FEMALE 2016–17	2017–18	% FEMALE 2017–18	2018–19	% FEMALE 2018–19	2019–20	% FEMALE 2019–20
Research										
Research scientists/ engineers	1,466	26	1,473	27	1,533	27	1,570	28	1,485	28
Research project staff	1,752	42	1,803	41	1,809	42	1,829	42	1,521	41
Research management	248	15	246	19	251	22	233	21	250	24
Research consulting	54	19	58	22	55	26	53	25	60	28
Non-research										
Senior specialists	20	50	21	43	19	42	17	47	13	46
Technical services	586	13	621	16	672	17	719	17	683	16
Communication and information services	203	75	237	78	260	78	281	80	230	80
General services	23	21	20	55	19	53	16	50	8	38
Administrative services	909	75	942	75	999	75	1,046	75	930	75
General management	106	34	144	40	150	45	151	50	139	52
Total headcount	**5,367**	**40**	**5,565**	**40**	**5,767**	**41**	**5,915**	**42**	**5,319**	**41**
Full-time equivalent (FTE)	**4,864**	**37**	**4,990**	**38**	**5,190**	**39**	**5,359**	**40**	**5,065**	**40**

In 2016–17, the creation of Data61 led to the classification of new roles in General Management.

Our sites

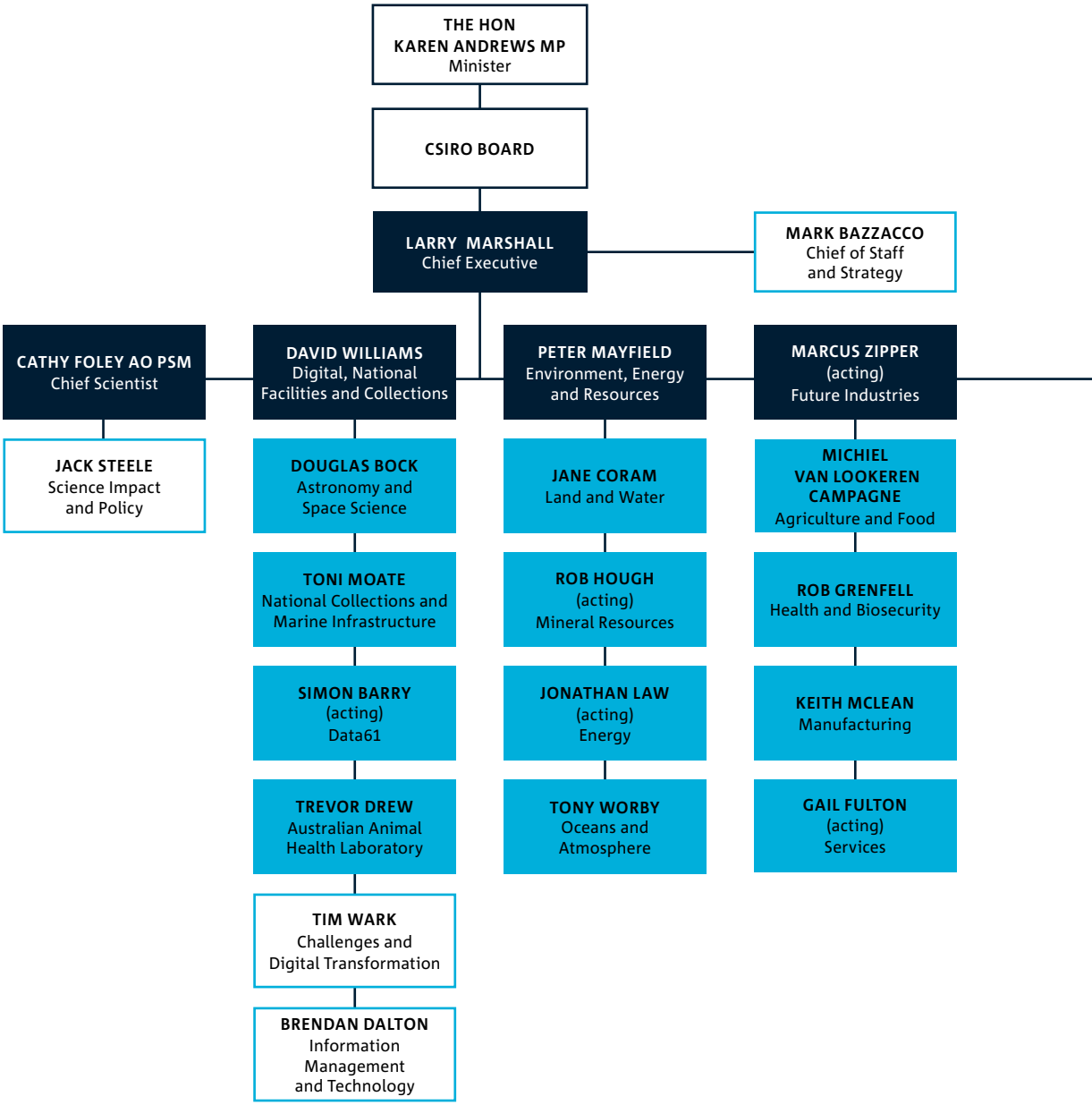
In 2019–20, we operated 55 sites across Australia and three sites overseas.

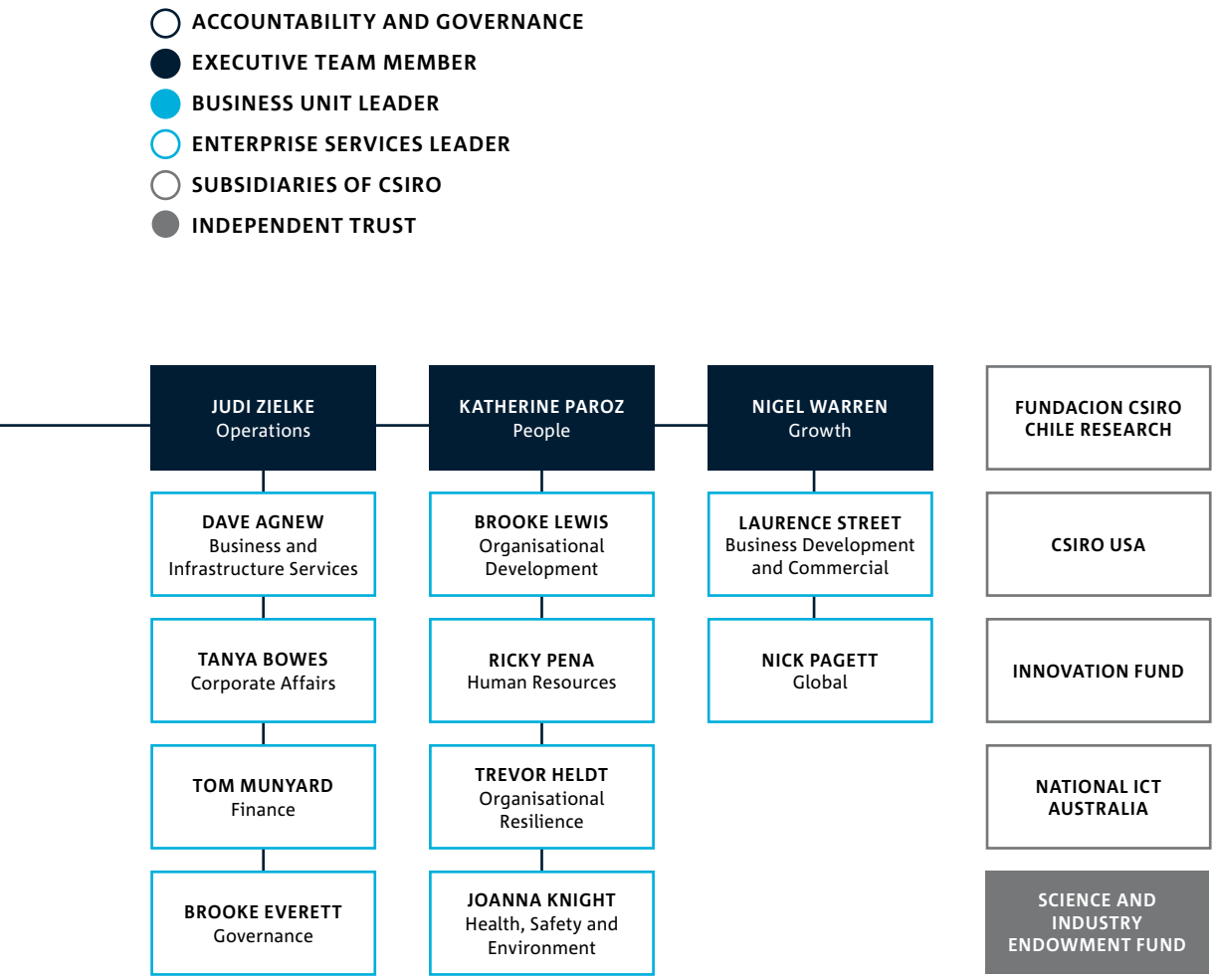
There are also 26 minor locations where our people may access desks or small areas of land for research purposes.



Our organisational structure

(as at 30 June 2020)




ACCOUNTABILITY AND GOVERNANCE
EXECUTIVE TEAM MEMBER
BUSINESS UNIT LEADER
ENTERPRISE SERVICES LEADER
SUBSIDIARIES OF CSIRO
INDEPENDENT TRUST
JUDI ZIELKE
Operations
KATHERINE PAROZ
People
NIGEL WARREN
Growth
FUNDACION CSIRO CHILE RESEARCH
DAVE AGNEW
Business and Infrastructure Services
BROOKE LEWIS
Organisational Development
LAURENCE STREET
Business Development and Commercial
CSIRO USA
TANYA BOWES
Corporate Affairs
RICKY PENA
Human Resources
NICK PAGETT
Global
INNOVATION FUND
TOM MUNYARD
Finance
TREVOR HELDT
Organisational Resilience
NATIONAL ICT AUSTRALIA
BROOKE EVERETT
Governance
JOANNA KNIGHT
Health, Safety and Environment
SCIENCE AND INDUSTRY ENDOWMENT FUND

Management and accountability

Government engagement

In 2019–20, our staff held regular meetings with ministers, parliamentarians and senior people from relevant government departments to discuss their needs, share research activities and provide scientific information. We also provided advice to inform policy development and program implementation and evaluation.

During the last financial year, we made 10 submissions to parliamentary inquiries and our staff provided information at 12 inquiry hearings. Inquiry topics included the nuclear industry in Australia; establishing the Square Kilometre Array Observatory; growing agriculture to a $100 billion industry by 2030; FinTech and RegTech in Australia; Australia's Waste Management and Recycling Industries; land management policy, practice and legislation and their effect on bushfires and risk to property, life and the environment; deployment, adoption and application of 5G in Australia; lessons to be learned in relation the Australian bushfire season 2019–20; and the response to the drought, and the adequacy and appropriateness of policies and measures to support farmers, regional communities and the Australian economy.

Legislation and government policy

We are a Corporate Commonwealth entity constituted and operating under the provisions of the *Science and Industry Research Act 1949* (SIR Act).

Our primary functions are to carry out scientific research to:

- assist Australian industry and to further the interests of the Australian community
- contribute to national and international objectives and responsibilities of the Commonwealth
- encourage or facilitate the application and use of the results of CSIRO scientific research.

Our secondary functions include international scientific liaison, training of research workers, publishing research results, making available scientific facilities, technology transfer of other research, providing scientific services and disseminating information about science and technology.

Reporting, accountability and other rules for our operations are set out in the *Public Governance, Performance and Accountability Act 2013* (PGPA Act).

Pursuant to section 19 (1) (e) of the PGPA Act, we have had no instances of significant non-compliance with finance law in 2019–20.

We also provide administrative support services to the Trustee of the Science and Industry Endowment Fund (SIEF) consistent with the *Science and Industry Endowment Act 1926*. SIEF has its own governance structure (see Part 6 for more information on SIEF).

There were no government policy orders to CSIRO during 2019–20.

Responsible Minister

CSIRO is an agency within the Industry, Sciences, Energy and Resources portfolio. As at 30 June 2020, the responsible Minister for CSIRO was the Hon Karen Andrews MP, Minister for Industry, Science and Technology.

Hon Karen Andrews MP, Minister for Industry, Science and Technology

Under the SIR Act, the Minister has power to:

- add to the functions of CSIRO; provide to the CSIRO Board, in writing, directions and guidelines with respect to the performance of the functions, or the exercise of the powers, of the Board or of CSIRO (SIR Act, section 13(1)).

On 13 February 2020, Minister Andrews issued a Statement of Expectations to CSIRO to provide greater clarity about relevant government policies, objectives and priorities. Focus areas in the Statement included resolving national challenges for a competitive Australia, working collaboratively to advance Australian industry, translation of research and commercialisation, embracing the digital economy and promoting STEM careers and STEM equity. The CSIRO Board responded with its Statement of Intent outlining how CSIRO intends to meet these expectations on 6 May 2020. These documents are available at www.csiro.au/About/Leadership-governance/Minister-and-Board/Statement-of-Expectations and www.csiro.au/About/Leadership-governance/Minister-and-Board/Statement-of-Intent.

Ministerial directions and notifications

On 15 July 2014, the Minister directed the CSIRO Board to apply the *Australian Government Public Sector Workplace Bargaining Policy* to Enterprise Bargaining Agreement negotiations in CSIRO. During 2019–20, CSIRO kept its responsible Minister and the Minister for Finance informed of the activities of CSIRO through our Board and in accordance with section 19(1)(a) of the PGPA Act.

In April, as part of COVID-19 measures, the Government placed a six-month pause on wage increases for non-Senior Executive Services Commonwealth public sector employees to remain in effect for 12 months. While this pause applies to Australian Public Service (APS) agencies, the Government's expectation is that non-APS Commonwealth entities and agencies would also implement a six-month wage pause, to the extent available to them.

Governance

The CSIRO Board is responsible under the SIR Act and the PGPA Act for the overall strategy, governance and performance of our organisation. Section 12 of the SIR Act sets out the functions of the Board. The Board Charter and other details are available on our website at: www.csiro.au/About/Leadership-governance/Minister-and-Board.

The Board comprises nine part-time, non-executive members including the Chairman, and a full-time Chief Executive. At 30 June 2020, there was one vacancy on the Board. All non-executive Board members are appointed by the Governor-General. The Chief Executive is appointed by the CSIRO Board, in consultation with the Minister pursuant to s10B of the SIR Act.

In 2019–20, our Board operated in part through three standing committees:

- The Audit and Risk Committee assists the Board in fulfilling its corporate governance responsibilities regarding financial reporting, audit and risk oversight, reporting obligations, and internal controls and compliance with relevant laws and policies.
- The People and Safety Committee assists the Board to meet its governance responsibilities relating to people, health and safety strategies, obligations, performance and culture.
- The Science Excellence Committee assists the Board to fulfil its governance responsibilities regarding science, capability and strategic plans to ensure CSIRO maintains its reputation for scientific excellence and capacity to respond to national challenges and opportunities.

As required under the PGPA Rule, all members of the Audit and Risk Committee are not employees of CSIRO. The Audit and Risk Committee's charter can be read on our website: www.csiro.au/About/Leadership-governance/Minister-and-Board/BARC.

On appointment, Board members are formally inducted in the organisation's functions, operations and activities and their duties and responsibilities as a member of the Board of a Corporate Commonwealth entity. Board members are provided with a comprehensive set of documents including the PGPA Act, SIR Act, Corporate Plan, Risk Management Framework and key plans and policies.

Members maintain their professional development and participate in CSIRO site visits, as well as governance and business briefings. Members may seek independent professional advice and liaise with CSIRO senior management in keeping with their duties, responsibilities and obligations as Board members.

Under its Charter and Operating Guidelines, the CSIRO Board examines its performance, composition and skill base regularly to ensure it is operating efficiently, effectively and is following the principles of good corporate governance. Board performance is usually reviewed at least every 18 months, with the most recent being a self-assessment in March 2020.

Details of remuneration and meeting attendance are shown in the financial statements on page 173 and 174.

Board membership

Mr David Thodey AO

Dr Larry Marshall

Ms Shirley In't Veld

Dr Michele Allan

Mr Drew Clarke AO PSM

Prof Edwina Cornish AO

Ms Kathryn Fagg AO

Mr David Knox

Prof Tanya Monro

Dr Peter Riddles AM

Board qualifications and experience

Mr David Thodey AO – Chairman (non-executive): BA FAICD, (15 October 2015 to 14 October 2020)

Mr Thodey is a business leader and Company Director focused on innovation, technology and digital, with more than 30 years' experience including as Chief Executive Officer of Telstra and Chief Executive Officer of IBM Australia and New Zealand. An experienced board director and chair, his current positions include Director of Ramsay Health Care, Tyro, Vodafone Group, Xero and Deputy Chair of the National COVID-19 Coordination Commission

Dr Larry Marshall – Chief Executive: BSc (Hons) PhD GAICD FTSE (1 January 2015 to 30 June 2023)

Dr Marshall is a scientist, technology innovator and business leader with over 25 years' experience in creating new value and impact with science. He founded six successful companies in biotechnology, photonics, telecommunications and semiconductors in the United States, and has served on 20 boards of high-tech companies operating in the United States, Australia and China.

Ms Shirley In't Veld – Deputy Chair (non-executive): BCom LLB FAICD, (28 June 2012 to 27 June 2020)

Ms In't Veld is an experienced Company Director with extensive senior executive experience including as Managing Director of Verve Energy for five years. Previously she held senior commercial, legal and marketing positions with Alcoa, WMC Resources Ltd, Bond Corporation and BankWest. Ms In't Veld is on the boards of the National Broadband Network, Northern Star Resources and Australian Pipeline Limited.

Dr Michele Allan – Member (non-executive): BAppSc MMgtTec MCommLaw DBA FAICD, (5 May 2016 to 4 May 2024)

Dr Allan is an experienced Company Director with significant skills and competencies in the university, private and public sector and domain expertise in food and advanced manufacturing. Her background is in biomedical science, management and law. Dr Allan is an experienced board Chair including Chair of the boards of Charles Sturt University, Apple and Pear Australia, Food and Agribusiness Growth Centre and Defence CRC for Trusted Autonomous Systems (FED).

Mr Drew Clarke AO PSM – Member (non-executive): BAppSc (Surveying) MSc GAICD FTSE, (24 August 2017 to 23 August 2022)

Mr Clarke is an experienced Company Director offering valuable applied science, public policy and government administration expertise from over 20 years in senior roles in the Australian Public Service, including as Secretary of the Department of Resources, Energy and Tourism and Chief of Staff in the Office of the Prime Minister. He is Chairman of the Australian Energy Market Operator Board, Director on the NBNCo Board and Chair of ACOLA Working Group developing a research plan for the Australian energy transition.

Professor Edwina Cornish AO – Member (non-executive): BSc (Hons) PhD FTSE AICD (26 November 2015 to 25 November 2020)

Professor Cornish is an experienced director with significant senior executive experience in the research and higher education sector. She brings vast experience in the interface between government, research, science and the higher education sector and provides strong business, industry and financial skills. Professor Cornish played a key role in building one of Australia's first biotechnology companies, Florigene Limited, which developed and successfully commercialised the world's first genetically modified flowers. She is on the Council of La Trobe University, a member of the South Australian Productivity Commission (for an inquiry into the State's Health and Medical Research Performance) and the Chair of the University of Queensland - Indian Institute of Technology Delhi (UQ-IITD) Academy Strategic Research Advisory Council.

Ms Kathryn Fagg AO – Member (non-executive): BE (Hons) Chem Eng MCom (Hons) FTSE GAICD, (2 August 2018 to 1 August 2023)

Ms Fagg, an experienced director, senior executive and engineer, has worked in logistics, manufacturing, resources, banking and professional services, including with Linfox, BlueScope Steel and the ANZ Banking Group. Her current board positions include Chair of Boral and Breast Cancer Network Australia and member of the boards of Myer Foundation, National Australia Bank and Djerriwarrh Investments. Formerly Ms Fagg was on the Board of the Reserve Bank of Australia (2013–18).

Mr David Knox – Member (non-executive): BSc (Hons) Mech Eng MBA FIE Aust FTSE GAICD, (5 May 2016 to 4 May 2024)

Mr Knox, an experienced executive with background in oil and gas, is the Chair of Snowy Hydro among other positions. He was Managing Director and Chief Executive of Australian Naval Infrastructure (until 3 April 2020), Chief Executive Officer and Managing Director, Santos Limited (2008- 2015). He is Chair of The Australian Centre for Social Innovation, and a Director of Migration Council Australia, Adelaide Festival Board, Redflow and Micro X.

Professor Tanya Monro – Member (non-executive): BSc (Hons) PhD FAA FTSE FOSA FAIP GAICD, (25 February 2016 to 24 February 2021)

Professor Monro is the Chief Defence Scientist. She was previously Deputy Vice Chancellor Research and Innovation and an Australian Research Council Georgina Sweet Laureate Fellow at the University of South Australia. Her experience at senior levels in industry and educational institutions includes research in photonics focusing on sensing, lasers and new classes of optical fibres. Professor Monro is a director of Red Chip Photonics, Science Patron of the National Youth Science Forum, a member of the South Australian Premier's Economic Advisory Council and National Committee for Physics.

Dr Peter Riddles AM – Member (non-executive): BSc (Hons) PhD Grad Dip Bus FAICD, (24 April 2014 to 23 April 2022)

Dr Riddles is an experienced Company Director and advisor to various international science organisations including in the United States and the United Kingdom. He has worked as a research scientist in molecular biology in the public sector including CSIRO, on commercialisation and new venture creation and government policy development and strategy. Dr Riddles' expertise is in biotechnology and entrepreneurship in the higher education and research sectors. His other roles include member of the Science and Industry Endowment Fund Advisory Council, advisor to the Queensland Government on the next generation of the Boggo Road Precinct and Advisory Board member of the Circular Economy Laboratory.

CSIRO Executive Management

(as at 30 June 2020)[15]

Dr Larry Marshall

Dr Cathy Foley AO PSM

Dr David Williams

Dr Peter Mayfield

Dr Marcus Zipper (acting)

Ms Judi Zielke

Ms Katherine Paroz

Mr Nigel Warren

The Chief Executive is accountable for managing the affairs of the organisation according to our strategy, plans and policies approved by the Board as well as the Board Directions to the Chief Executive (section 10A (3) SIR Act).

The Executive Team (ET) supports our Chief Executive. As a team and through their individual roles, ET members lead, direct, coordinate and control our operations and performance in line with the Executive Team Charter. ET's responsibilities include development of the Corporate Plan 2020–21 and the Budget. Newly appointed ET members undergo a formal induction process to ensure they are aware of their responsibilities.

ET is assisted by the Major Transaction Committee and the Security Committee. The Major Transactions Committee assists the ET by providing governance oversight on our involvement in major transactions, and related matters and investments. During 2019–20, this committee held 26 meetings, including three out-of-session meetings.

CSIRO's Leadership Team of senior managers provides a forum for sharing and discussing issues relating to CSIRO's management and future strategy.

15 Dr Anita Hill served on the Executive Team until the end of January.

Disclosure of interests and related entity transactions

Board members and the Chief Executive declare material interests as required under the SIR Act and PGPA Act. The Board Governance document has processes for managing conflicts of interest, including a requirement that members absent themselves from discussions and voting where a member has declared a material personal interest, or where a potential or actual conflict of interest or duty arises.

In 2019–20, the Board considered the following transactions where a Board member was also a director on or employed with the entity involved in the transaction:

- Board 216: 30 August 2019, Item 5.1, Ginninderra – Approval for CSIRO to enter a Due Diligence period with Defence Housing Australia (DHA). Professor Tanya Monro declared her interest as Defence Chief Scientist.
- Board 219: 30 April 2020, Item 3.2, Power Purchase Agreement – Approval for CSIRO to enter into Power Purchase Agreement with preferred supplier. David Knox declared his interest as Chair of Snowy Hydro noting that this was not a direct transaction between CSIRO and Snowy Hydro.

There have been 11 transactions involving entities related to CSIRO above $10,000, which came to a total combined value of $19 million.

Remuneration of key management personnel, executives and other highly paid staff

Remuneration details are provided to meet enhanced disclosure requirements as required under the *Public Governance, Performance and Accountability Rule 2014* (PGPA Rule). Remuneration of key management personnel, senior executives other highly paid staff is reported in detail in note 3.2 of the Financial statements in Part 5.

Enterprise agreements

Enterprise agreements set the terms and conditions of employment for our people. Two enterprise agreements are in operation: the CSIRO Enterprise Agreement 2017–20 and the CSIRO Canberra Deep Space Communication Complex (CDSCC) Enterprise Agreement 2018–21.

The CSIRO Enterprise Agreement 2017–20 came into operation on 14 August 2017. It reaches its nominal expiry date on 14 November 2020. Work commenced in late 2019 to develop the next CSIRO Enterprise Agreement with the intention for it to be operational from mid-November 2020.

The CSIRO CDSCC Enterprise Agreement 2018–21 came into operation on 21 February 2019. It reaches its nominal expiry date on 20 February 2022.

Remuneration policy, strategy and governance

Our remuneration policy considers applicable remuneration provisions within both the CSIRO Enterprise Agreement 2017–20 and the CSIRO Canberra Deep Space Communication Complex (CDSCC) Enterprise Agreement 2018–21. Clause 11 and 12 of the CSIRO Enterprise Agreement 2017–20 provides for market-related remuneration and individual flexibility arrangements. The remuneration policy also considers the Workplace Bargaining Policy 2018 as provided by the Australian Public Service Commission. Key management personnel, executives and other highly paid staff are remunerated in accordance with their contracts of employment and relevant governing provisions.

The Chief Executive is a position within the Commonwealth Principal Executive Officer structure. The Remuneration Tribunal sets the Total Remuneration reference rate and the maximum achievable performance payment.

Remuneration for members of the CSIRO Board is established by Determination of the Remuneration Tribunal for Part Time Office Holders. Determinations of the Remuneration Tribunal are established in accordance with the *Remuneration Tribunal Act 1973*.

The remuneration committee

The CSIRO Board People and Safety Committee assists the Board to fulfil its governance responsibilities for organisational development, people-related activities and health and safety. In relation to remuneration and performance, this Committee:

- makes recommendations to the Board on the remuneration and performance of the Chief Executive, including possible key result areas and performance targets
- reviews the Chief Executive's decisions regarding the remuneration and performance assessment of Executive Team members, and ratifies these recommendations as appropriate
- exercises oversight of CSIRO's executive remuneration policy, including the senior executive banding structure (focus on positions, not individuals) and with references to the market
- specifically oversees negotiations with the Chief Executive or nominee regarding terms and conditions of appointment.

Remuneration Framework

The Chief Executive evaluates and determines the appropriate level of pay for executive positions in line with our executive remuneration policy. Our Remuneration Framework comprises fixed and variable components. Base salary is determined on a range of factors, including work value assessments, individual performance, competence and skill, internal relativities and external market rates. The annual variable 'at-risk' component of remuneration is based on the achievement of pre-determined key result areas.

Annual remuneration review

Remuneration levels for executives are reviewed annually by the Chief Executive and Board People and Safety Committee who assess any increases and performance payment structure for the next financial year.

The remuneration review process considers:

- market practice
- individual performance
- organisation performance and affordability
- current remuneration competitiveness vs desired remuneration level.

Market-related remuneration arrangements may increase because of contract provisions aligned with Enterprise Agreement salary increases or by market-related adjustments, which are determined annually by the CSIRO Board People and Safety Committee.

The Committee makes recommendations to the CSIRO Board on the Chief Executive's remuneration and performance, including possible key result areas and performance targets. The CSIRO Board determines the Chief Executive's remuneration and any applicable performance payment within the range set by the Remuneration Tribunal after the Tribunal's annual determination of the reference rate.

Reviewing and improving our risk management

Identifying and managing risks is central to delivering our purpose and objectives and maximising the impact of our science and benefit to Australia. This includes understanding scientific, financial, commercial and legal, health, safety and security, environmental, and reputational risks.

By actively identifying and managing strategic, operational and external risks we aim to increase our effectiveness as an organisation and provide greater certainty and confidence for the Government, our people, collaborators and other stakeholders in the community about our operations. Our Risk Framework, methodology and approach are grounded in and aligned with both the international standard AS/NZS ISO 31000 Risk Management Principles and Guidelines and Commonwealth Risk Management Policy. Our Risk Framework is applied across the organisation at the enterprise, Business Unit/Functional and activity levels.

The CSIRO Board supports our efforts to identify and manage our risks through three Board standing committees (read more about these committees on page 125):

- People and Safety Committee
- Audit and Risk Committee
- Science Excellence Committee.

In 2019–20 we continued to strengthen and increase our risk maturity through:

Risk Culture: developing a culture that supports taking risks where this is done mindfully, within organisational tolerances and is managed effectively.

Integration: aligning risk with key processes to enable decision-making and strengthening that alignment by increasing risk capability applied to each element of our strategic planning and execution framework.

Risk capability: enhanced focus on risk reporting at the enterprise level, supported by regular update and review of risk registers across all Business Units and Enterprise Support areas.

Resilience: responding to significant issues and events and enhancing our design and application of our Situation Management Framework.

Our Organisational Risk Profile articulates how we manage our key risks at an enterprise level. The profile is developed through consultations and extensive engagement with organisational leaders across the Executive and all Business Units and Functions. It conducts an internal and external environmental scan that considers external, strategic and internally generated risks with the potential to impact the achievement of our objectives.

The Organisational Risk Profile was reported to the Board Audit and Risk Committee and Board at their respective meetings in November. Key risk activities and changes to the Organisational Risk Profile are reported to the Board Audit and Risk Committee throughout the year.

General insurance, including General Liability and Professional Indemnity Insurance, is provided through Comcover. Our workers' compensation liability is covered through a Comcare premium.

Advisory mechanisms

Our Advisory Committees advise on our longer-term strategic direction and research and development priorities, and how we can meet the research, technical and business needs of customers and communities. The committees meet at least twice a year, or more regularly if required. The committees provide advice relating to the effectiveness of our businesses to achieve their goals. The committees comprise representatives from industry, government, non-government organisations and other stakeholders.

Policies, principles and procedures

Our Policy Framework comprises policies, principles and procedures. The policies, approved by our Board, reflect our commitment to:

- people
- science and delivery
- governance
- risk
- health, safety and environmental sustainability
- freedom to conduct CSIRO research and technology transfer
- child safety
- finance.

The CSIRO Policy Reform Project supports the continual streamlining of our policies, principles and procedures, and is intended to lead to improved transparency, accountability, efficiency and effectiveness in the daily work of all our people.

Ethics and Code of Conduct

The CSIRO Code of Conduct sets out the standard of behaviour expected of our people and others working in the organisation. All CSIRO people must undertake training in the code as part of their induction and every two years.

Ethical conduct is a priority and we have procedures for Ethical Conduct in Human Research and Animal Welfare for the care and use of animals in scientific research. Our practices comply with national codes and relevant state and national legislative requirements. We operate two human research ethics committees to cover our social and interdisciplinary science, and health and medical-related research. These committees review about 320 new projects each year and provide ongoing monitoring and support for more than 550 active projects at any given time. The committees provide independent, expert advice on appropriate engagement of people and communities in research and the use of human data. Issues such as privacy, informed consent and the risks and benefits flowing from research are effectively managed.

We operate four Animal Ethics Committees that review our use of animals in research. This covers a range of fields including wildlife conservation, farm animal production, nutrition, disease control and prevention, and human health. These committees review about 109 new projects each year. They also play an active role in monitoring the care and wellbeing of animals during any research and ensure that we comply with all regulatory requirements. Ongoing support and monitoring is provided for more than 200 projects at any given time.

Targeted training programs on human and animal research ethics is provided to our people and ethics committee members each year to ensure capability levels for responsible research practice are supported and maintained. We also provide online resources to support best practice.

Following the National Health and Medical Research Council's release of the revised *Australian Code for the Responsible Conduct of Research (2018)*, we assessed the alignment of the organisation's policies, procedures and practices to the new national framework and guidelines in order to formally adopt the revised code as part of our governance framework for research integrity on 1 July 2019. Updates were made to some areas of our policy and new policies introduced to ensure compliance with the revised standards and further support best practice. In 2019–20, we implemented additional initiatives such as the roll out of an organisation wide training program on the Research Code and commenced the establishment a network of research integrity advisers across the organisation.

Internal controls

We comply with section 10 of the PGPA Rule by establishing and maintaining an effective fraud control framework. Our Fraud and Corruption Control Plan comprises strategies to prevent, detect, respond and report fraud and corruption affecting CSIRO, and is complemented by our policy and procedures, system and internal controls, financial management, assurance and accountability activities, and an Enterprise Risk Framework. We adhere to the Commonwealth Fraud Control Framework 2017's 'Fraud Rule', and in line with fraud control best practice, endeavour to apply the Fraud Policy and Fraud Guidance. We are committed to nurturing and promoting an anti-fraud culture, which is predicated on predicting, pre-empting and preventing fraud and misconduct affecting our organisation.

Fraud control

As a Corporate Commonwealth entity under the PGPA Act, we are required to comply with section 10 of the PGPA Rule. The Rule sets out the Australian Government's expectations in relation to fraud prevention, detection and response and sets a standard for the effective management of organisational fraud risks and fraud incidents. Our Fraud and Corruption Control Framework is accompanied by our Enterprise Risk Framework, policy and procedures, system, financial and internal controls, and other assurance and accountability practices, procedures and activities.

Security

We recognise the Australian Government's Protective Security Policy Framework as our practice guide and use elements from this framework as well as the Australian Government Information Security Manual to inform our security frameworks. We continually review the organisation's risk appetite. We implement agreed management actions on protective security and will continue to do so through the endorsed Enterprise Security Program.

We continue to embed Cyber and ICT Security to support our strategy and to demonstrate to our customers that we are a trusted advisor.

Reviews of outside bodies

The Senate Standing Committees on Economics examines the operations of CSIRO following the Federal Budget, the tabling of our annual report and the introduction to Parliament of the additional Appropriation Bills. This year, our senior executives appeared before the Committee during the Senate Estimates process on two occasions and responded to all questions on notice.

In June, the Australian National Audit Office presented its independent performance audit report, *Implementation of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Property Investment Strategy* to Parliament. The Auditor-General made five recommendations to improve our monitoring and measurement, governance, risk management, reporting and performance targets. We agreed with the recommendations.

Judicial decisions

During 2019–20, there were no judicial decisions or decisions of administrative tribunals that have had, or may have, a significant effect on the operations of CSIRO.

Service charter

Our service charter describes the standards of service we aim to deliver to our customers and our commitment to ensuring that these standards are maintained.

In summary:

- We believe our customers and partners are essential to our success.
- We maintain relevance in our work through input from the public, government, industry and the research community.
- We communicate with our customers in a courteous, helpful and professional manner.
- We respect customer confidentiality.
- We evaluate our services to ensure continuous improvement of our service delivery.

Our complete service charter is available at www.csiro.au/Service-Charter.

We welcome feedback on our performance. Contact the CSIRO officer with whom you have been dealing or CSIRO Enquiries, which can direct your feedback to the relevant person:

Private Bag 10, Clayton South VIC 3169
1300 363 400
csiroenquiries@csiro.au

Administrative Law

Freedom of Information

The *Freedom of Information Act 1982* (FOI Act) provides the public with a general right of access to documents held by Australian Government agencies, including CSIRO. The general right is limited by exceptions to protect essential public interests and the privacy or business affairs of those who give information to the agency. In the reporting year to 30 June 2020, we received 57 requests for, or consultations on, documents under the FOI Act.

General information about our FOI procedures, including how to make an FOI request, is available at www.csiro.au/About/Access-to-information/Freedom-of-Information.

Part V of the FOI Act confers a right to request CSIRO to amend a document to which lawful access has been granted, where the applicant claims that information in the document:

- relates to his or her personal affairs
- is incomplete, incorrect, out of date or misleading
- has been used, is being used or is available for use by the agency or Minister for an administrative purpose.

During 2019–20, we received no requests for amendments of personal information under the FOI Act.

Information Publication Scheme

We are required to publish information to the public as part of the Information Publication Scheme. This requirement, in Part II of the FOI Act, replaces the former requirement to publish a section 8 statement in an annual report. We provide a plan on our website showing what information we publish in keeping with the Information Publication Scheme requirements.

Members of the public may access scientific and technical publications from CSIRO Publishing (www.publish.csiro.au) and the ePublish Repository (publications.csiro.au). Research data used by CSIRO is routinely published on the CSIRO Data Access Portal (data.csiro.au/dap/browse).

Archives, privacy and administrative decisions

CSIRO's archives collection includes material from the Council for Science and Industrial Research, the predecessor of CSIRO, dating from 1926. Certain CSIRO records are held by the National Archives of Australia. Disposal arrangements for CSIRO records follow the *Archives Act 1983*. Access to records over 20 years old is provided in accordance with that Act.

We are bound by the Australian Privacy Principles under the *Privacy Act 1988* (the Privacy Act) and have various measures in place to manage compliance with the Privacy Act including the mandatory data breach requirements. During 2019–20, we notified the Office of the Australian Information Commissioner (OAIC) of one data breach. During 2019–20, OAIC undertook one investigation under section 40 of the Privacy Act in relation to CSIRO.

The *Administrative Decisions (Judicial Review) Act 1977* enables a person aggrieved by certain classes of administrative decisions made by Australian Government agencies, including CSIRO, to obtain reasons for or to challenge those decisions. During 2019–20, we received no challenges or requests for statements of reasons under the Act.

Contact

All enquiries under the above legislation (including FOI requests) should be directed to:

FOI Officer/Privacy Officer
CSIRO
GPO Box 1700
Canberra ACT 2601
02 6276 6431

FOI@csiro.au

Public Interest Disclosure

Internal procedures have been implemented to comply with the *Public Interest Disclosure Act 2013* (PID Act) through a Public Interest Disclosure Scheme (the PID Scheme).

The PID Scheme promotes integrity and accountability by encouraging the disclosure of information about suspected wrongdoing, protecting people who make disclosures and ensuring we take appropriate action. We have contributed to the Commonwealth Ombudsman's annual report on the PID, as required in section 76(3) of the Act. In 2019–20, we received one public interest disclosures pursuant to s26 of the PID Act.

Consultancy services

We engage consultants where we lack specialist expertise or when independent research, review or assessment is required. Consultants are typically engaged to investigate or diagnose a defined issue or problem; carry out defined reviews or evaluations; or provide independent advice, information or creative solutions to assist in our decision-making.

Before engaging consultants, we consider the skills and resources required for the task, the skills available internally and the cost-effectiveness of engaging external expertise. The decision to engage a consultant adheres to the Commonwealth Procurement Rules, our procurement policy and other relevant internal policies.

Our policy on selection and engagement of consultants is based on the principles of:

- value for money
- open and effective competition
- ethics and fair dealing
- accountability and reporting
- national competitiveness and industry development
- support for other Australian Government policies.

Tables 4.2, 4.3 and 4.4 summarise the consultancies let and the annual spend, the reason for the consultancy and the procurement method. All values include goods and services tax.

Table 4.2: Annual spend on consultancies

YEAR	SPENT ($)	LET ($) (ESTIMATED WHOLE OF LIFE)
2015–16	373,751	1,158,231
2016–17	1,642,455	1,420,166
2017–18	1,561,210	1,625,863
2018–19	1,553,566	1,700,668
2019–20	1,690,411	1,856,563

Table 4.3: Summary by reason code for 2019–20

CATEGORY CODE	REASON FOR CONSULTANCY	NUMBER OF CONSULTANCIES	VALUE ($)
IS	Need for independent study/evaluation	2	330,858
PA	Need for professional assistance to manage and facilitate change and its consequence	3	1,401,185
SS	Specialist skills were not otherwise available	2	124,520
Total		**7**	**1,856,563**

Table 4.4: Summary by procurement method code for 2019–20

CATEGORY CODE	PROCUREMENT METHOD	NUMBER OF CONSULTANCIES	VALUE ($)
PM	An existing panel member – this category includes standing offers, common use arrangements and approved supplier panels	6	1,805,523
RQ	Purchasing was undertaken in accordance with Division 1 of the Commonwealth procurement rules (CPRs) and procurement did not require application of Division 2 of the CPRs	1	51,040

Part 5
Financial statements

INDEPENDENT AUDITOR'S REPORT

To the Minister for Industry, Science and Technology

Opinion

In my opinion, the financial statements of the Commonwealth Scientific and Industrial Research Organisation and the Consolidated Entity for the year ended 30 June 2020:

(a) comply with Australian Accounting Standards – Reduced Disclosure Requirements and the *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015*; and

(b) present fairly the financial positions of the Commonwealth Scientific and Industrial Research Organisation and the Consolidated Entity as at 30 June 2020 and their financial performance and cash flows for the year then ended.

The financial statements of the Commonwealth Scientific and Industrial Research Organisation and the Consolidated Entity, which I have audited, comprise the following as at 30 June 2020 and for the year then ended:

- Statement by the Chairman of the Board, Chief Executive and Chief Finance Officer;
- Statement of Comprehensive Income;
- Statement of Financial Position;
- Statement of Changes in Equity;
- Cash Flow Statement; and
- Notes to and forming part of the financial statements.

Basis for opinion

I conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. My responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of my report. I am independent of the Entity and the Consolidated Entity in accordance with the relevant ethical requirements for financial statement audits conducted by the Auditor-General and his delegates. These include the relevant independence requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants (including Independence Standards)* (the Code) to the extent that they are not in conflict with the *Auditor-General Act 1997*. I have also fulfilled my other responsibilities in accordance with the Code. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Accountable Authority's responsibility for the financial statements

As the Accountable Authority of the Commonwealth Scientific and Industrial Research Organisation, the Board is responsible under the *Public Governance, Performance and Accountability Act 2013* (the Act) for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards – Reduced Disclosure Requirements and the rules made under the Act. The Board is also responsible for such internal control as the Board determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board is responsible for assessing the ability of the Commonwealth Scientific and Industrial Research Organisation and the Consolidated Entity to continue as a going concern, taking into account whether the entities' operations will cease as a result of an administrative restructure or for any other reason. The Board is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the assessment indicates that it is not appropriate.

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Auditor's responsibilities for the audit of the financial statements

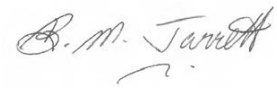
My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian National Audit Office Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with the Australian National Audit Office Auditing Standards, I exercise professional judgement and maintain professional scepticism throughout the audit. I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control;
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Entity and the Consolidated Entity's internal control;
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Accountable Authority;
- conclude on the appropriateness of the Accountable Authority's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Entity or the Consolidated Entity's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause the Entity or the Consolidated Entity to cease to continue as a going concern;
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation; and
- obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Consolidated Entity to express an opinion on the financial report. I am responsible for the direction, supervision and performance of the Consolidated Entity audit. I remain solely responsible for my audit opinion.

I communicate with the Accountable Authority regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

Australian National Audit Office



Brandon Jarrett

Senior Executive Director

Delegate of the Auditor-General

Canberra

7 September 2020

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION
Financial Statements

for the period ended 30 June 2020

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION
STATEMENT BY THE CHAIRMAN OF THE BOARD, CHIEF EXECUTIVE AND CHIEF FINANCE OFFICER

In our opinion, the attached financial statements for the period ended 30 June 2020 comply with subsection 42(2) of the Public Governance, Performance and Accountability Act 2013 (PGPA Act), and are based on properly maintained financial records as per subsection 41(2) of the PGPA Act.

In our opinion, at the date of this statement, there are reasonable grounds to believe that the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and its subsidiaries will be able to pay their debts as and when they fall due.

This statement is made in accordance with a resolution of the directors.

David Thodey
Chairman of the Board
7 September 2020

Larry Marshall
Chief Executive and Board Member
7 September 2020

Tom Munyard
Chief Finance Officer
7 September 2020

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF COMPREHENSIVE INCOME
For the period ended 30 June 2020

		Consolidated		CSIRO	
		2020	2019	**2020**	2019
NET COST OF SERVICES	**Notes**	**$'000**	$'000	**$'000**	$'000
Expenses					
Employee benefits	1.1A	**794,602**	763,169	**792,351**	760,029
Suppliers	1.1B	**433,420**	482,954	**427,919**	483,718
Depreciation and amortisation	2.2A	**182,830**	148,019	**182,233**	147,861
Finance costs	1.1C	**2,707**	1,430	**2,666**	1,403
Impairment loss on financial instruments	1.1D	**1,304**	536	**895**	536
Write-down and impairment of other assets	1.1E	**12,188**	13	**12,188**	13
Loss on revaluation of investment properties		**2,700**	(2,375)	**2,700**	(2,375)
Total expenses		**1,429,751**	1,393,746	**1,420,952**	1,391,185
Own-Source Income					
Own-source revenue					
Revenue from contracts with customers	1.2A	**449,419**	-	**462,735**	-
Sale of goods and rendering of services	1.2A		410,432		435,475
Royalties and licence fees	1.2A	**-**	34,427	**-**	34,427
Bank and term deposits interest	1.2B	**5,772**	13,501	**4,251**	10,536
Rental income	1.2C	**9,200**	10,546	**9,200**	10,546
Other revenues	1.2D	**34,708**	28,961	**25,167**	25,453
Total own-source revenue		**499,099**	497,867	**501,353**	516,437
Gains					
Gain/(loss) on foreign exchange- non-speculative	1.2E	**383**	117	**(394)**	238
Gain/(loss) from equity investments and intellectual property		**2,032**	12,094	**1,580**	11,498
Gain/(loss) from asset sales	1.2F	**29,662**	(2,847)	**29,662**	(2,847)
Gain/(loss) on valuation of equity investments	4.2B	**101,503**	14,660	**43,915**	(1,497)
Total gains		**133,580**	24,024	**74,763**	7,392
Total own-source income		**632,679**	521,891	**576,116**	523,829
Net cost of services		**(797,072)**	(871,855)	**(844,836)**	(867,356)
Revenue from Government	1.2G	**837,873**	834,561	**837,873**	834,561
Surplus/(deficit)		**40,801**	(37,294)	**(6,963)**	(32,795)
OTHER COMPREHENSIVE INCOME					
Items not subject to subsequent reclassification to net cost of services - change in asset revaluation reserves	1.3A	**-**	30,943	**-**	30,943
Items subject to subsequent reclassification to net cost of services - change in other reserves	1.3B	**(176)**	(15,256)	**-**	(5,982)
Total other comprehensive income		**(176)**	15,687	**-**	24,961
Total comprehensive income/(loss)		**40,625**	(21,607)	**(6,963)**	(7,834)
Profit for the year is attributable to:					
Non-controlling interest		**18,994**	4,316	**-**	-
CSIRO		**21,807**	(41,610)	**(6,963)**	(32,795)
Total surplus/(deficit)		**40,801**	(37,294)	**(6,963)**	(32,795)
Total comprehensive income for the year is attributable to:					
Non-controlling interest		**18,994**	4,316	**-**	-
CSIRO		**21,631**	(25,923)	**(6,963)**	(7,834)
Total comprehensive income/(loss)		**40,625**	(21,607)	**(6,963)**	(7,834)

The above Statement should be read in conjunction with the accompanying notes.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF FINANCIAL POSITION
as at 30 June 2020

		Consolidated		CSIRO	
		2020	2019	**2020**	2019
	Notes	**$'000**	$'000	**$'000**	$'000
ASSETS					
Financial Assets					
Cash and cash equivalents	2.1A	**403,496**	320,075	**302,619**	198,829
Trade and other receivables	2.1B	**88,945**	76,295	**89,936**	72,486
Other investments	2.1C	**304,490**	145,805	**177,467**	125,335
Total financial assets		**796,931**	542,175	**570,022**	396,650
Non-Financial Assets[1]					
Land and buildings	2.2A	**1,608,249**	1,564,162	**1,606,931**	1,564,162
Heritage and cultural	2.2A	**4,463**	4,463	**4,463**	4,463
Plant and equipment	2.2A	**559,183**	563,342	**559,009**	563,143
Intangibles	2.2A	**13,650**	16,740	**13,650**	16,740
Investment properties	2.2B	**49,373**	52,072	**49,373**	52,072
Inventories		**1,420**	1,265	**1,420**	1,265
Other non-financial assets	2.2C	**18,748**	50,060	**18,803**	50,152
Total non-financial assets		**2,255,086**	2,252,104	**2,253,649**	2,251,997
Properties held for sale		**5,200**	59,200	**5,200**	59,200
Total assets		**3,057,217**	2,853,479	**2,828,871**	2,707,847
LIABILITIES					
Payables					
Suppliers	2.3A	**215,021**	72,519	**210,200**	72,695
Other payables	2.3B	**17,796**	151,602	**18,601**	145,239
Total payables		**232,817**	224,121	**228,801**	217,934
Interest Bearing Liabilities					
Lease liabilities	2.4A	**116,740**	27,337	**115,371**	27,337
Deposits	2.4B	**22,508**	23,310	**25,588**	27,364
Total Interest bearing liabilities		**139,248**	50,647	**140,959**	54,701
Provisions					
Employee provisions	3.1A	**262,913**	238,498	**262,729**	238,374
Provision for remediation		**40,457**	41,020	**40,457**	41,020
Total provisions		**303,370**	279,518	**303,186**	279,394
Total liabilities		**675,435**	554,286	**672,946**	552,029
Net assets		**2,381,782**	2,299,193	**2,155,925**	2,155,818
EQUITY					
Contributed equity		**310,954**	300,954	**310,646**	300,646
Asset revaluation reserves		**1,523,229**	1,523,229	**1,523,229**	1,523,229
Other reserves		**(203)**	(27)	**-**	-
Retained surplus		**455,993**	435,198	**322,050**	331,943
Non-controlling interest		**91,809**	39,839	**-**	-
Total equity		**2,381,782**	2,299,193	**2,155,925**	2,155,818

The above Statement should be read in conjunction with the accompanying notes.

[1]Right-of-use assets are included in Land and buildings and Plant and equipment.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF CHANGES IN EQUITY – CONSOLIDATED
For the period ended 30 June 2020

	Retained earnings		Asset revaluation reserve		Other reserves		Contributed equity/capital		Non-controlling interest		Total equity	
	2020 $'000	2019 $'000	**2020 $'000**	2019 $'000	**2020 $'000**	2019 $'000	**2020 $'000**	2019 $'000	**2020 $'000**	2019 $'000	**2020 $'000**	2019 $'000
Opening balance	**435,198**	461,536	**1,523,229**	1,492,286	**(27)**	15,229	**300,954**	290,954	**39,839**	-	**2,299,193**	2,260,005
Adjustment on initial application of AASB 15/AASB 1058	**(1,012)**	-	**-**	**-**	**-**	-	**-**	**-**	**-**	**-**	**(1,012)**	-
Adjustment on initial application of AASB 16	**-**	-	**-**	-	**-**	-	**-**	-	**-**	**-**	**-**	-
Adjusted opening balance	**434,186**	461,536	**1,523,229**	1,492,286	**(27)**	15,229	**300,954**	290,954	**39,839**	-	**2,298,181**	2,260,005
Comprehensive income												
Other comprehensive income[1]	**-**	15,272	**-**	30,943	**(176)**	(15,256)	**-**	-	**-**	-	**(176)**	30,959
Surplus/(deficit) for the period	**21,807**	(41,610)	**-**	-	**-**	-	**-**	-	**18,994**	4,316	**40,801**	(37,294)
Total comprehensive income/(loss)	**21,807**	(26,338)	**-**	30,943	**(176)**	(15,256)	**-**	-	**18,994**	4,316	**40,625**	(6,335)
Other movements	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Contributions by owners												
Equity injection	**-**	-	**-**	-	**-**	-	**10,000**	10,000	**32,976**	35,523	**42,976**	45,523
Contributions by owners – other	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Closing balance	**455,993**	435,198	**1,523,229**	1,523,229	**(203)**	(27)	**310,954**	300,954	**91,809**	39,839	**2,381,782**	2,299,193

The above Statement should be read in conjunction with the accompanying notes.

[1]Refer to Note 1.3.

Accounting Policy

Equity Injections

Amounts that are designated as equity injections for a year are recognised directly in contributed equity in that year.

Non-controlling interests

Non-controlling interests refer to equity in a subsidiary that is not attributable (directly or indirectly) to CSIRO as parent. CSIRO recognises non-controlling interests in the CSIRO Innovation Fund subsidiary entities.

CONSOLIDATED FINANCIAL STATEMENTS
STATEMENT OF CHANGES IN EQUITY – CSIRO
For the period ended 30 June 2020

	Retained earnings		Asset revaluation reserve		Other reserves		Contributed equity/capital		Non-controlling interest		Total equity	
	2020	2019	**2020**	2019	**2020**	2019	**2020**	2019	**2020**	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000	**$'000**	$'000
Opening balance	**331,943**	358,756	**1,523,229**	1,492,286	**-**	5,982	**300,646**	290,646	**-**	-	**2,155,818**	2,147,670
Adjustment on initial application of AASB 15/AASB 1058	**(2,930)**	-	**-**	-	**-**	-	**-**	-	**-**	-	**(2,930)**	-
Adjustment on initial application of AASB 16	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Adjusted opening balance	**329,013**	358,756	**1,523,229**	1,492,286	**-**	5,982	**300,646**	290,646	**-**	-	**2,284,709**	2,147,670
Comprehensive income												
Other comprehensive income[1]	**-**	5,982	**-**	30,943	**-**	(5,982)	**-**	-	**-**	-	**-**	30,943
Surplus/(deficit) for the period	**(6,963)**	(32,795)	**-**	-	**-**	-	**-**	-	**-**	-	**(6,963)**	(32,795)
Total comprehensive income/(loss)	**(6,963)**	(26,813)	**-**	30,943	**-**	(5,982)	**-**	-	**-**	-	**(6,963)**	(1,852)
Other movements	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Contributions by owners												
Equity injection	**-**	-	**-**	-	**-**	-	**10,000**	10,000	**-**	-	**10,000**	10,000
Contributions by owners – other	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-
Closing balance	**322,050**	331,943	**1,523,229**	1,523,229	**-**	**-**	**310,646**	300,646	**-**	**-**	**2,155,925**	2,155,818

The above Statement should be read in conjunction with the accompanying notes.

[1]Refer to Note 1.3.

Accounting Policy

Equity Injections

Amounts that are designated as equity injections for a year are recognised directly in contributed equity in that year.

Non-controlling interests

Non-controlling interests refer to equity in a subsidiary that is not attributable (directly or indirectly) to CSIRO as parent. CSIRO recognises non-controlling interests in the CSIRO Innovation Fund subsidiary entities.

CONSOLIDATED FINANCIAL STATEMENTS
CASH FLOW STATEMENT
For the period ended 30 June 2020

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
OPERATING ACTIVITIES				
Cash received				
Receipts from Government	**837,873**	832,641	**837,873**	832,641
Sale of goods and rendering of services	**573,857**	545,055	**571,706**	557,414
Interest	**6,563**	13,841	**4,676**	10,967
Net GST received	**21,203**	17,900	**21,235**	19,031
Deposits	**-**	9,329	**-**	13,362
Total cash received	**1,439,496**	1,418,766	**1,435,490**	1,433,415
Cash used				
Employees	**765,251**	742,886	**763,146**	739,716
Suppliers	**520,701**	552,049	**513,555**	552,034
Interest payments on lease liabilities	**2,585**	-	**2,573**	-
Finance costs	**122**	1,430	**93**	1,403
Deposits	**799**	-	**1,773**	-
Total cash used	**1,289,458**	1,296,365	**1,281,140**	1,293,153
Net cash from operating activities	**150,038**	122,401	**154,350**	140,262
INVESTING ACTIVITIES				
Cash received				
Proceeds from sales of property, plant and equipment	**90,547**	967	**90,547**	988
Proceeds from sales of equity investments and intellectual property	**6,842**	6,147	**6,390**	425
Total cash received	**97,389**	7,114	**96,937**	1,413
Cash used				
Purchase of property, plant and equipment	**103,765**	119,647	**103,634**	119,647
Equity investments	**61,907**	52,250	**12,942**	12,492
Other selling costs	**1,397**	82	**1,397**	50
Total cash used	**167,069**	171,979	**117,973**	132,189
Net cash used in investing activities	**(69,680)**	(164,865)	**(21,036)**	(130,776)
FINANCING ACTIVITIES				
Cash received				
Contributed equity	**42,976**	45,523	**10,000**	10,000
Total cash received	**42,976**	45,523	**10,000**	10,000
Cash used				
Finance leases	**-**	4,631	**-**	4,631
Principal payments of lease liabilities	**39,913**	-	**39,524**	-
Total cash used	**39,913**	4,631	**39,524**	4,631
Net cash from financing activities	**3,063**	40,892	**(29,524)**	5,369
Net increase (decrease) in cash held	**83,421**	(1,572)	**103,790**	14,855
Cash and cash equivalents at the beginning of the reporting period	**320,075**	321,647	**198,829**	183,974
Cash and cash equivalents at the end of the reporting period	**403,496**	320,075	**302,619**	198,829

The above Statement should be read in conjunction with the accompanying notes.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

Overview

Objectives of the CSIRO and its Subsidiaries (the Group)

CSIRO is an Australian Government controlled not-for-profit entity and is classified as a Corporate Commonwealth entity under the *Public Governance, Performance and Accountability Act 2013*. CSIRO is a research enterprise that aims to deliver great science and innovative solutions for industry, society and the environment.

CSIRO is structured to meet the following outcome:

> Provide innovative scientific and technological solutions to national challenges and opportunities to benefit industry, the environment and the community, through scientific research and capability development, services and advice.

The continued existence of CSIRO in its present form and with its present programs is dependent on Government policy and on continued funding by Parliament for CSIRO's administration and programs.

The Basis of Preparation

The financial statements are required by section 42 of the *Public Governance, Performance and Accountability Act 2013* and are general purpose financial statements.

CSIRO and the Group's Consolidated Financial Statements have been prepared in accordance with:

- *Public Governance, Performance and Accountability (Financial Reporting Rule) 2015* (FRR) for reporting periods ending on or after 1 July 2015; and
- *Australian Accounting Standards and Interpretations – Reduced Disclosure Requirements* issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period

The financial statements have been prepared on an accrual basis and in accordance with the historical cost convention, except for certain assets and liabilities at fair value. Except where stated, no allowance is made for the effect of changing prices on the results or the financial position.

The impacts of Coronavirus ("COVID-19") have been assessed by CSIRO and it is not expected to have a material impact on CSIRO operations or its ability to meet its objectives.

The financial statements are presented in Australian dollars and values are rounded to the nearest thousand dollars unless otherwise specified.

Key Judgements and Estimates

In the process of applying the Group's accounting policies, management has made a number of judgements and applied estimates and assumptions to future events. Information around judgements and estimates which are material to the financial statements are found in the following notes:

- Note 3.1 Employee Provisions
- Note 4.3 Fair Value Measurement

CSIRO has a provision (under provisions) for remediation costs required at a remote and other CSIRO locations, based on estimates provided by internal and external qualified experts. The provision is predominantly based on externally provided costings, with additional amounts derived from comparable remediation works. The provision is based on the scope of work as it currently stands as at 30 June 2020. As remediation works progress, the scope and costs may be subject to change. The work is expected to take several years to reach completion. Provisions for remediation also includes a provision for the makegood costs at leased CSIRO sites which is based on rates provided by an expert valuer.

Consolidation

The consolidated financial statements comprise the financial statements of the CSIRO and its subsidiaries (referred to as 'the Group'). The subsidiaries of CSIRO are the Science and Industry Endowment Fund (SIEF), the CSIRO Chile Research Fundación (Fundación), National ICT Australia (NICTA), the Innovation Fund and the US Office. WLAN Services Pty Ltd (WLAN) was deregistered in 2019. Refer to Note 3.6 for further information.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

The consolidated financial statements incorporate the assets and liabilities of all entities controlled by CSIRO as at 30 June 2020 and the results of the controlled entities for the year then ended. Subsidiaries are consolidated from the date on which control is obtained through to the date on which control ceases. The Group applies consistent accounting policies and the effects of all transactions and balances between the entities are eliminated in full.

The non-controlling interest in the results and equity of subsidiaries is shown separately in the statement of comprehensive income, statement of financial position and statement of changes in equity of the consolidated Group.

Foreign Currency Translation

The functional currency of CSIRO and its Australian subsidiaries is Australian dollars. The Group has three overseas subsidiary entities, the Fundación and the US Office entities. On consolidation, those entities:

- Assets and liabilities are translated into Australian dollars at the rate of exchange prevailing at the reporting date; and
- The statement of comprehensive income is translated at average exchange rate.

The exchange rate differences arising are recognised in the net cost of services.

New Australian Accounting Standards

All new, revised and/or amending standards and/or interpretations that were issued prior to the signing of these statements and applicable to the current reporting period were adopted by CSIRO. This includes the following new standards:

Standard/Interpretation	Nature of change in accounting policy, transitional provisions, and adjustment to financial statements
AASB 15 Revenue from Contracts with Customers / AASB 2016-8 Amendments to Australian Accounting Standards – Australian Implementation Guidance for Not-for-Profit Entities and AASB 1058 Income of Not-For-Profit Entities	AASB 15, AASB 2016-8 and AASB 1058 became effective 1 July 2019. AASB 15 establishes a comprehensive framework for determining whether, how much and when revenue is recognised. It replaces existing revenue recognition guidance, including AASB 118 *Revenue*, AASB 111 *Construction Contracts* and Interpretation 13 *Customer Loyalty Programmes*. The core principle of AASB 15 is that an entity recognises revenue to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. AASB 1058 is relevant in circumstances where AASB 15 does not apply. AASB 1058 replaces most of the not-for-profit (NFP) provisions of AASB 1004 *Contributions and applies to transactions where the consideration to acquire an asset is significantly less than fair value principally to enable the entity to further its objectives, and where volunteer services are received.* The details of the changes in accounting policies, transitional provisions and adjustments are disclosed below and in the relevant notes to the financial statements.
AASB 16 Leases	AASB 16 became effective on 1 July 2019. This new standard has replaced AASB 117 Leases, Interpretation 4 Determining whether an Arrangement contains a Lease, Interpretation 115 Operating Leases—Incentives and Interpretation 127 Evaluating the Substance of Transactions Involving the Legal Form of a Lease. AASB 16 provides a single lessee accounting model, requiring the recognition of assets and liabilities for all leases, together with options to exclude leases where the lease term is 12 months or less, or where the underlying asset is of low value. AASB 16 substantially carries forward the lessor accounting in AASB 117, with the distinction between operating leases and finance leases being retained. The details of the changes in accounting policies, transitional provisions and adjustments are disclosed below and in the relevant notes to the financial statements.

Application of AASB 15 *Revenue from Contracts with Customers* / AASB 1058 *Income of Not-For-Profit Entities*

CSIRO adopted AASB 15 and AASB 1058 using the modified retrospective approach, under which the cumulative effect of initial application is recognised in retained earnings at 1 July 2019. Accordingly, the comparative information presented for 2019 is not restated. It is presented as previously reported under the applicable standards and related interpretations.

Under the new income recognition model CSIRO first determines whether an enforceable agreement exists and whether the promises to transfer goods or services to the customer are 'sufficiently specific'. If an enforceable agreement exists and the promises are 'sufficiently specific' (to a transaction or part of a transaction), CSIRO applies the general AASB 15 principles to determine the appropriate revenue recognition. If these criteria are not met, CSIRO considers whether AASB 1058 applies.

In relation to AASB 15, CSIRO elected to apply the new standard to all new and uncompleted contracts from the date of initial application. CSIRO is required to aggregate the effect of all of the contract modifications that occur before the date of initial application.

In terms of AASB 1058, CSIRO is required to recognise volunteer services at fair value if those services would have been purchased if not provided voluntarily, and the fair value of those services can be measured reliably.

The impact on transition is summarised below:

	Consolidated 1 July 2019 $'000	CSIRO 1 July 2019 $'000
Impact on Transition of AASB 15		
Assets		
Contract assets	**661**	**661**
Total assets	**661**	**661**
Liabilities		
Contract liabilities	**351**	**2,269**
Total liabilities	**351**	**2,269**
Total adjustment recognised in retained earnings	**1,012**	**2,930**

Set out below are the amounts by which each financial statement line item is affected as at and for the year ended 30 June 2020 as a result of the adoption of AASB 15 and AASB 1058. The table shows amounts prepared under AASB 15 and AASB 1058, compared to what the amounts would have been had AASB 15 and AASB 1058 not been adopted, for both the Consolidated Group, and CSIRO only:

	Consolidated			CSIRO		
	AASB 15 / AASB 1058	**Previous AAS**	Increase / (decrease)	**AASB 15 / AASB 1058**	**Previous AAS**	Increase / (decrease)
	$'000	**$'000**	$'000	**$'000**	**$'000**	$'000
Transitional Disclosure						
Expenses						
Employee benefits	-	-	-	-	-	-
Suppliers	-	3,941	(3,941)	-	3,941	(3,941)
Total Expenses	**-**	**3,941**	**(3,941)**	**-**	**3,941**	**(3,941)**
Revenue						
Revenue from contracts with customers	1,937	3,716	(1,779)	1,937	3,716	(1,779)
Grant income	-	-	-	292	25	267
Total Revenue	**1,937**	**3,716**	**(1,779)**	**2,229**	**3,741**	**(1,512)**
Net (cost of)/contribution by services	**1,937**	**(225)**	**2,162**	**2,229**	**(200)**	**2,429**
Assets						
Contract assets	899	1,823	(924)	899	1,823	(924)
Total Assets	**899**	**1,823**	**(924)**	**899**	**1,823**	**(924)**
Liabilities						
Contract liabilities	-	-	-	-	-	-
Other Payables	217	181	36	1,869	181	1,688
Total Liabilities	**217**	**181**	**36**	**1,869**	**181**	**1,688**
Retained earnings	**682**	**1,642**	**(960)**	**(970)**	**1,642**	**(2,612)**

Application of AASB 16 *Leases*

CSIRO adopted AASB 16 using the modified retrospective approach. Accordingly, the comparative information presented for 2019 is not restated, that is, it is presented as previously reported under AASB 117 and related interpretations.

CSIRO elected to apply the practical expedient to not reassess whether a contract is, or contains a lease at the date of initial application. Instead, for contracts entered into before the transition date the group relied on its assessment made in applying AASB 117. The definition of a lease under AASB 16 was applied only to contracts entered into or changed on or after 1 July 2019.

AASB 16 provides for certain optional practical expedients, including those related to the initial adoption of the standard. CSIRO applied the following practical expedients when applying AASB 16 to leases previously classified as operating leases under AASB 117:

- Exclude initial direct costs from the measurement of right-of-use assets at the date of initial application for leases where the right-of-use asset was determined as if AASB 16 had been applied since the commencement date;
- Reliance on previous assessments on whether leases are onerous as opposed to preparing an impairment review under AASB 136 Impairment of assets as at the date of initial application; and
- Applied the exemption not to recognise right-of-use assets and liabilities for leases with less than 12 months of lease term remaining as of the date of initial application.

As a lessee, CSIRO previously classified leases as operating or finance leases based on its assessment of whether the lease transferred substantially all of the risks and rewards of ownership. Under AASB 16, CSIRO recognises right-of-use assets and lease liabilities for most leases. However, CSIRO has elected not to recognise right-of-use

assets and lease liabilities for some leases of low value assets based on the value of the underlying asset when new or for short-term leases with a lease term of 12 months or less.

On adoption of AASB 16, CSIRO recognised right-of-use assets and lease liabilities in relation to land and buildings and plant and equipment, which had previously been classified as operating leases. The lease liabilities were measured at the present value of the remaining lease payments, discounted using CSIRO's incremental borrowing rate based on zero coupon yields as prescribed by the Department of Finance at 1 July 2019. The weighted-average rate applied was 1.00%.

The right-of-use assets were measured at an amount equal to the lease liability, adjusted by the amount of any prepaid lease payments. The total Consolidated and CSIRO impact on transition is summarised below:

	Consolidated 1 July 2019 $'000	CSIRO 1 July 2019 $'000
CSIRO & Consolidated entities		
Right-of-use assets - property, plant and equipment	**133,600**	**131,821**
Prepayments	**(6,204)**	**(5,757)**
Lease liabilities	**127,396**	**126,064**

The following table reconciles the minimum lease commitments disclosed in the entity's 30 June 2019 annual financial statements to the amount of lease liabilities recognised on 1 July 2019:

Minimum operating lease commitment at 30 June 2019	**132,606**	**131,415**
Less: short-term leases not recognised under AASB 16	**(591)**	**(591)**
Less: low value leases not recognised under AASB 16	**(5,463)**	**(5,361)**
Less: GST on minimum operating lease commitment at 30 June 2019	**(10,344)**	**(10,344)**
Less: other adjustments	**(6,163)**	**(6,266)**
Plus: effect of extension options reasonably certain to be exercised	**20,917**	**20,917**
Undiscounted lease payments	**130,962**	**129,771**
Less: effect of discounting using the incremental borrowing rate as at the date of initial application	**(3,566)**	**(3,707)**
Lease liabilities recognised at 1 July 2019	**127,396**	**126,064**

Taxation

In accordance with Section 53 of the *Science and Industry Research Act 1949*, CSIRO is exempt from all forms of Australian taxation except the fringe benefits tax (FBT) and the goods and services tax (GST). The Group pays applicable taxes in overseas countries.

Revenues, expenses, assets and liabilities are recognised net of GST except:

- where the amount of GST incurred is not recoverable from the Australian Taxation Office; and
- for receivables and payables.

The SIEF is exempt from income tax in Australia. WLAN and the Innovation Fund entities are subject to all applicable taxes in Australia. The Fundación is subject to all applicable taxes in Chile. The US Office is subject to taxes in the United States. NICTA is exempt from income tax however NICTA's subsidiaries (including NICTA IPR Pty Ltd) are subject to applicable taxes in Australia.

Events after the Reporting Period

At the time of completion of these financial statements, the Group is not aware of any significant events occurring after the reporting date.

Future Events

CSIRO is exploring future commercial opportunities for the Ginninderra Field Station, a 701 hectare area of land which CSIRO owns in north Canberra. Due to rapid urban growth in the surrounding area, the site has become under-utilised and the field station requires relocation to a more rural setting. As part of its focus on exploring the future possibilities for this site, CSIRO has

successfully requested the National Capital Authority (NCA) to include the site as 'Urban Area' on the General Policy Plan for Metropolitan Canberra in the National Capital Plan draft Amendment 86. The Amendment became effective in November 2016.

This initial step in rezoning the land has allowed CSIRO to explore avenues to divest the Ginninderra land in a commercially beneficial way. The CSIRO proposes to divest Ginninderra east via a conditional sale. External advice has indicated that a sale would be more attractive to potential developers than partnering with the CSIRO in a joint venture development. The conditions on the sale are necessary to meet community expectations that the land will be developed with a significant componenet of science and sustainability. As this progresses, it is expected that there will be a material increase in the recorded value of the Ginninderra land.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

1. Financial Performance

This section analyses the financial performance of CSIRO for the year ended 30 June 2020.

1.1. Expenses

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 1.1A: Employee Benefits				
Wages and salaries	**594,433**	563,969	**590,762**	561,042
Superannuation				
Defined contribution plans	**53,661**	22,764	**53,661**	22,764
Defined benefit plans	**43,933**	73,413	**43,839**	73,281
Leave and other entitlements	**96,659**	111,294	**96,468**	111,213
Separation and redundancies	**11,538**	(4)	**11,538**	(4)
Gross employee benefits	**800,224**	771,436	**796,268**	768,296
Less				
Capitalised labour	**(3,701)**	(6,403)	**(3,701)**	(6,403)
Employee cost recovery from subsidiary companies	**(1,921)**	(1,864)	**(216)**	(1,864)
Total employee benefits	**794,602**	763,169	**792,351**	760,029

Accounting Policy

Accounting policy for employee related expenses is contained in Section 3. People and Relationships.

Note 1.1B: Suppliers

Goods supplied	**91,264**	103,314	**91,037**	102,827
Services rendered	**333,672**	336,828	**328,513**	338,568
Total goods and services supplied or rendered	**424,936**	440,142	**419,550**	441,395
Other suppliers				
Property lease rental[1]	**-**	33,896	**-**	33,429
Other operating lease rentals[1]	**-**	5,631	**-**	5,631
Short-term lease rentals[2]	**4,902**	-	**4,811**	-
Low value leases	**-**	-	**-**	-
Workers compensation expenses	**3,582**	3,285	**3,558**	3,263
Total other suppliers	**8,484**	42,812	**8,369**	42,323
Total Suppliers	**433,420**	482,954	**427,919**	483,718

[1]CSIRO has applied AASB 16 using the modified retrospective approach and therefore the comparative information has not been restated and continues to be reported under AASB 117.

[2]CSIRO has short-term lease commitments of $0.5m as at 30 June 2020.

The above lease disclosures should be read in conjunction with the accompanying notes 1.1C, 1.2C, 2.2A and 2.4A.

Accounting Policy

Research and Development Expenditure and Intellectual Property

All research and development costs, including costs associated with protecting intellectual property (e.g. patents and trademarks), are expensed as incurred.

Short-term leases and leases of low-value assets

The Entity has elected not to recognise right-of-use assets and lease liabilities for short-term leases of assets that have a lease term of 12 months or less or leases of low-value assets (less than $10,000). The entity recognises the lease payments associated with these leases as an expense on a straight-line basis over the lease term.

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 1.1C: Finance Costs				
Other interest payments	**122**	-	**93**	-
Finance leases[1]	**-**	1,430	**-**	1,403
Interest on lease liabilities	**2,585**	-	**2,573**	-
Total Finance costs	**2,707**	1,430	**2,666**	1,403

[1]CSIRO has applied AASB 16 using the modified retrospective approach and therefore the comparative information has not been restated and continues to be reported under AASB 117.
The above lease disclosures should be read in conjunction with the accompanying notes 1.1B, 1.2C, 2.2A and 2.4A.

Note 1.1D: Impairment loss on financial instruments				
Asset write-downs and impairments from:				
Bad debts written off	**659**	925	**659**	925
Expected credit loss on trade and other receivables	**645**	(389)	**236**	(389)
Total write-downs and impairments on financial instruments	**1,304**	536	**895**	536

Note 1.1E: Write-down and impairment of other assets				
Asset write-downs and impairments from:				
Property, plant and equipment	**12,188**	13	**12,188**	13
Total write-down and impairment of other assets	**12,188**	13	**12,188**	13

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

1.2. Revenue and Gains

Own Source Revenue

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 1.2A: Revenue from contracts with customers				
Sale of goods	**14,494**	-	**14,494**	-
Rendering of services	**406,341**	-	**419,657**	-
Royalties and licence fees	**28,584**	-	**28,584**	-
Total revenue from contract with customers	**449,419**	-	**462,735**	-
Sale of goods and rendering of services[1]	**-**	410,432	**-**	435,475
Total sale of goods and rendering of services	**-**	410,432	**-**	435,475
Royalties and licence fees[1]	**-**	34,427	**-**	34,427
Total royalties and licence fees	**-**	34,427	**-**	34,427

[1] CSIRO has applied AASB 15 and AASB 1058 using the modified retrospective approach and therefore the comparative information has not been restated and continues to be reported under either AASB 118 *Revenue*, AASB 111 *Construction Contracts* and Interpretation 13 *Customer Loyalty Programmes.*

Disaggregation of revenue from contracts with customers

CSIRO derives its revenue under AASB 15 from two main sources, being the sale of goods and rendering of services and royalties and licence fees. The sale of goods and rendering of services has been disaggregated based on the line of business, with each line providing similar services to CSIRO customers. No disaggregation is available for royalties and licence fees.

Revenue from contracts with customers - line of business:		
Impact Science	**329,855**	**342,313**
National Facilities and Collections	**73,404**	**73,404**
Services and Other	**46,160**	**47,018**
	449,419	**462,735**

Accounting Policy

Revenue from contracts with customers

Revenue from the sale of goods is recognised when control has been transferred to the buyer. A contract falls within the scope of AASB 15 when the criteria for accounting for a contract with a customer is met as per paragraph 9 of the standard. Performance obligations are required by an enforceable contract with the satisfaction of these performance obligations either measured over time or a point in time.

Disaggregation	Nature	Timing	Payment Terms
Impact Science	CSIRO conducts and facilitates the uptake of scientific technology solutions to deliver a positive impact on Australia.	Performance obligations are typically satisfied over time, as the customer simultaneously receives and consumes the benefits associated with CSIRO conducting scientific research. The progress towards the completion of a performance obligation are typically measured using either milestones reached or time elapsed. In the absence of an observable output method, an input method is used to measure the progress towards the completion of the performance obligation.	Payment terms are specified in the contract but are generally 30 days after the customer has been billed over time or a point in time.
National Facilities	CSIRO is a provider of a range of specialised laboratories, scientific and testing	Performance obligations are typically satisfied over time, as the customer simultaneously receives and consumes the benefits associated with using the science-ready facilities. The progress	Payment terms are specified in the contract but are

	equipment, and other research facilities. The science-ready facilities are used by Australian and international researchers through application and user-funded arrangements.	towards the completion of a performance obligation are typically measured using the time elapsed method. In the absence of an observable output method, an input method is used to measure the progress towards the completion of the performance obligation.	generally 30 days after the customer has been billed over time or a point in time.
Services & Other	CSIRO is a subject matter expert and provides advisory services to a range of customers in addition to education and outreach to Australia.	Performance obligations are satisfied over time or a point in time depending on the services provided. The methods used to measure the progress towards completion of a performance obligation over time or at a point in time is dependent on the services provided.	Payment terms are specified in the contract but are generally 30 days after the customer has been billed over time or a point in time.
Royalties & Licence Fees	CSIRO provides a licence to a customer which gives the customer a right to access or right to use of CSIRO developed Intellectual Property ("IP").	If the licence provides the customer with the right to access CSIRO IP as it exists through the licence period, performance obligations are satisfied over time as time elapses. If the licence provides the customer with the right to use of CSIRO IP as it exists when the licence is granted, performance obligations are satisfied at a point in time. Control exists when the customer has a present right to payment for the granting of the licence.	Payment terms are specified in the contract but are generally 30 days after the customer has been billed over time or a point in time.

The transaction price is the total amount of consideration to which CSIRO expects to be entitled in exchange for transferring promised goods or services to a customer. The consideration promised in a contract with a customer may include fixed amounts, variable amounts or both.

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 1.2B: Bank and term deposits interest				
Bank and term deposits	**5,772**	13,501	**4,251**	10,536

Accounting Policy

Interest revenue is recognised using the effective interest method as set out in AASB 9 *Financial Instruments*.

Note 1.2C: Rental Income				
Operating lease				
Rental income[1]	**-**	10,546	**-**	10,546
Lease income	**9,200**	-	**9,200**	-
Total Rental Income	**9,200**	10,546	**9,200**	10,546

[1] CSIRO has applied AASB 16 using the modified retrospective approach and therefore the comparative information has not been restated and continues to be reported under AASB 117.

Operating Leases
CSIRO has operating lease income receivables from the sub-leasing of offices and scientific research accommodation. The amounts below are GST inclusive.

Maturity analysis of operating lease income receivables

	Consolidated 2020 $'000	CSIRO 2020 $'000
Within 1 year	**4,175**	**4,175**
One to two years	**2,307**	**2,307**
Two to three years	**1,625**	**1,625**
Three to four years	**1,475**	**1,475**
Four to five years	**909**	**909**
More than 5 years	**2,119**	**2,119**
Total undiscounted lease payment receivable	**12,610**	**12,610**

The above lease disclosure should be read in conjunction with the accompanying notes 1.1B, 1.1C, 2.2A and 2.4A.

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 1.2D: Other revenues				
Sale of primary produce	**1,044**	1,989	**1,044**	1,989
Donation	**4,086**	916	**4,086**	916
Capital contributions	**9,349**	12,587	**9,349**	13,805
Education programs and subscriptions	**266**	347	**266**	347
Other	**19,963**	13,122	**10,422**	8,396
Total other revenues	**34,708**	28,961	**25,167**	25,453
Note 1.2E: Foreign exchange gains				
Non-speculative gain/(loss)	**383**	117	**(394)**	238
Note 1.2F: Gain/(loss) from asset sales				
Land and buildings				
Proceeds from sale	**90,000**	-	**90,000**	-
Carrying value of assets sold	**(56,264)**	(26)	**(56,264)**	(26)
Selling expense	**(1,375)**	(8)	**(1,375)**	(8)
Net gain/(loss) from sale of land and buildings	**32,361**	(34)	**32,361**	(34)
Plant and equipment				
Proceeds from sale	**399**	987	**399**	987
Carrying value of assets sold	**(3,076)**	(3,758)	**(3,076)**	(3,758)
Selling expense	**(22)**	(42)	**(22)**	(42)
Net gain/(loss) from sale of plant and equipment	**(2,699)**	(2,813)	**(2,699)**	(2,813)
Total losses from asset sales	**29,662**	(2,847)	**29,662**	(2,847)
Note 1.2G: Revenue from Government				
Appropriations	**837,873**	834,561	**837,873**	834,561

Accounting Policy

Other Revenue

Other revenues includes sale of CSIRO publications and products, conferences and 'pass through' funding for costs of suppliers and external service providers.

Revenues from Government

Amounts appropriated for departmental appropriations for the year (adjusted for any formal additions and reductions) are recognised as Revenue from Government when the entity gains control of the appropriation, except for certain amounts that relate to activities that are reciprocal in nature, in which case revenue is recognised only when it has been earned. Appropriations receivable are recognised at their nominal amounts.

Funding received or receivable from non-corporate Commonwealth entities (appropriated to the non-corporate Commonwealth entity as a corporate Commonwealth entity payment item for payment to this entity) is recognised as Revenue from Government by the corporate Commonwealth entity unless the funding is in the nature of an equity injection or a loan.

Appropriations are received from the Australian Government Department of Industry and Science (appropriated to CSIRO as a corporate Commonwealth entity payment item).

1.3. Other Comprehensive Income

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Items that will not be classified to income or loss				
Note 1.3A: Changes in asset revaluation reserves				
Revaluation of plant and equipment	**-**	30,943	**-**	30,943
Revaluation of heritage and cultural assets	**-**	-	**-**	-
Net increase/(decrease) in asset revaluation reserves	**-**	30,943	**-**	30,943
Items that may be reclassified to income and loss				
Note 1.3B: Change in other reserve				
Net change in fair value of equity investments	**-**	(15,272)	**-**	(5,982)
Net change arising from foreign exchange movements on conversion of subsidiary accounts	**(176)**	16	**-**	-
Net increase/(decrease) in other reserve	**(176)**	(15,256)	**-**	(5,982)

Accounting Policy

Reserves for equity valuation

Under AASB 9 *Financial Instruments*, changes in the fair value of CSIRO's equity investment portfolio assets are recognised through Profit and Loss. Changes in the fair value of the Innovation Fund equity investment portfolio are recognised through Profit and Loss (refer Note 4.2 and 4.3).

2. Financial Position

This section analyses CSIRO's assets used to generate financial performance and the operating liabilities incurred as a result. Employee related information is disclosed in the People and Relationships section.

2.1. Financial Assets

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 2.1A: Cash and Cash equivalents				
Cash at bank and on hand	**371,496**	178,936	**270,619**	118,829
Term deposits	**32,000**	141,139	**32,000**	80,000
Total cash and cash equivalents	**403,496**	320,075	**302,619**	198,829

The closing balance of Cash does not include amounts held in trust: $7.6m in 2020 and $7.9m in 2019. See note 5.3.

Accounting Policy

Cash is recognised at its nominal value. Cash and cash equivalents includes:

a) cash on hand;

b) demand deposits in bank accounts with an original maturity of 3 months or less that are readily convertible to known amounts of cash and subject to insignificant risk of changes in value; and

c) cash in special accounts.

Note 2.1B: Trade and other receivables				
Goods and services receivable				
Goods and services	**56,292**	65,729	**55,581**	65,269
Statutory receivables	**-**	5,764	**-**	4,311
Interest	**491**	1,282	**63**	488
Contract assets[1]	**31,853**	-	**31,853**	-
Other receivables	**1,399**	3,965	**3,120**	2,863
Total trade and other receivables (gross)	**90,035**	76,740	**90,617**	72,931
Less: expected credit loss allowance for trade and other receivables	**(1,090)**	(445)	**(681)**	(445)
Total trade and other receivables (net)	**88,945**	76,295	**89,936**	72,486
Trade and other receivables (gross) aged as follows				
Not overdue	**76,620**	61,763	**77,202**	57,954
Overdue by				
0 to 30 days	**6,460**	11,790	**6,460**	11,790
31 to 60 days	**2,620**	1,126	**2,620**	1,126
61 to 90 days	**1,589**	770	**1,589**	770
More than 90 days	**2,746**	1,291	**2,746**	1,291
Total receivables (gross)	**90,035**	76,740	**90,617**	72,931
Reconciliation of expected credit loss allowance				
Opening balance	**445**	834	**445**	834
Increase /(decrease) recognised in net surplus	**645**	(389)	**236**	(389)
Closing balance	**1,090**	445	**681**	445

[1]Contract assets are associated with services that have been transferred to the customer by CSIRO but there are remaining services to be performed in order to invoice the customer.

Accounting Policy

Trade and Other Receivables

Receivables for goods and services, which have 30 day terms, are recognised at the nominal amounts due less any impairment allowance. Collectability of debts is reviewed on an ongoing basis and allowances are made before collectability of the debt is no longer probable and before the loss is incurred. All trade and other receivables are expected to be recovered in no more than 12 months.

Impairment of Financial Assets

Financial assets are assessed for impairment at the end of each reporting period. Where there is objective evidence that an impairment loss has been incurred for loans and receivables, the amount of the loss is measured as the difference between the asset's carrying amount and the present vaue of estimated future cash flows discounted at the asset's original effective interest rate. The carrying amount is reduced by way of an allowance account. The loss is recognised in the Statement of Comprehensive Income.

Receivables for goods and services, which have 30 day terms, are recognised at the nominal amounts due less any impairment

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 2.1C: Other Investments				
Listed companies	**13,063**	9,188	**13,063**	9,188
Unlisted companies	**98,828**	57,236	**84,941**	46,735
Innovation Fund	**183,723**	70,472	**70,587**	60,503
Uniseed Investment	**8,876**	8,909	**8,876**	8,909
Total investments	**304,490**	145,805	**177,467**	125,335

Accounting Policy

CSIRO has investments in a number of unlisted start-up companies over which it does not have significant influence or control. These companies have been established for the purpose of commercialisation of CSIRO's intellectual property. CSIRO also has some investments in companies which have been listed on the Australian Stock Exchange and in the Uniseed trust. CSIRO, as part of the National Innovation and Science Agenda, has also established and invested in an Innovation Fund to invest in the development of early stage technology opportunities. Refer to Note 3.6 Related Party Disclosures for more information.

CSIRO's other investments are accounted for in accordance with *AASB 9 Financial Instruments* and *AASB 10 Consolidated Financial Statements*. See note 4.2 and 4.3 for further information.

2.2. Non-Financial Assets

Note 2.2A: Reconciliation of the opening and closing balances of Land and Buildings, Plant and Equipment and Intangibles

(a) Reconciliation of the opening and closing balances of Land and Buildings, Plant and Equipment and Intangibles for 2020 - Consolidated

	Land	Buildings	Total land and buildings	Plant and equipment	Heritage and cultural	Intangibles	Total
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
As at 1 July 2019							
Gross book value	**386,600**	**2,674,812**	**3,061,412**	**1,294,098**	**13,997**	**56,366**	**4,425,873**
Accumulated depreciation and amortisation	**-**	**(1,497,250)**	**(1,497,250)**	**(730,756)**	**(9,534)**	**(39,626)**	**(2,277,166)**
Net book value as at 1 July 2019	**386,600**	**1,177,562**	**1,564,162**	**563,342**	**4,463**	**16,740**	**2,148,707**
Recognition of right-of-use asset on initial application of AASB 16	**-**	**132,168**	**132,168**	**1,432**	**-**	**-**	**133,600**
Adjusted total as at 1 July 2019	**386,600**	**1,309,730**	**1,696,330**	**564,774**	**4,463**	**16,740**	**2,282,307**
Additions:							
By purchase	**-**	**34,449**	**34,449**	**69,159**	**-**	**(1,578)**	**102,030**
Right-of-use assets	**-**	**224**	**224**	**1,510**	**-**	**-**	**1,734**
Assets first recognised through a gain in net cost of services	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Reclassification	**-**	**271**	**271**	**(1,928)**	**-**	**1,657**	**-**
Revaluations recognised in other comprehensive income	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Impairments recognised in net cost of services	**-**	**(11,779)**	**(11,779)**	**-**	**-**	**(409)**	**(12,188)**
Write-offs and impairments on right-of-use assets recognised in net cost of services	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Depreciation expense	**-**	**(67,824)**	**(67,824)**	**(70,572)**	**-**	**(2,592)**	**(140,988)**
Depreciation on right-of-use assets	**-**	**(41,157)**	**(41,157)**	**(685)**	**-**	**-**	**(41,842)**
Total depreciation and amortisation	**-**	**(108,981)**	**(108,981)**	**(71,257)**	**-**	**(2,592)**	**(182,830)**
Disposals	**-**	**(2,265)**	**(2,265)**	**(2,907)**	**-**	**(167)**	**(5,339)**
Disposals of Right-of-Use Assets	**-**	**-**	**-**	**(148)**	**-**	**-**	**(148)**
Other movements	**(8,500)**	**(89,489)**	**(97,989)**	**(20)**	**-**	**(1)**	**(98,010)**
Other movements of right-of-use assets	**8,500**	**89,489**	**97,989**	**-**	**-**	**-**	**97,989**
Net book value as at 30 June 2020	**386,600**	**1,221,649**	**1,608,249**	**559,183**	**4,463**	**13,650**	**2,185,545**
Net book value as at 30 June 2020 represented by:							
Gross book value	**386,600**	**2,817,200**	**3,203,800**	**1,341,527**	**13,997**	**52,628**	**4,611,952**
Accumulated depreciation and amortisation	**-**	**(1,595,551)**	**(1,595,551)**	**(782,344)**	**(9,534)**	**(38,978)**	**(2,426,407)**
Total as at 30 June 2020	**386,600**	**1,221,649**	**1,608,249**	**559,183**	**4,463**	**13,650**	**2,185,545**
Carrying amount of right-of-use assets	**8,500**	**180,724**	**189,224**	**2,109**	**-**	**-**	**191,333**

CONSOLIDATED FINANCIAL STATEMENTS
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(b) Reconciliation of the opening and closing balances of Land and Buildings, Plant and Equipment and Intangibles for 2020 - CSIRO

	Land	Buildings	Total land and buildings	Plant and equipment	Heritage and cultural	Intangibles	Total
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
As at 1 July 2019							
Gross book value	386,600	2,674,812	3,061,412	1,293,251	13,997	56,366	4,425,026
Accumulated depreciation and amortisation	-	(1,497,250)	(1,497,250)	(730,108)	(9,534)	(39,626)	(2,276,518)
Net book value as at 1 July 2019	386,600	1,177,562	1,564,162	563,143	4,463	16,740	2,148,508
Recognition of right-of-use asset on initial application of AASB 16	-	130,389	130,389	1,432	-	-	131,821
Adjusted total as at 1 July 2019	386,600	1,307,951	1,694,551	564,575	4,463	16,740	2,280,329
Additions							
By purchase	-	34,449	34,449	69,028	-	(1,578)	101,899
Right-of-use assets	-	224	224	1,510	-	-	1,734
Assets first recognised through a gain in net cost of services	-	-	-	-	-	-	-
Reclassification	-	271	271	(1,928)	-	1,657	-
Revaluations recognised in other comprehensive income	-	-	-	-	-	-	-
Impairments recognised in net cost of services	-	(11,779)	(11,779)	-	-	(409)	(12,188)
Write-offs and impairments on right-of-use assets recognised in net cost of services	-	-	-	-	-	-	-
Depreciation expense	-	(67,824)	(67,824)	(70,436)	-	(2,592)	(140,852)
Depreciation on right-of-use assets	-	(40,696)	(40,696)	(685)	-	-	(41,381)
Total depreciation and amortisation	-	(108,520)	(108,520)	(71,121)	-	(2,592)	(182,233)
Disposals	-	(2,265)	(2,265)	(2,907)	-	(167)	(5,339)
Disposals of Right-of-Use Assets	-	-	-	(148)	-	-	(148)
Other movements	(8,500)	(89,489)	(97,989)	-	-	(1)	(97,990)
Other movements of right-of-use assets	8,500	89,489	97,989	-	-	-	97,989
Net book value as at 30 June 2020	386,600	1,220,331	1,606,931	559,009	4,463	13,650	2,184,053
Net book value as at 30 June 2020 represented by:							
Gross book value	386,600	2,815,421	3,202,021	1,340,678	13,997	52,628	4,609,324
Accumulated depreciation and amortisation	-	(1,595,090)	(1,595,090)	(781,669)	(9,534)	(38,978)	(2,425,271)
Total as at 30 June 2020	386,600	1,220,331	1,606,931	559,009	4,463	13,650	2,184,053
Carrying amount of right-of-use assets	8,500	179,406	187,906	2,109	-	-	190,015

Valuation of non-financial assets

All valuations were conducted in accordance with the revaluation policy at Note 4.3 – Fair Value Measurement.

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Contractual commitments for fixed assets:				
Capital commitments comprise outstanding payments for buildings under construction and commitments for purchase of plant and equipment. Commitments are reported inclusive of GST.				
Land and buildings	**25,751**	15,797	**25,751**	15,797
Plant and equipment	**12,999**	4,170	**12,999**	4,170
Total commitments payable	**38,750**	19,967	**38,750**	19,967
Within 1 year	**29,638**	18,535	**29,638**	18,535
Between 1 to 5 years	**7,464**	1,432	**7,464**	1,432
More than 5 years	**1,648**	-	**1,648**	-
Total commitments payable	**38,750**	19,967	**38,750**	19,967

Accounting Policy

Acquisition of Assets

Assets are recorded at cost on acquisition except as stated below. The cost of acquisition includes the fair value of assets transferred in exchange and liabilities undertaken. Financial assets are initially measured at their fair value plus transaction costs where appropriate.

Assets acquired at no cost or for nominal considerations are initially recognised as assets and revenues at their fair value at the date of acquisition. Property, plant and equipment which are purchased from contract research funds and where the control and subsequent sale proceeds are refunded to contributors under the terms of the agreements, are expensed during the year of purchase.

Lease Right of Use (ROU) Assets

Leased ROU assets are capitalised at the commencement date of the lease and comprise of the initial lease liability amount, initial direct costs incurred when entering into the lease less any lease incentives received. These assets are accounted for by CSIRO as separate asset classes to corresponding assets owned outright, but included in the same column as where the corresponding underlying assets would be presented if they were owned.

On initial adoption of AASB 16 CSIRO has adjusted the ROU assets at the date of initial application by the amount of any provision for onerous leases recognised immediately before the date of initial application. Following initial application, an impairment review is undertaken for any right of use lease asset that shows indicators of impairment and an impairment loss is recognised against any right of use lease asset that is impaired. Leased ROU assets continue to be measured at cost after initial recognition in CSIRO, GGS and Whole of Government financial statements.

Asset Recognition Threshold

Purchases of property, plant and equipment are recognised initially at cost in the Statement of Financial Position, except for purchases costing less than $5,000, which are expensed in the year of acquisition (other than where they form part of a group of similar items which are significant in total).

Revaluations

Following initial recognition at cost, property, plant and equipment, including assets under finance leases are carried at fair value less accumulated depreciation and accumulated impairment losses. Valuations are conducted with sufficient frequency to ensure the carrying amount of assets do not differ materially from the assets' fair value as at reporting date. The regularity of valuation depends upon the volatility of movements in the market values for the relevant assets.

Revaluation adjustments are made on a class basis. Any revaluation increment is credited to equity under asset revaluation reserve, except to the extent that it reverses a previous revaluation decrement of the same asset class that was previously recognised in the surplus or deficit. Revaluation decrements for a class of assets are recognised directly through the statement of comprehensive income except to the extent that they reverse a previous revaluation increment for that class.

Any accumulated depreciation as at the revaluation date is restated proportionately with the change in the gross carrying amount of the asset so that the carrying amount of the asset after revaluation equals its revalued amount.

Fair value for each class of asset is determined as follows:

- Land, which will continue to be used for research activity, is valued by independent valuers at fair value (highest and best use). Highest and best use is determined from the perspective of market participants. An entity's current use of a non-financial asset is presumed to be its highest and best use unless market or other factors suggest otherwise. Land underwent a full revaluation as at 30 June 2018 by Jones Lang LaSalle (JLL).

- Buildings and leasehold improvements, which will continue to be used for research activities, are valued by independent valuers at fair value (highest and best use). Building valuations include plant, fit-outs, fixtures and fittings, which form an integral part of buildings. Buildings underwent a full revaluation as at 30 June 2018 by JLL.

- Plant and equipment which will continue to be used for research activities are valued by independent valuers at fair value (highest and best use). Plant and equipment assets were revalued as at 30 June 2019 by JLL.
- Properties held for sale are valued at the lower of its carrying amount and fair value less costs to sell. An assessment is undertaken annually of any properties held for sale.
- Heritage and cultural assets are valued by independent valuers at their depreciated replacement cost. Heritage assets underwent a full revaluation as at 30 June 2018 by JLL.

In addition to independent valuations conducted, CSIRO makes an internal assessment at balance date considering any major events, market changes or indicators of impairment that may impact on fair value. Jones Lang LaSalle (JLL) was engaged to undertake a materiality review of CSIRO's land and buildings and plant and equipment assets and also perform a desktop valuation of the Ginninderra land asset as at 30 June 2020, outside of the three-year full valuation cycle, in consideration of the potential impacts of COVID-19 on the fair value of assets. After undertaking qualitative, quantitative and uncertainty analyses for the asset classes, JLL are of the opinion that there are no significant material differences between the carrying amounts and fair values for the CSIRO's assets. JLL note that their valuation is subject to significant valuation uncertainty, considering that the outbreak of COVID-19 may potentially result in market uncertainty and volatility. The potential impact on the market (if any) is unknown at this stage, until the wider/global situation can be controlled. The extent of the impact on asset values will be mixed across the various market sectors, not only limited to the actual sale/transaction process but may extend considerably beyond the normal sale period, depending on the nature, market sector and size of the property.

Depreciation and Amortisation

Depreciable property, plant and equipment assets are written-off to their estimated residual values over their estimated useful lives using, in all cases, the straight-line method of depreciation. Leasehold improvements are depreciated on a straight-line basis over the lesser of the estimated useful life of the improvements or the unexpired period of the lease. Land is not depreciated.

Depreciation/amortisation rates (useful lives), residual values and methods are reviewed at each reporting date and necessary adjustments are recognised in the current, or current and future reporting periods, as appropriate.

Depreciation rates applying to each class of depreciable asset are based on the following useful lives:

Buildings on freehold land	40 to 80 years
Leasehold improvements	Lease term
Buildings under lease	Lease term
Passenger vehicles	7 years
Agricultural and transport equipment	8 to 20 years
Computing equipment	2 to 5 years
Scientific equipment	5 to 20 years
Furniture and office equipment	5 to 15 years
Workshop equipment	20 to 25 years
Research vessel	25 years
Australia telescope	15 to 58 years
Heritage and cultural assets	Indefinite

Impairment

All assets were assessed for impairment as at 30 June 2020. Where indicators of impairment exist, the asset's recoverable amount is estimated and an impairment adjustment made if the asset's recoverable amount is less than its carrying amount.

The recoverable amount of an asset is the higher of its fair value less costs to sell and its value in use. Value in use is the present value of the future cash flows expected to be derived from the asset. Where the future economic benefit of an asset is not primarily dependent on the asset's ability to generate future cash flows, and the asset would be replaced if the entity were deprived of the asset, its value in use is taken to be its depreciated replacement cost.

There was no impairment recognised for the year ended 30 June 2020 with the exception of impairments disclosed in Note 1.1E.

Derecognition

An item of property, plant and equipment is derecognised upon disposal or when no further future economic benefits are expected from its use or disposal.

Heritage and Cultural Assets

Heritage and cultural items include buildings of historical or cultural significance. CSIRO has classified them as heritage and cultural assets as they are primarily used for purposes that relate to their cultural significance and original purpose. Heritage and cultural assets are stored and managed in ways to preserve their heritage and cultural value over time. Where conservation and preservation activities, specified in an asset's Heritage Management Plan, demonstrate that an asset will be maintained for an indefinite period, these items are considered to have indefinite useful lives and therefore, not subject to depreciation. Copies of the Heritage Management Plans may be obtained by contacting enquiries@csiro.au.

Intangibles

Intangibles are internally developed and acquired software for internal use. These assets are carried at cost, less accumulated amortisation and impairment losses, except where the estimated cost of software is less than the $250,000 threshold and expensed in the year of acquisition. Software are amortised on a straight-line basis over their anticipated useful lives. The useful lives are 2 to 10 years (2019: 2 to 10 years). All software assets were assessed for indications of impairment as at 30 June 2020.

CSIRO does not recognise its internally generated intellectual property as an asset on the Balance Sheet as it does not meet the recognition and measurement requirements under *AASB* 138 *Intangible Assets*. CSIRO's Intellectual property includes patents, inventions, trademarks, plant breeder's rights and registered designs.

Properties Held for Sale

Properties which are expected to be recovered primarily through sale rather than through continuing use are classified as 'properties held for sale'. Immediately before classification, the properties are remeasured in accordance with the Group's accounting policies. Thereafter, at reporting date the properties are measured at the lower of their carrying amount and fair value less cost to sell.

Impairment losses on initial classification as held for sale and subsequent gains or losses on re-measurement are recognised in the Statement of Comprehensive Income.

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 2.2B: Investment properties				
Reconciliation of the opening and closing balances of investment properties				
As at 1 July	**52,072**	49,697	**52,072**	49,697
Net gain/(loss) from fair value adjustments	**(2,699)**	2,375	**(2,699)**	2,375
Total as at 30 June	**49,373**	52,072	**49,373**	52,072

No indicators of impairment were identified for investment properties.

Accounting Policy

Investment properties are measured initially at cost, including transaction costs. Subsequent to initial recognition, investment properties are stated at fair value. Gains or losses arising from changes in the fair values of investment properties are recognised in profit or loss in the year in which they arise.

Where an investment property is acquired at no cost or for nominal cost, its cost is deemed to be its fair value as at the date of acquisition.

Investment properties are derecognised either when they have been disposed of or when the investment property is permanently withdrawn from use and no future economic benefit is expected from its disposal. Any gain or losses on disposal of an investment property are recognised in profit or loss in the year of disposal.

Investment properties were valued as at 30 June 2020 by JLL and they are of the opinion that there are no significant material differences between the carrying amounts of investment properties and fair value. JLL note that their valuation is subject to significant valuation uncertainty in the current environment, considering that the outbreak of COVID-19 may potentially result in market uncertainty and volatility. The potential impact on the market (if any) is unknown at this stage, until the wider/global situation can be controlled. The extent of the impact on asset values will be mixed across the various market sectors, not only limited to the actual sale/transaction process but may extend considerably beyond the normal sale period, depending on the nature, market sector and size of the property. Revaluation increments are recorded as a gain or loss in the Statement of Comprehensive Income. Rental income from investment properties is included in the lease income disclosed in Note 1.2 and was $3.8m for 2020 (2019:$3.6m). Operating costs that are recoverable amounted to $1.15m (2019: $1.1m).

Note 2.2C: Other non-financial assets				
Contract research work in progress - at cost	**-**	30,413	**-**	30,413
Other prepayments	**18,748**	19,647	**18,803**	19,739
Total other non-financial assets	**18,748**	50,060	**18,803**	50,152

In accordance with AASB 15 CSIRO recognises contract assets (refer Note 2.1). As the modified retrospective approach was applied on adoption of the new standard, the comparative information presented for 2019 is not restated. No indicators of impairment were identified for other non-financial assets.

2.3. Payables

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 2.3A: Suppliers				
Suppliers payable	**54,220**	72,519	**51,319**	72,695
Contract liabilities[1]	**160,801**	-	**158,881**	-
Refund liabilities	**-**	-	**-**	-
Total	**215,021**	72,519	**210,200**	72,695

[1]Contract liabilities are associated with consideration that has been received from the customer but services are yet to be performed by CSIRO.

Note 2.3B: Other Payables				
Accrued salaries and wages	**12,267**	7,195	**12,153**	7,167
Contract research revenue received in advance	**-**	131,008	**-**	131,008
Other revenue received in advance	**-**	5,294	**-**	6,728
Other creditors and accrued expenses	**142**	8,105	**956**	336
GST payable to ATO	**5,387**	-	**5,492**	-
Payment to the Commonwealth	**-**	-	**-**	-
Total other payables	**17,796**	151,602	**18,601**	145,239

Accounting Policy

Accounting policy for contract revenue received in advance is contained in Note 1.2.

2.4. Interest Bearing Liabilities

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 2.4A: Leases				
Lease liabilities				
Buildings	**114,620**	-	**113,251**	-
Plant and equipment	**2,120**	-	**2,120**	-
Finance leases[1]	**-**	27,337	**-**	27,337
Total Leases	**116,740**	**27,337**	**115,371**	**27,337**

[1]CSIRO has applied AASB 16 using the modified retrospective approach and therefore the comparative information has not been restated and continues to be reported under AASB 117.
The cash outflow for leases for the year ended 30 June 2020 was $39.9m for Consolidated and $39.5m for CSIRO.

Accounting Policy

Refer to the Overview section for accounting policy on leases.

Note 2.4B: Deposits

Deposits represent monies held on behalf of third parties. If the amounts are not spent for their specified purpose they will be returned to the third party.

Total deposits held are:	**22,508**	23,310	**25,588**	27,364

3. People and Relationships

This section describes a range of employment and post employment benefits provided to our people and our relationship with other key people.

3.1. Employee Provisions

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 3.1A: Employee Provisions				
Annual leave	**67,101**	61,274	**66,917**	61,150
Long service leave	**182,621**	167,810	**182,621**	167,810
Severance pay	**8,036**	7,419	**8,036**	7,419
Redundancies	**5,155**	1,995	**5,155**	1,995
Total employee provisions	**262,913**	238,498	**262,729**	238,374

Accounting Policy

Liabilities for short-term employee benefits (as defined in *AASB 119 Employee Benefits*) and termination benefits due within twelve months of the end of the reporting period are measured at their nominal amounts. The nominal amount is calculated with regard to the rate expected to be paid on settlement of the liability.

Other long-term employee benefit liabilities are measured at the present value of the estimated future cash outflows to be made in respect of services provided by employees up to the reporting date.

Leave

The liability for employee benefits includes provisions for annual leave, long service leave and severance payments. No provision has been made for sick leave as all sick leave is non-vesting and the average sick leave taken in future years by employees is estimated to be less than the annual entitlement for sick leave.

The leave liabilities are calculated on the basis of employees' remuneration at the estimated salary rates that will apply at the time the leave is taken, including the employer superannuation contribution rates to the extent that the leave is likely to be taken during service rather than paid out on termination.

The liability at 30 June 2020 for long service leave and annual leave has been determined by the short hand method and reference to the work of the Australian Government Actuary (AGA). The estimate of the present value of the liability takes into account attrition rates and pay increases through promotion and inflation.

Separation and Redundancy

Provision is made for separation and redundancy benefit payments. A CSIRO plan of termination is binding when the following criteria are met:

- actions required to complete the plan indicate that it is unlikely that significant changes to the plan will be made;
- the plan identifies the number of employees whose employment is to be terminated; and
- the plan established the termination benefits that employees will receive.

Superannuation

Employees of CSIRO are members of the Commonwealth Superannuation Scheme (CSS), the Public Sector Superannuation Scheme (PSS), or the PSS accumulation plan (PSSap). The CSS and PSS are defined benefit schemes for the Australian Government. The PSSap is a defined contribution scheme.

The liability for defined benefits is recognised in the financial statements of the Australian Government and is settled by the Australian Government in due course. This liability is reported by the Department of Finance as an administered item.

CSIRO makes employer contributions to the employee superannuation schemes at rates determined by an actuary to be sufficient to meet the cost to the Government of the superannuation entitlements of the Group's employees. CSIRO accounts for the contributions as if they were contributions to defined contribution plans.

The liability for superannuation recognised as at 30 June 2020 represents outstanding contributions for the financial year.

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NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
3.2 (a) Key Management Personnel Remuneration

Key management personnel are those persons having authority and responsibility for planning, directing and controlling the activities of CSIRO, directly or indirectly, including any director of CSIRO. Those key management personnel along with their remuneration are reported in table below.

		Short Term Benefits			Post Employment Benefits	Other Long Term Benefits			
CSIRO Key Management Personnel	Position	Base Salary $	Performance Payment $	Other Benefits and Allowances $	Super-annuation Contributions $	Long Service Leave $	Other Long Term Benefits $	Termination Benefits $	Total Remuneration $
Marshall, Larry	Chief Executive	772,059	196,313	25,495	21,972	34,082	-	-	1,049,921
Zielke, Judi	Chief Operating Officer	441,406	15,972	-	68,958	16,965	-	-	543,301
Mayfield, Peter	Executive Director - Environment, Energy & Resources	484,929	26,475	18,114	61,344	22,610	-	-	613,472
Hill, Anita[1]	Executive Director - Future Industries	238,603	23,700	10,322	38,138	16,741	-	-	327,504
Zipper, Marcus[1]	Executive Director - Future Industries	138,805	-	7,125	9,613	6,473	-	-	162,016
Williams, David	Executive Director - Digital, National Facilities and Collections	406,311	25,485	19,130	21,972	29,395	-	-	502,293
Total remuneration for CSIRO Key Management Personnel		2,482,113	287,945	80,186	221,997	126,266	-	-	3,198,507
CSIRO Subsidiary Key Management Personnel									
Jimenez, Orlando	Fundacion CEO	255,866	-	9,193	-	-	-	-	265,059
Total remuneration for Fundacion		255,866	-	9,193	-	-	-	-	265,059
Total Consolidated Remuneration for Key Management Personnel		2,737,979	287,945	89,379	221,997	126,266	-	-	3,463,566

Performance payment amounts represent estimated amounts based on the contract amount allowable. Actual performance payments are decided by the Board following the end of financial year.

[1]During the reporting period ended 30 June 2020, CSIRO had five executives who meet the definition of key management personnel. All were employed for the full financial year, with the exception of Anita Hill, whose term as Executive Director ended 2 February 2020, and Marcus Zipper, whose term began 3 February 2020. Consolidated figures include the remuneration of the Fundacion CEO Orlando Jimenez. This note has been prepared on an accrual basis for substantive and long term acting senior management personnel during the period. Remuneration details for the non-executive members of the CSIRO Board are disclosed at note 3.4.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
3.2. (b) Senior Executive Staff Remuneration

Senior Executive Staff Remuneration		Short Term Benefits			Post Employment Benefits	Other Long Term Benefits			
Remuneration Band	Number of Senior Executive Staff	Average Base Salary $	Average Performance Payment $	Average Other Benefits and Allowances $	Average Super-annuation Contributions $	Average Long Service Leave $	Average Other Long Term Benefits $	Average Termination Benefits $	Average Total Remuneration $
$0 - $220,000	6	104,619	10,977	4,795	13,043	4,498	-	-	137,932
$270,001 - $295,000	1	218,757	11,527	17,448	26,169	8,878	-	-	282,779
$295,001 - $320,000	3	224,548	20,691	19,687	33,865	8,787	-	-	307,578
$320,001 - $345,000	3	237,366	16,887	17,159	44,727	17,173	-	-	333,312
$345,001 - $370,000	1	283,866	16,770	-	51,964	16,080	-	-	368,680
$370,001 - $395,000	3	294,690	13,108	16,781	38,441	15,013	-	-	378,033
$395,001 - $420,000	2	305,620	21,882	17,448	51,085	10,740	-	-	406,775
$420,001 - $445,000	1	335,778	-	42,715	47,176	5,262	-	-	430,931

During the reporting period ended 30 June 2020, CSIRO had twenty executives who meet the definition of senior executive staff. This note has been prepared on an accrual basis for substantive and long term acting senior management personnel during the period. Base Salary includes annual leave accrued in the period. Performance payment amounts represent estimated amounts based on the contract amount allowable. Actual performance payments are decided by the Board following the end of financial year.

CONSOLIDATED FINANCIAL STATEMENTS
NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

3.2 (c) Remuneration of highly paid staff

Remuneration of other highly paid staff		Short Term Benefits			Post Employment	Other Long Term Benefits		Average Termination Benefits	Average Total Remuneration
Remuneration Band	Number of Highly Paid Staff	Average Base Salary	Average Performance Payment	Average Other Benefits and Allowances	Average Super-annuation Contributions	Average Long Service Leave	Average Other Long Term Benefits		
		$	$	$	$	$	$	$	$
$225,001 - $245,000	72	176,541	2,722	4,760	31,376	8,782		9,643	233,824
$245,001 - $270,000	62	182,458	5,073	10,329	30,329	15,473		10,862	255,124
$270,001 - $295,000	26	205,602	11,281	16,783	34,873	8,814		5,066	282,419
$295,001 - $320,000	8	189,340	10,594	14,148	30,936	19,856		37,944	302,818
$320,001 - $345,000	1	290,117	-	-	21,972	8,386		-	320,475
$345,001 - $370,000	10	244,862	11,453	15,926	33,909	15,604		33,681	355,435
$370,001 - $395,000	5	261,864	15,812	23,359	28,668	11,552		40,757	382,012
$395,001 - $420,000	2	295,400	17,695	17,448	53,214	13,734		-	397,491
$420,001 - $445,000	1	126,882		-	22,784	77,916		203,450	431,032
$445,001 - $470,000	1	346,889	57,000	-	46,673	11,450		-	462,012

Base salary includes annual leave accrued in the period.

Peformance payment amounts represent estimated amounts based on the contract amount allowable. Actual performance payments are decided by the Board following the end of financial year.

3.3. Remuneration of Auditors

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$	$	**$**	$
Amounts received or due and receivable by the Group's auditors for:				
Audit of the financial statements	**378,909**	327,759	**255,000**	215,000
Audit of projects	**-**	10,709	**-**	-
	378,909	338,468	**255,000**	215,000

The Group's auditor (except for the Fundacion) is the Australian National Audit Office (ANAO) who has appointed RSM to assist with the assignment since 2015-16. The Fundacion is audited by Ernst & Young Chile, who conduct both financial statement and project audits for the Fundacion.

3.4. Remuneration of Board Members

			Short Term Benefits		Post employment benefits	
Name	**Position**	**Term**	**Base Salary $**	**Other benefits and allowances $**	**Super Contributions $**	**Total 2019-20 Remuneration $**
Michele Allan	Board member	05/05/16 - 04/05/19; 05/05/19 - 04/05/24	70,717	8,195	7,498	**86,410**
Drew Clarke	Board member	24/08/17 - 23/08/22	70,717	8,195	7,498	**86,410**
Edwina Cornish	Board member	26/11/15 - 25/11/20	70,717	8,195	7,498	**86,410**
Kathryn Fagg	Board member	02/08/18 - 01/08/23	70,717	6,820	7,366	**84,903**
Shirley In't Veld	Deputy Chairman	28/06/12 - 27/06/15; 28/06/15 - 27/06/20	104,784	-	9,955	**114,739**
David Knox	Board member	05/05/16 - 04/05/19; 05/05/19 - 04/05/24	70,717	8,373	7,514	**86,604**
Tanya Monro	Board member	25/02/16 - 24/02/21	-	-	-	**-**
Peter Riddles	Board member	24/04/14 - 23/04/17; 24/04/17 - 23/04/22	70,717	16,568	8,293	**95,578**
David Thodey	Chairman	15/10/15 - 14/10/20	141,433	-	13,437	**154,870**
Total remuneration for CSIRO Board Members			670,519	56,346	69,059	795,924
CSIRO Subsidiary Board Members (Chile Fundacion)						
Claudia Bobadilla	Board Member	15/3/17-15/3/22	33,130	-	-	**33,130**
Maria Del Rosario Navarro	Board Member	13/9/19-13/9/24	32,649	-	-	**32,649**
Total remuneration for CSIRO Subsidiary Board Members (Chile Fundacion)			65,779	-	-	**65,779**
Total Consolidated Remuneration for CSIRO Group			736,298	56,346	69,059	861,703

The remuneration of the Chief Executive Officer, who is also a CSIRO Board Member is reported under Note 3.2 Key Management Personnel Remuneration.

3.5. Meetings of the Board and Board Committees

During the financial year 2019-20, 9 Board meetings (4 out of session), 5 Board Audit & Risk Committee meetings, 4 Board People & Safety Committee meetings and 4 Board Science Excellence Committee Meetings were held. The number of meetings attended by each of the Board members was as follows:

Board member	CSIRO Board		CSIRO Board Audit & Risk Committee		CSIRO Board People and Safety Committee		CSIRO Board Science Excellence Committee	
	Number eligible to attend as a member	Number attended	Number eligible to attend as a member	Number attended	Number eligible to attend as a member	Number attended	Number eligible to attend as a member	Number attended
Michele Allan	9	8	5	5	-	1	4	4
Edwina Cornish	9	9	5	5	-	3	4	4
Shirley In't Veld	9	7	5	5	4	4	-	-
David Knox	9	8	-	-	4	4	4	4
Tanya Monro	9	6	-	-	4	3	4	2
Kathryn Fagg	9	8	4	5	4	4	-	3
Peter Riddles	9	9	5	5	-	1	4	4
David Thodey	9	9	-	5	-	4	-	4
Drew Clarke	9	9	5	5	4	4	-	4
Larry Marshall	9	9	-	5	-	4	-	4

3.6. Related Party Disclosures

(a) Controlled Entities

SIEF was established under the *Science and Industry Endowment Act 1926*. The principal activity of the SIEF Trust is to provide assistance to persons engaged in scientific research and in training of students in scientific research. The SIEF Trustee is the CSIRO Chief Executive and SIEF is a wholly controlled entity. The SIEF's separate financial statements are reported in the CSIRO Annual Report.

The Fundación was established in October 2013. The Fundación is a controlled entity governed by a Board in accordance with the Constitution of the Fundación. The Fundación is working with industry and leading Chilean Universities to develop cutting-edge technologies to reduce the environmental impact of mining and increase productivity.

NICTA is Australia's ICT Research Centre of Excellence and undertakes internationally recognised research in partnership with industry, government and researchers to create national benefit and wealth for Australia. NICTA is the parent entity of NICTA IPR Pty Ltd and a small number of minor proprietary limited companies that exist to hold intellectual property and commercialise research. CSIRO obtained full control of NICTA on 28 August 2015, when the members of the NICTA Board resolved to adopt a revised company constitution which provided CSIRO with effective control over NICTA.

CSIRO has established an Innovation Fund with Commonwealth funding support to invest in the development of early stage technology opportunities from the public research sector, to increase their translation into commercial opportunities to be taken up by Australian industry. The Fund has been established through a structure of entities whose purpose is to manage and operate the Fund. At 30 June 2020 a second Innovation Fund is in the process of being established, with new entities established but not yet operational in the 2019-20 year. The entities that comprose the Innovation Fund are:

- CSIRO Innovation Fund 1, LP is an incorporated limited partnership formed under the Partnership Act 1892 (NSW). It is registered by Innovation and Science Australia as an Early Stage Venture Capital Limited Partnership (ESVCLP). It was established in January 2017.
- CSIRO Management Partnership Pty LP is an incorporated limited partnership formed under the Partnership Act 1892 (NSW). It was established in January 2017 as a Venture Capital Management Partnership and acts as the General Partner of the CSIRO Innovation Fund 1, LP.
- CSIRO General Partner 2 Pty Ltd was established in December 2016 and is a small proprietary company limited by shares, which are solely held by CSIRO. This company acts as the general partner of CSIRO Management Partnership Pty LP.
- CSIRO Fund of Funds, LP is an incorporated limited partnership formed under the Partnership Act 1892 (NSW) and is registered by Innovation and Science Australia as an Australian Venture Capital Fund of Funds. It was established in May 2016.
- CSIRO General Partner Pty Ltd was established in May 2016 and is a small proprietary company limited by shares, which are solely held by CSIRO. It acts as the general partner of CSIRO Fund of Funds LP. It also acts as the trustee of CSIRO Innovation Holding Trust that was established in July 2018.
- CSIRO Financial Services Pty Ltd was established in December 2015 and is a small proprietary company limited by shares, which are solely held by CSIRO. The company has been issued an Australian Financial Services License by ASIC and acts as Manager of CSIRO Innovation Fund 1, LP.
- CSIRO Innovation Services Pty Ltd was established in October 2016 and is a small proprietary company limited by shares, which are solely held by CSIRO. It acts as trustee of a discretionary trust established to distribute some returns from CSIRO Innovation Fund 1, LP, and as trustee of a unit trust established to distribute some returns form CSIRO Innovation Follow-on Fund 1.
- CSIRO Innovation Holding Trust is a trust established in July 2018 to distribute returns from CSIRO Innovation Fund 1, LP according to an agreed distribution policy administered by CSIRO Innovation Services Pty Ltd.
- CSIRO Follow-on Services Pty Ltd was established in April 2018 and is a small proprietary company limited by shares, which are solely held by CSIRO. It serves as trustee of the CSIRO Innovation Follow-on Fund 1, a managed investment trust.
- CSIRO Innovation Follow On Fund 1 was established October 2018 and is structured as a Managed Investment Trust, formed to provide follow-on investment to companies supported by CSIRO Innovation Fund 1, LP.
- CSIRO Innnovation Fund Discretionary Trust was established in January 2017 to hold and distribute some of the returns from CSIRO Innovation Fund 1, LP according to an agreed distribution policy administered by CSIRO Innovation Services Pty Ltd.
- CSIRO Follow-on Sponsor Trust was established in June 2019 for the purpose of distributing carried interest from the CSIRO Innovation Follow-on Fund 1.
- CSIRO Innovation Fund 2, LP is an incorporated limited partnership formed under the Partnership Act 1892 (NSW). It is registered by Innovation and Science Australia as an Early Stage Venture Capital Limited Partnership (ESVCLP). It was established in March 2020.
- CSIRO Follow-on Services 2 Pty Ltd was established in March 2020 to serve as trustee of CSIRO Innovation Follow-on Fund 2, which is yet to be established and will be setup as a managed investment trust.
- CSIROGP Fund 2 Pty Ltd was established in March 2020 to serve as the General Partner of CSIRO Innovation Fund 2, LP.
- CSIRO Management Partnership 2, LP was established in March 2020 for the purposes of distributing some of the returns from CSIRO Innovation Fund 2, LP.
- CSIRO Custodial Services Pty Ltd was established in April 2020 for the purpose of providing custodial services under an Australian Financial Services Licence to the Innovation Fund entities.

All of the above Innovation Fund related companies are under the sole control of the CSIRO as at 30 June 2020. The above entities (with the exception of CSIRO Financial Services Pty Ltd; CSIRO Innovation Services Pty Ltd; and CSIRO Custodial Services Ptd Ltd) sit outside the General Government Sector.

CSIRO USA LLC and CSIRO Innovations LLC were established in February 2017 to support the establishment of a CSIRO presence in the United States. Both entities are incorporated within Delaware and are wholly controlled by the CSIRO.

(b) Related party relationships

The entity is an Australian Government controlled entity. Related parties to this entity are the Board, Key Management Personnel including the Portfolio Minister and Executive, and other Australian Government entities.

Transactions with related parties:

Given the breadth of Government activities, related parties may transact with the government sector in the same capacity as ordinary citizens. Such transactions include the payment or refund of taxes, receipt of a Medicare rebate or higher education loans. These transactions have not been separately disclosed in this note.

Significant transactions with related parties can include the payments of grants or loans; purchases of goods and services; asset purchases, sales transfers or leases; debts forgiven; and guarantees. Giving consideration to relationships with related entities, and transactions entered into during the reporting period by the entity, it has been determined that there are no related party transactions to be separately disclosed.

4. Managing Uncertainties

This section analyses how CSIRO manages financial risk within its operating environment.

4.1. Contingent Assets and Liabilities

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Quantifiable Contingencies				
Contingent assets				
Insurance claims	**15,958**	2,123	**15,958**	2,123
Bank guarantees received from suppliers	**5,237**	4,879	**5,237**	4,879
Contingent revenue (equity instrument)	**-**	500	**-**	-
Total contingent assets	**21,195**	7,502	**21,195**	7,002
Contingent liabilities				
Estimated legal claims	**6,000**	6,000	**6,000**	6,000
Total contingent liabilities	**6,000**	6,000	**6,000**	6,000
Total net contingent asset/(liability)	**15,195**	1,502	**15,195**	1,002

A natural disaster (hailstorm) occurred on 20th January 2020 impacting the CSIRO Black Mountain site and operations. At 30 June 2020 the insurance claim for business interruption and costs incurred had not been settled and no monies had been received. Included in the above insurance claims contingent asset amount is $13.9m for the hailstorm claim.

Depending on the materiality of risks involved with certain commercial transactions, CSIRO has requested bank guarantees where necessary to mitigate risks, notably where substantial advance payments were made.

In June 2019, the Commonwealth Director of Public Prosecutions filed four charges in the Magistrates' Court of Victoria, alleging the Commonwealth Scientific and Industrial Research Organisation failed in its duties under the Work Health and Safety Act 2011 in relation to an incident that occurred in a Melbourne research facility in 2017. If found to be guilty, each charge carries a maximum penalty of $1,500,000.

Unquantifiable contingencies

As disclosed in the Overview Note, a financial provision for the estimated costs in restoring and decontaminating land where a legal or constructive obligation has arisen has been recognised on the Statement of Financial Position. For cases where there is no legal or constructive obligation, the potential costs have not been assessed and are unquantifiable contingencies. CSIRO has no other identified unquantifiable contingencies to report.

Accounting Policy

Contingent liabilities and contingent assets are not recognised in the Statement of Financial Position. They may arise from uncertainty as to the existence of a liability or asset, or represent a liability or asset in respect of which the amount cannot be reliably measured. Contingent assets are disclosed when settlement is probable but not virtually certain and contingent liabilities are disclosed when settlement is greater than remote.

4.2. Financial Instruments

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 4.2A: Categories of financial instruments				
Financial Assets				
Financial assets at fair value through profit or loss				
Investments	**304,490**	75,333	**177,467**	64,832
Total financial assets at fair value through profit and loss	304,490	75,333	177,467	64,832
Financial assets at fair value through other comprehensive income				
Investments - Innovation Fund	**-**	70,472	**-**	60,503
Total financial assets at fair value through other comprehensive income	**-**	70,472	**-**	60,503
Financial assets at amortised cost				
Cash at bank	**371,496**	178,936	**270,619**	118,829
Term deposits	**32,000**	141,139	**32,000**	80,000
Receivable for goods and services	**56,292**	65,729	**55,581**	65,269
Other receivables	**1,890**	5,247	**3,183**	3,351
Total financial assets at amortised cost	**461,678**	391,051	**361,383**	267,449
Total financial assets	**766,168**	536,856	**538,850**	392,784
Financial Liabilities				
Financial liabilities measured at amortised cost				
Trade creditors	**215,021**	72,519	**210,200**	72,695
Research revenue received in advance	**-**	131,008	**-**	131,008
Other creditors	**17,796**	20,594	**18,601**	14,231
Lease liabilities	**116,740**	27,337	**115,371**	27,337
Deposits	**22,508**	23,310	**25,588**	27,364
Total financial liabilities at amortised cost	**372,065**	274,768	**369,760**	272,635
Total financial liabilities	**372,065**	274,768	**369,760**	272,635

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 4.2B: Net income and expense from financial assets				
Financial assets at amortised cost				
Interest revenue	**5,772**	13,501	**4,251**	10,536
Impairment expense	**(1,304)**	(536)	**(895)**	(536)
Net gain from financial assets at amortised cost	**4,468**	12,965	**3,356**	10,000
Investments assets at fair value through profit or loss				
Fair value changes	**101,503**	14,660	**43,915**	(1,497)
Net gain/(loss) from investment assets at fair value through profit or loss	**101,503**	14,660	**43,915**	(1,497)
Net gain/(loss) on financial assets	**105,971**	27,625	**47,271**	8,503
Note 4.2C: Net income and expense from financial liabilities				
Financial liabilities measured at amortised cost				
Interest expense	**2,707**	1,430	**2,666**	1,403
Net loss from financial liabilities	**2,707**	1,430	**2,666**	1,403

Accounting Policy

Financial Assets

The entity classifies its financial assets under AASB 9 *Financial Instruments* in the following categories:

a) financial assets at fair value through profit or loss;

b) financial assets at fair value through other comprehensive income; and

c) financial assets measured at amortised cost.

The classification depends on both the entity's business model for managing the financial assets and contractual cash flow characteristics at the time of initial recognition. Financial assets are recognised when the entity becomes a party to the contract and, as a consequence, has a legal right to receive or a legal obligation to pay cash and derecognised when the contractual rights to the cash flows from the financial asset expire or are transferred upon trade date.

Financial Assets at Amortised Cost

Financial assets included in this category need to meet two criteria:

1. the financial asset is held in order to collect the contractual cash flows; and

2. the cash flows are solely payments of principal and interest (SPPI) on the principal outstanding amount.

Amortised cost is determined using the effective interest method.

Effective Interest Method

Income is recognised on an effective interest rate basis for financial assets that are recognised at amortised cost.

Financial Assets at Fair Value Through Other Comprehensive Income (FVOCI)

Financial assets measured at fair value through other comprehensive income are held with the objective of both collecting contractual cash flows and selling the financial assets and the cash flows meet the SPPI test. Any gains or losses as a result of fair value measurement or the recognition of an impairment loss allowance is recognised in other comprehensive income.

Financial Assets at Fair Value Through Profit or Loss (FVTPL)

Financial assets are classified as financial assets at fair value through profit or loss where the financial assets either don't meet the criteria of financial assets held at amortised cost or at FVOCI (i.e. mandatorily held at FVTPL) or may be designated. Financial assets at FVTPL are stated at fair value, with any resultant gain or loss recognised in profit or loss. The net gain or loss recognised in profit or loss incorporates any interest earned on the financial asset. CSIRO values it's equity investment portfolio in listed companies, unlisted companies and in Uniseed Trust as FVTPL. CSIRO Innovation Fund values it's equity investment portfolio in unlisted companies as FVTPL.

Impairment of Financial Assets

Financial assets are assessed for impairment at the end of each reporting period based on Expected Credit Losses, using the general approach which measures the loss allowance based on an amount equal to lifetime expected credit losses where risk has significantly increased, or an amount equal to 12-month expected credit losses if risk has not increased.

The simplified approach for trade, contract and lease receivables is used. This approach always measures the loss allowance as the amount equal to the lifetime expected credit losses. A write-off constitutes a de-recognition event where the write off directly reduces the gross carrying amount of the financial asset.

Financial liabilities

Financial liabilities are classified as either financial liabilities 'at fair value through profit or loss' or other financial liabilities. Financial liabilities are recognised and derecognised upon 'trade date'.

Financial Liabilities at Fair Value Through Profit or Loss

Financial liabilities at fair value through profit or loss are initially measured at fair value. Subsequent fair value adjustments are recognised in profit or loss. The net gain or loss recognised in profit or loss incorporates any interest paid on the financial liability.

Financial Liabilities at Amortised Cost

Financial liabilities, including borrowings, are initially measured at fair value, net of transaction costs. These liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

Supplier and other payables are recognised at amortised cost. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced).

4.3. Fair Value Measurement

Note 4.3A: Fair value measurement

	Fair value measurements at the end of the reporting period	
	2020	**2019**
	$'000	**$'000**
Financial assets		
Other investments	**304,490**	145,805
Total financial assets	**304,490**	145,805
Non-financial assets		
Land	**386,600**	386,600
Buildings	**1,221,649**	1,177,562
Plant and equipment	**559,183**	563,342
Investment properties	**49,373**	52,072
Properties held for sale	**5,200**	59,200
Heritage and cultural	**4,463**	4,463
Total non-financial assets	**2,226,468**	2,243,239
Financial liabilities		
Lease liabilities	**116,740**	27,337
Deposits	**22,508**	23,310
Total financial liabilities	**139,248**	50,647

The above disclosure represents the consolidated financial position of the Group.

Significant Accounting Judgements and Estimates

In the process of applying the accounting policies listed in this note, CSIRO has made the following judgements that have the most significant impact on the amounts recorded in the financial statements:

- Properties classified as 'properties held for sale' are measured at the lower of the carrying amount and fair value less costs to sell (level 1 inputs), 'investment properties' has been taken to be the market value (level 2 inputs), of similar properties as determined by an independent valuer;

- The fair value of land which will continue to be used for research activities, and buildings held for specialised purposes and where there is no readily available market price has been taken to be Fair Value- Highest and Best Use (level 3 inputs), as determined by an independent valuer;
- The fair value of plant and equipment has been taken to be Fair Value – Highest and Best Use (level 2 and 3 inputs) as they mainly comprise of specialised research equipment. Fair value is determined by an independent valuer; and
- The fair value of listed companies is assessed at market value (level 1 inputs); whereas unlisted companies and commercial vehicles are assessed at fair value using the best information available (level 1 and 3 inputs). For investments in unlisted companies where there is no readily available market pricing, the fair value has been determined by applying valuation techniques in line with the generally accepted valuation guidelines 'International Private Equity and Venture Capital Valuation Guidelines (IPEV).' Where recent transactions for the unlisted companies' equity have taken place, these equity transaction prices are used to value CSIRO's investment. For unlisted companies that have not had any recent equity transactions, other IPEV valuation techniques are used such as discounted cash flows and share of net assets. Investments in special purpose entities are either valued at cost of share of net realisable assets since a reliable estimate of fair value cannot be established. These entities have been set up primarily to gain access to research facilities/networks, or to provide services to owners. Hence, there is not 'active market' for these equity investments.

No accounting assumptions and estimates have been identified that have a significant risk of causing a material adjustment to the carrying amounts of assets and liabilities within the next reporting period.

5. Other information

5.1. Aggregate Assets and Liabilities

	Consolidated		CSIRO	
	2020	2019	**2020**	2019
	$'000	$'000	**$'000**	$'000
Note 5.1A: Aggregate Assets and Liabilities				
Assets expected to be recovered in:				
No more than 12 months	**516,389**	505,630	**416,558**	380,667
More than 12 months	**2,540,828**	2,347,849	**2,412,313**	2,327,180
Total assets	**3,057,217**	2,853,479	**2,828,871**	2,707,847
Liabilities expected to be settled in:				
No more than 12 months	**350,743**	261,732	**346,086**	256,896
More than 12 months	**324,692**	292,554	**326,860**	295,133
Total liabilities	**675,435**	554,286	**672,946**	552,029

5.2. Cooperative Research Centres (CRCs)

All CRCs have been classified as joint operations as the purpose is for the pursuit of collaborative scientific research where participants share in the scientific outcomes and outputs of the CRCs. In the event that CRC research results in a move to commercialisation, a separate legal entity is established and the CSIRO's share of the new entity is treated either as subsidiary, joint venture or associate in the Statement of Financial Position as appropriate.

CRC grants provide successful applicants with access to grant funds for up to 10 years for collaborations from industry, research and community sectors to solve industry problems and improve the competitiveness, productivity and sustainability of the Australian industries. CRC-P grants support short term industry-led collaborations to develop important new technologies, products and services that deliver tangible outcomes.

CSIRO's total cash and in-kind contribution (e.g. staff and use of assets) to CRCs from its own resources was $15.2 million and to CRC-Ps $3.2 million. Contributions made by CSIRO are expensed as incurred and these are included in the Statement of Comprehensive Income.

CSIRO was a participant in the following CRCs during 2019-20:

Name of CRC	Scheduled Termination Date
Alertness Safety & Productivity CRC (Alertness CRC)	30-Jun-20
Autism CRC	30-Jun-21
Bushfire and Natural Hazards CRC (BNHCRC)	30-Jun-21
Cancer Therapeutics CRC (CTX)	30-Jun-20
Contamination Assessment & Remediation of the Environment CRC (CRC Care)	30-Jun-20
CRC for Developing Northern Australia: Establishing eye screening services	30-Jun-21
CRC for Developing Northern Australia: Northern Australia aquaculture industry situational analysis study	30-Apr-20
CRC for Developing Northern Australia: Northern Australian beef sector industry situational analysis study	30-Apr-20
Cyber Security CRC	01-Dec-24
Innovative Manufacturing CRC (IMCRC)	30-Jun-22
MinEx CRC	30-Jun-28
Optimising Resource Extraction (CRC ORE)	30-Jun-21
Rail Manufacturing CRC	30-Jun-20
SmartSat CRC	30-Jun-26
Future Battery Industries CRC	30-Jun-25
Blue Economy CRC	30-Jun-29
CO2 CRC	11-Dec-20

CSIRO was a participant in the following CRC-Ps during 2019-20:

Name of CRC-P	Scheduled Termination Date
CRC-P Automating data collection and analytics in underground mines using drones and AI	31-Dec-21
CRC-P Implementing intelligent automated reporting in radiology practice	30-Jun-21
CRC-P Kapunda In-Situ Copper and Gold Field Recovery Trial	31-Dec-20
CRC-P Long-life alloy components for efficient hydrometallurgical processing	31-Dec-20
CRC-P Optimal scheduling of air conditioning systems with renewable energy and thermal storage	30-Jun-21
CRC-P Oventus (targeted therapy for sleep apnoea)	20-Dec-19
CRC-P Smart Sensor & Deep Learning Behavioural Engine for Personalised Health Monitoring	31-Mar-22
CRC-P Smart tools for agronomic crop insights using Machine learning (ML) and Artificial Intelligence (AI)	01-Jan-22
CRC-P Transforming joint surgery rehabilitation with artificial intelligence in telehealth	19-Jul-21
Developing Northern Australia: Developing sustainable cropping systems for cotton, grains and fodder	01-Oct-20
Developing Northern Australia: New pastures to increase livestock productivity across the north	30-Sep-20
CRC-P A novel process for producing battery grade nickel and cobalt sulphates	30-Sep-21
CRC-P Future-proofing the salmon farming industry in the face of climate warming	31-Mar-23
CRC-P Privacy-Preserving Analytics for the Education Technology Industry	14-Aug-22
CRC-P Using AI and a hybrid ESS solution to fully integrate solar generation into the distribution system	31-Aug-22
CRC-P Development of a new commercial-scale process for producing high purity graphite (>99.95%)	31-Dec-21

Accounting Policy

Joint Operations – Cooperative Research Centres (CRCs)

The primary source of funding for CRCs is from the Australian Government and funding is progressively drawn down over the life of the CRCs and distributed to participants, including CSIRO and universities, for research and development purposes. CSIRO's contributions to the CRCs are expensed as incurred and funds received from CRCs are recognised as revenue to the extent that work has been performed in the Statement of Comprehensive Income. CSIRO has been a participant in 17 CRCs and 16 CRC-Ps during the financial year.

5.3. Monies Held in Trust

	2020	2019
	$'000	$'000
Monies held in trust represented by cash, deposits and investments for the benefit of the Group which are not included in the Statement of Financial Position are:		
The Sir Ian McLennan Achievement for Industry Award - established to award outstanding contributions by the Group's scientists and engineers to national development.	**366**	422
The Elwood and Hannah Zimmerman Trust Fund - established to fund weevil research and the curation of the Australian National Insect Collection (ANIC) weevil collection.	**4,933**	5,069
The Schlinger Trust - established to research the taxonomy, biosystematics, general biology and biogeography of Australasian Diptera conducted by the Australian National Insect Collection.	**2,273**	2,371
Total monies held in trust as at 30 June	**7,572**	7,862

Summary of movements:	**McLennan $'000**	**Zimmerman $'000**	**Schlinger $'000**	**Total $'000**
Balance as at 1 July 2019	**422**	**5,069**	**2,371**	**7,862**
Adjustments	**-**	**-**	**-**	**-**
Interest and distribution adjustments	**(18)**	**113**	**35**	**130**
Expenditure in the period	**(38)**	**(249)**	**(133)**	**(420)**
Balance as at 30 June 2020	**366**	**4,933**	**2,273**	**7,572**

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5.4. Collections

CSIRO is the custodian of several collections used for scientific research. These collections have been established over time and document an extensive range of Australian flora and fauna species. The collections are irreplaceable, bear scientific and historical value and are not reliably measurable in monetary terms. Therefore, CSIRO has not recognised them as an asset in its financial statements.

The main collections held by CSIRO are:

- Australian National Herbarium (ANH) – With a focus on the Australian flora and that of neighbouring regions such as New Guinea and the Pacific, the ANH has over 1 million herbarium specimens, with additional holdings at the Australian Tropical Herbarium (ATH) in Cairns, Queensland. The ANH collections include the Dadswell Memorial Wood Collection and comprehensive holdings of a number of groups, including cryptogams, eucalypts and orchids.

- Australian National Insect Collection (ANIC) – Specialising in Australian terrestrial invertebrates, ANIC houses over 12 million specimens and is the world's largest collection of Australian insects, as well as groups such as mites, spiders, earthworms, nematodes and centipedes. ANIC is an important research collection used by CSIRO researchers, university staff, and students, and scientists from Australian and international research organisations.

- Australian National Wildlife Collection (ANWC) – Specialising in terrestrial vertebrates, ANWC contains specimens of most species of Australian mammals, birds, reptiles, and amphibians. It is particularly rich in specimens of birds from New Guinea. ANWC is a valuable asset for biologists engaged in biodiversity research. Its research library holds 60,000 recordings of wildlife sounds, more than a thousand tissue samples, and the egg collections from more than 300 bird species.

- Australian National Fish Collection (ANFC) – Specialising in marine fishes, the ANFC contains almost 150,000 specimens representing more than 3,000 species from the Indo-Pacific region. It is an invaluable resource for biodiversity and biogeographic research on Australian and Indo-Pacific fishes. Its major strengths are sharks, rays, and deep-water fishes. It also contains a large collection of images and radiographs of Australian fishes.

- Australian Tree Seed Centre (ATSC) – The ATSC is managed as a collection and research centre for Australian native tree species. For over 50 years the centre has been collecting, researching and supplying quality, fully documented tree seed to both domestic and overseas customers. Collections of seed are sourced from wild populations and genetically improved seed from our domestication and improvement programs.

- Australian National Algae Culture Collection (ANACC) – The ANACC consists of more than 300 microalgae species and is a resource for research on algal diversity, distribution, richness, and taxonomic relationships, including those of economic importance and environmental concern. Aligned with the collection is the National Algae Supply Service, which provides microalgae strains as starter cultures to industry, research, organisations and educational institutions in over 70 countries.

6. Budgetary Reports and Explanations of Major Variances

The following provides a comparison of the original budget as presented in the 2019-20 Portfolio Budget Statements to the actual outcome reported for 2019-20. The intention of this variance analysis is to provide the reader with information relevant to assessing the performance of CSIRO, including the accountability for the resources entrusted to it.

Statement of Comprehensive Income
for the period ended 30 June 2020

	Actual	Consolidated Original Budget	Variance
	2020	**2020**	2020
	$'000	**$'000**	$'000
NET COST OF SERVICES			
Expenses			
Employee benefits	**794,602**	**778,993**	(15,609)
Suppliers	**433,420**	**495,889**	62,469
Depreciation and amortisation	**182,830**	**159,351**	(23,479)
Finance leases	**2,707**	**3,380**	673
Impairment loss on financial instruments	**1,304**	**-**	(1,304)
Write-down and impairment of other assets	**12,188**	**-**	(12,188)
Loss on revaluation of investment properties	**2,700**	**-**	(2,700)
Total expenses	**1,429,751**	**1,437,613**	7,862
Own-Source Income			
Own-source revenue			
Revenue from contracts with customers	**449,419**	**478,248**	(28,829)
Royalties and licence fees	**-**	**38,611**	(38,611)
Bank and term deposits interest	**5,772**	**8,131**	(2,359)
Rental income	**9,200**	**6,100**	3,100
Other revenues	**34,708**	**17,936**	16,772
Total own-source revenue	**499,099**	**549,026**	(49,927)
Gains			
Gain/(loss) on foreign exchange - non speculative	**383**	**-**	383
Gain/(loss from equity investments and intellectual property	**2,032**	**-**	2,032
Gain/(loss) from asset sales	**29,662**	**6,000**	23,662
Gain on valuation of equity investments	**101,503**	**-**	101,503
Total gains	**133,580**	**6,000**	127,580
Total own-source income	**632,679**	**555,026**	77,653
Net cost of services	**(797,072)**	**(882,587)**	85,515
Revenue from Government	**837,873**	**839,151**	(1,278)
Surplus on continuing operation	**837,873**	**839,151**	(1,278)
Surplus/(Deficit)	**40,801**	**(43,436)**	84,237
OTHER COMPREHENSIVE INCOME			
Items not subject to subsequent reclassification to net cost of services			
Changes in asset revaluation reserves	**-**	**-**	-
Items subject to subsequent reclassification to net cost of services			
Changes in other reserves	**(176)**	**-**	(176)
Total other comprehensive income	**(176)**	**-**	(176)
Total comprehensive income/(loss)	**40,625**	**(43,436)**	84,061

Statement of Financial Position
as at 30 June 2020

	Actual	Consolidated Original Budget	Variance
	2020	2020	2020
	$'000	$'000	$'000
ASSETS			
Financial Assets			
Cash and cash equivalents	**403,496**	**283,420**	120,076
Trade and other receivables	**88,945**	**91,151**	(2,206)
Other investments	**304,490**	**127,495**	176,995
Total financial assets	**796,931**	**502,066**	294,865
Non-Financial Assets			
Land and buildings	**1,608,249**	**1,601,934**	6,315
Plant and equipment	**559,183**	**514,092**	45,091
Heritage and cultural	**4,463**	**4,463**	-
Intangibles	**13,650**	**18,173**	(4,523)
Investment properties	**49,373**	**49,697**	(324)
Inventories	**1,420**	**1,440**	(20)
Other non-financial assets	**18,748**	**44,295**	(25,547)
Total non-financial assets	**2,255,086**	**2,234,094**	20,992
Properties held for sale	**5,200**	**-**	5,200
Total assets	**3,057,217**	**2,736,160**	321,057
LIABILITIES			
Payables			
Suppliers	**215,021**	**89,578**	(125,443)
Other payables	**17,796**	**143,032**	125,236
Total payables	**232,817**	**232,610**	(207)
Interest Bearing Liabilities			
Leases	**116,740**	**-**	(116,740)
Deposits	**22,508**	**-**	(22,508)
Total Interest bearing liabilities	**139,248**	**80,664**	(139,248)
Provisions			
Employee provisions	**262,913**	**224,807**	(38,106)
Provision for remediation	**40,457**	**21,000**	(19,457)
Total provisions	**303,370**	**245,807**	(57,563)
Total liabilities	**675,435**	**559,081**	(197,018)
Net assets	**2,381,782**	**2,177,079**	124,039
EQUITY			
Contributed equity	**310,954**	**310,954**	-
Asset revaluation reserves	**1,523,229**	**1,492,334**	30,895
Other reserves	**(203)**		(203)
Retained surplus	**455,993**	**373,791**	82,556
Non-controlling interest	**91,809**		91,455
Total equity	**2,381,782**	**2,177,079**	204,703

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Statement of Changes in Equity

for the period ended 30 June 2020

	Retained earnings			Asset revaluation reserve			Other reserves			Contributed equity/capital			Non-controlling interest			Total equity		
	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance	Actual	Original Budget	Variance
	2020	**2020**	2020	**2020**	**2020**	2020	**2020**	**2020**	2020	**2020**	**2020**	2020	**2020**	**2020**	2020	**2020**	**2020**	2020
	$'000	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000	**$'000**	**$'000**	$'000
Opening balance	**435,198**	**417,227**	17,971	**1,523,229**	**1,492,286**	30,943	**(27)**	**48**	(75)	**300,954**	**300,954**	-	**39,839**	-	39,839	**2,299,193**	**2,210,515**	88,678
Adjustment on initial application of AASB15/AASB 1058	**(1,012)**															**(1,012)**		
Adjustment on initial application of AASB 16																		
Adjusted opening balance	**434,186**	**417,227**	17,971	**1,523,229**	**1,492,286**	30,943	**(27)**	**48**	(75)	**300,954**	**300,954**	-	**39,839**	-	39,839	**2,298,181**	**2,210,515**	88,678
Comprehensive income																		
Other comprehensive income	-	-	-	-	-	-	**(176)**	-	(176)	-	-	-	-	-	-	**(176)**	-	(176)
Surplus/(deficit) for the period	**22,161**	**(43,436)**	65,597	-	-	-	-	-	-	-	-	-	**18,640**	-	18,640	**40,801**	**(43,436)**	84,237
Total comprehensive income	**22,161**	**(43,436)**	65,597	-	-	-	**(176)**	-	(176)	-	-	-	**18,640**		18,640	**40,625**	**(43,436)**	84,061
Other Movements	-	-	-		-	-		-	-	-	-	-	-	-	-	-	-	-
Contributions by owners																		
Equity injection	-	-	-	-	-	-	-	-	-	**10,000**	**10,000**	-	**32,976**	-	32,976	**42,976**	**10,000**	32,976
Contributions by owners – other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Closing balance	**456,347**	**373,791**	83,568	**1,523,229**	**1,492,286**	30,943	**(203)**	**48**	(251)	**310,954**	**310,954**	-	**91,455**		72,815	**2,381,782**	**2,177,079**	205,715

Cash Flow Statement

for the period ended 30 June 2020

	Actual	Consolidated Original Budget	Variance
	$'000	$'000	$'000
OPERATING ACTIVITIES			
Cash received			
Receipts from Government	**837,873**	**839,151**	(1,278)
Sale of goods and rendering of services	**573,857**	**521,373**	52,484
Interest	**6,563**	**7,985**	(1,422)
Net GST received	**21,203**	**(719)**	21,922
Deposits	**-**	**-**	-
Other	**-**	**17,936**	(17,936)
Total cash received	**1,439,496**	**1,385,726**	53,770
Cash used			
Employees	**765,251**	**777,017**	11,766
Suppliers	**520,701**	**496,452**	(24,249)
Interest payments on lease liabilities	**2,585**	**-**	(2,585)
Finance costs	**122**	**2,680**	2,558
Deposits	**799**	**-**	799
Other	**-**	**5,000**	(5,000)
Total cash used	**1,289,458**	**1,281,149**	(16,711)
Net cash from operating activities	**150,038**	**104,577**	37,059
INVESTING ACTIVITIES			
Cash received			
Proceeds from sales of property, plant and equipment	**90,547**	**67,300**	23,247
Proceeds from sales of equity investments and intellectual property	**6,842**	**-**	6,842
Total cash received	**97,389**	**67,300**	30,089
Cash used			
Purchase of property, plant and equipment	**103,765**	**179,291**	75,526
Equity investments	**61,907**	**10,000**	(51,907)
Other selling costs	**1,397**	**-**	(1,397)
Total cash used	**167,069**	**189,291**	22,222
Net cash used in investing activities	**(69,680)**	**(121,991)**	52,311
FINANCING ACTIVITIES			
Cash received			
Contributed equity	**42,976**	**10,000**	32,976
Other	**-**	**45,000**	(45,000)
Total cash received	**42,976**	**55,000**	(12,024)
Cash used			
Finance leases	**-**	**4,485**	4,485
Principal payments of lease liabilities	**39,913**	**-**	(39,913)
Total cash used	**39,913**	**4,485**	**(35,428)**
Net cash from financing activities	**3,063**	**50,515**	(47,452)
Net increase in cash held	**83,421**	**33,101**	41,918
Cash and cash equivalents at the beginning of the reporting period	**320,075**	**320,075**	-
Cash and cash equivalents at the end of the reporting period	**403,496**	**353,176**	41,918

Explanation of Major Variances

Australian Accounting Standard *AASB 1055 Budgetary Reporting* requires variance explanations of major variances between the original budget as presented in the 2019-20 Portfolio Budget Statements and the actual outcome as reported in these financial statements. CSIRO considers that major variances are those greater than 10% of the original estimate and that are relevant to an assessment of the discharge of accountability and to an analysis of the performance of the entity. Variances below this threshold are not included unless considered significant by their nature.

It should be noted that the original budget was prepared before the 2018-19 actual figures were known. As a consequence the opening balance of the 2019-20 Statement of Financial Position needed to be estimated and in some cases, variances between 2019-20 actuals and budget numbers can be, at least in part, attributed to unanticipated movements in the prior period figures. Variances attributable to factors which would not reasonably have been identifiable at the time of the budget preparation, such as the revaluation of plant and equipment and investment properties, sale of equity investments, and impairment of assets, have not been included as part of the explanation.

The Budget is not audited.

Statement of Comprehensive Income

Depreciation and amortisation expense is above budget and *Suppliers* expense is below budget due to the application of AASB 16 *Leases* effective 1 January 2019. The budget estimates were updated to reflect this standard in the subsequent budget rounds.

Own source revenue is lower than budget due to the impact of the Coronavirus ("COVID-19") on CSIRO and customers, as well as other unforeseen project delays which have impacted CSIRO's ability to meet milestones.

Royalties and licence fees have been reclassified to *revenue from contracts with customers* on application of AASB 15 *Revenue from Contracts with Customers*.

Net gains are higher than budget due to the sale of the former site at Highett, Victoria exceeding expectations, and the increased value of the equity portfolio for both CSIRO and the CSIRO Innovation Fund.

Statement of Financial Position

Cash and cash equivalents are higher than budget due to the difference in basis of preparation between the PBS and the financial statements relating to the Innovation Fund investment. The Portfolio Budget Statements are prepared on the basis of only including General Government Sector (GGS) entities, whereas the Financial Statements for CSIRO include the results of CSIRO and all controlled entities, regardless of whether they are within the GGS or not. Therefore, there is a difference in the accounting treatment between the two, resulting in the budget containing the Innovation Fund investment as an *Investment Accounted for using the Equity Method*, while the Financial Statements account for this investment in the consolidation as *Cash and cash equivalents* held by a controlled entity.

Other investments are higher than budget due to the acquisition of a number of shares not foreseen at the time of preparing the budget, an increase in the valuation of the share portfolio, and the difference in basis of preparation between the PBS and the financial statements relating to the Innovation Fund investment.

Other non-financial assets are lower than budget as revenue contracts that are currently in the work-in-progress stage have been reclassified to *Trade and other receivables* on application of AASB 15 *Revenue from Contracts with Customers*.

Suppliers payable is higher and *Other payables* is lower than budget as contract liabilities associated with consideration received by the customer where services are yet to be performaned by CSIRO have been reclassified between the two categories on application of AASB 15 *Revenue from Contracts with Customers*.

Interest bearing liabilities are higher than budget due to the application of AASB 16 *Leases* , effective 1 January 2019. The budget estimates were updated to reflect this standard in the subsequent budget rounds.

The higher balance for *Employee provisions* is due to the decrease in the long-term government bond rate used to discount expected future employee benefit payments, as well as higher end of year leave balances than forecasted.

Provision for remediation is higher than budget reflecting higher than expected make-good, waste removal and site remediation costs.

Retained Surplus is higher than budgeted as the operating result for 2019-20 was positive in comparison to the budgeted loss.

The *Non-controlling interest* balance is higher than budget due to the difference in basis of preparation between the PBS and the financial statements relating to the Innovation Fund investment.

Cash Flow Statement

Variances relating to cash flows are a reflection of the factors detailed under Statement of Comprehensive Income and Statement of Financial Position.

Part 6

Science and Industry Endowment Fund

Trustee's report

SIEF Trustee, Dr Larry Marshall

I'm delighted to present the 2019–20 report that highlights the important role the Science and Industry Endowment Fund (SIEF) plays in addressing national challenges and encouraging collaboration and capacity building. Funded through several gifts and endowments, SIEF's strategic investments have enabled Australia to respond to its greatest challenges and develop greater resilience and self-sufficiency.

The gifts and endowments:

- the CSIRO Gift (2009)
- the New South Wales (NSW) Government Endowment (2017)
- the National ICT Australia Ltd (NICTA) Gift (2018)
- the Metcalf Gift (2019).

Supporting our emerging scientists and engineers

Since its beginnings in 1926, SIEF has encouraged Science, Technology, Engineering and Mathematics (STEM) capability, development and the education of our future scientists and engineers, for the benefit of the nation.

During its 11 years, the CSIRO Gift's Promotion of Science Program has provided learning and career opportunities for over 400 students and early career researchers.

I am very proud of two unique programs that SIEF supports through the CSIRO Gift: the SIEF (Ross Metcalf) STEM+Business Fellowships and the SIEF-Australian Academy of Science (AAS) Lindau Nobel Laureate Meetings Fellowships program.

The STEM+Business Fellowships program commenced in 2015 and is facilitated by CSIRO's SME Connect. I was delighted to announce in last year's SIEF report that the Metcalf gift would fund an additional eight to ten fellowships for this highly successful program. To recognise Mr Metcalf's gift, the fellowships are now known as the SIEF Ross Metcalf STEM+Business Fellowships. The new fellowships were launched in November, and the first fellowship funded by the Metcalf Gift commenced in April.

In September, I attended a SIEF-AAS Lindau Nobel Laureate meeting fellowships alumni event to announce an additional 10 years' funding for the SIEF-AAS Lindau Nobel Laureate meeting fellowships program. The program provides funding for 10 to 15 postgraduate students or postdoctoral fellows to attend annual meetings of the Nobel Laureates in Lindau, Germany. This program, managed by the Australian Academy of Science, has strengthened the scientific diplomacy between Australia and Germany. The Academy's exemplary planning and coordination of activities has positioned our Australian representatives as highly professional and sought-after delegates. This once in a lifetime opportunity allows them to learn from some of the most distinguished scientists, and network with the brightest young minds from all over the world. SIEF also provides funding to support a tour of German universities and research institutions for the Australian delegation after the Lindau meeting, furthering the scientific connections between the two countries. The additional funding ensures that our future scientists and engineers will continue to benefit by attending this unique event until 2031.

The NSW Government Endowment funds Generation STEM, a program building the capability of our future scientists and engineers, managed by CSIRO's Education and Outreach team. It increases the supply of students trained in STEM to meet the needs of employers in NSW and the nation.

Read the performance analysis of the NSW Generation STEM initiative under Function 1.3 on page 71.

Attending the SIEF-AAS Nobel Laureate Fellowships alumni event. Credit: Dr Tom Carruthers, Australian Academy of Science.

Investing in research infrastructure and precincts

The CSIRO Gift Research Infrastructure Program supports the creation or enhancement of nationally significant research infrastructure facilities or equipment with a strong emphasis on collaboration. It comprises the Major Research Infrastructure Program and the Medium Equipment Program.

SIEF has invested $31.6 million for the Major Research Infrastructure Program for precincts in Western Australia, Victoria and the Australian Capital Territory (ACT).

The Boorowa Agricultural Research Station.

The ACT precinct – the National Agricultural and Environmental Science Precinct – is a collaborative project between CSIRO and the Australian National University. SIEF provided funding to establish the Centre for Genomics, Metabolomics and Bioinformatics (CGMB) and construct a new life sciences building at the Black Mountain Innovation and Science Precinct. The precinct fosters research and innovation essential to food security and environmental stewardship in the face of climate change, population growth and land degradation. It will enable new crop development with improvements in yields and nutrient profiles, provide innovative solutions to environmental management and opportunities to connect with partners locally, nationally and globally. The CGMB was awarded a grant from the Australian Research Council for a mass spectrometer to complement the existing instrumentation within the precinct and two joint initiatives have commenced: the Centre for Entrepreneurial Agri-Technology and the Biological Data Science Institute.

The Medium Equipment Program (MEP) facilitates leading-edge innovation in Australia, enhances collaboration across the innovation system, and grows the capability and capacity of the equipment stock available to researchers. SIEF's investment of $9.8 million in a range of scientific equipment is being realised through instruments and facilities for use by the research community.

Australia prides itself in its ability to feed the nation using efficient farming practices. To assist Australia to meet the growing demand for food, reduce food wastage and develop high-value food products, the SIEF MEP is supporting two state-of-the-art facilities: the Boorowa Agricultural Research Station in Boorowa, NSW, and the Food Ingredient Process Innovation Platform in Werribee, Victoria.

Boorowa is conducting cutting-edge agricultural and environmental research using digital agriculture technologies, such as precision agriculture, and remote and non-destructive crop monitoring. It is a showcase for agricultural technologies and a catalyst for industry and funding agencies to explore new ideas and opportunities. Universities, state departments of agriculture and agribusiness use the farm, its facilities and underlying digital infrastructure for collaborative research. Industry will benefit from increased efficiencies in farming practices, a greater understanding of the nutrient and water requirements of crops, and using a test bed to assess growing conditions and new breeds of crops, which will provide greater returns on investment for primary producers.

The Werribee food processing facility provides Australia with a unique ingredient platform that adds value to commodity agricultural produce by transforming it into nutritious food, beverages, and nutraceutical, supplement and cosmeceutical ingredients. This facility is fully commissioned and has been actively engaging with industry and the research sector to showcase its capabilities and uses. I'm particularly pleased that these outreach activities have attracted several of Australia's large food companies to collaborate on projects at the facility.

Hydrogen generator for refuelling fuel-cell electric vehicles

Growing global demand for clean hydrogen fuel represents a significant opportunity to establish an Australian renewable hydrogen export industry. Using ammonia as a carrier, renewable hydrogen produced in Australia can be readily distributed, at large scale, to emerging markets in Japan, Korea and Europe while using existing infrastructure for ammonia transport. The gap in this supply chain is a technology that can efficiently and inexpensively convert ammonia into high-purity hydrogen at or near the point of use for fuel-cell electric vehicles (FCEVs).

Transportation and storage are the critical challenges faced by the hydrogen fuel industry; the current available technologies are complex and expensive.

A hydrogen generating system was developed that allows hydrogen in the form of liquid ammonia to be transported economically and efficiently. Liquid ammonia stores 35 per cent more energy than liquid hydrogen, is easier to ship and distribute, and can use the existing logistics chains for this purpose. Our solution addresses the conversion of ammonia back to high-purity hydrogen at, or near, the point of use. This opens up the possibility for a renewable energy export market.

SIEF's support enabled the demonstration of this concept on a 5–15 kilogram per day hydrogen pilot-production scale, operating over 1,000 hours with more than 80 per cent ammonia 'cracking' efficiency and more than 80 per cent hydrogen extraction rate. The world's first demonstration of fuel-cell vehicles refuelled with hydrogen derived directly from ammonia was held in August 2018 with two commercial FCEVs (Toyota Mirai and Hyundai Nexo).

The final step to commercialise this technology requires the hydrogen and FCEV industries to facilitate incorporating the commercial-scale hydrogen generating system and validating the first step for refuelling to day-to-day FCEV for real-life customers.

SIEF funding for this project facilitated the translation of knowledge to a commercial solution. The support enabled the successful scaling up of the technology and demonstrated its potential as the critical last step in ammonia-based hydrogen distribution.

The SIEF funding was instrumental to realise the value-proposition of this work and aided in the fast-tracking of this technology from research to its future uptake and commercialisation.

Refuelling a hydrogen fuel cell electric vehicle by the Hon Keith Pitt MP, former Assistant Minister to the Deputy Prime Minister, with Dr Larry Marshall.

SIEF supporting Australia's preparedness for natural disasters and diseases

As part of the MEP, SIEF is funding a small multispectral shortwave infrared imaging satellite. This CubeSat, named CSIROsat-1, is being in Australia and specifically designed for Australian needs, which has provided substantial opportunities to Australian industry and increased capabilities for the national innovation system. After it is launched, the CubeSat will provide data on Australia's environment, which may be used to detect land cover changes such as flooding or deforestation, bushfires through smoke, and tropical cyclones through cloud formation.

To solve the greatest challenges, it is essential we that collaborate with others and have access to the best scientific equipment. The SIEF Special Research Program funded a new transmission electron microscope for the Australian Centre for Disease Preparedness. Electron microscopy capability is a critical contributor to our understanding of viruses, host interaction and viral mechanisms for diseases such as COVID-19. The instrument will enhance Australia's pathogen research capability, and as it will be made available to the research community, it will foster collaborations with university partners, state animal health laboratories, international collaborators and Microscopy Australia partners.

SIEF also invested in pandemic preparedness through the Vaximiser Experimental Development Program project. Knowing that many vaccines are manufactured using eggs, CSIRO developed a premium high-yield egg specifically to maximise vaccine production cost effectively, and with less waste than current production processes. SIEF's funding will enable the validation of CSIRO's technology under commercial conditions and support large-scale pilot trials with leading vaccine companies. The industrial application of this invention will enhance our capacity to respond to disease outbreaks to help protect the world from the next pandemic.

Assisting Australian industry

The Experimental Development Program (EDP) funded by the CSIRO Gift provides Australian companies with a competitive advantage by assisting with collaborative research and the commercialisation of new technologies.

The use of hydrogen as an alternative fuel source to fossil fuels for transport has taken a great leap forward since SIEF invested in an EDP project that converts liquid ammonia to hydrogen. This technology will pave the way for bulk hydrogen to be transported in the form of ammonia, using existing infrastructure, and then reconverted back to fuel cell vehicle-quality hydrogen.

SIEF commissioned an impact case study to evaluate this EDP on hydrogen technology. Read more about the performance analysis of this EDP under Function 1.3 on page 71.

Supporting food security and supply chains

SIEF supports food security, food sustainability and supply chain integrity through the NICTA Gift's Future National ICT Industry Platform Program's digital initiatives. The pilot digital initiative Food Provenance developed testing tools and platforms for Australia's seafood industries to trace their products, reduce supply chain inefficiencies, adopt more sustainable food production practises, and increase international consumer confidence in the origin, quality, and handling of Australian food. SIEF commissioned an impact case study on the Boat to Plate project that is developing solutions for automated video analysis of fish catches using computer vision, machine learning, catch species identification, system integration and connections with the Australian fishing industry and fisheries management authorities.

The performance analysis of the digital initiatives under Function 1.3 is on page 71.

SIEF has supported two additional digital initiatives in supply chain integrity, which is now an issue of national importance as we've witnessed the vulnerability of international supply chains as a result of the COVID-19 pandemic. I am proud that SIEF's support for such timely research will provide great benefit to Australia.

In my role as SIEF Trustee, I am assisted by the advisory bodies and expert reviewers who generously contribute their time and expertise to SIEF to provide advice on funding decisions across the portfolio. I sincerely thank them for the advice they have provided me this year.

SIEF plays a critical role in assisting Australian industry, furthering the interests of the Australian community and contributing to solving national challenges. Through collaboration, developing capability and investing in new scientific research and infrastructure, SIEF is preparing Australia for an innovative and prosperous future.

Dr Larry Marshall
SIEF Trustee

SIEF advisory bodies

CSIRO Gift Advisory Council Members

Emeritus Prof Alan Robson (Chair)
Dr Peter Riddles AM (Chair, EDP Review Panels)
Mr Nigel Poole
Dr Ezio Rizzardo
Professor Margaret Sheil
Professor Tom Spurling

Generation STEM Consultative Council

Professor Brian Boyle (Chair)*
Ms Maile Carnegie
Mr Simon Rowell*
Ms Gail Fulton
Mr Graeme Plato*
Dr Dave Williams
Mr David Wright (Chair)

NICTA Program Advisory Council

Ms Michelle Price
Ms Petra Andren*
Mr John Paitaridis
Mr Adrian Turner*
Dr Simon Barry

*Indicates retirement from the Councils.

From Boat to Plate

The seafood industry faces inefficiency from lack of traceability in the supply chain – from capture to the consumer.

With the increasing demand for seafood, around food safety, quality, food fraud, sustainability and regulatory breaches make seafood provenance a concern for consumers, producers, and regulatory bodies across the globe.

Imagery from point of capture is seen as the basis for the supply chain management for industry, yet automated species identification and tracking remains a challenge.

The Boat to Plate team developed an innovative solution in the form of an automated species identification system, embedded within a tagging and data management system. The product offers a convenient, cost- and time-effective solution for seafood providers to monitor and manage their product throughout the supply chain. The implementation of the technology has the potential to reduce losses due to market and supply chain inefficiencies in the seafood industry.

The team collaborated with external organisations for testing and validating, including the Mures Tasmania fishing and strategic operations team, to get insights about their supply chain challenges for development and testing of a mock-up system. The mock-up system is being used as a prototype to build similar systems for other fish species, and commercial partnerships.

The on-board automated visual identification of fish catch will help markets gain greater clarity of products and provide regulators assurances of sustainability, and faster, more cost effective practices. This will lead to enhanced seafood supply chain management, traceability and food security for industry, wholesalers and retailers that purchase Australian seafood products. Boat to Plate has potential to boost confidence between buyers and sellers of Australian seafood and create a substantially improved product-market fit.

It presents an opportunity to generate cost-savings in the order of billions of dollars associated with current market inefficiencies and seafood wastage.

The work has significant application in the Australian domestic industry to maintain good regulatory compliance. The work also offers significant potential for global application. New Zealand and Chile are installing electronic monitoring systems on thousands of fishing vessels over the next two years, offering potential for uptake and adoption. Southeast Asian fisheries alone consist of 3.5 million fishing vessels and represent a significant global market for this innovation.

SIEF funding support has played an instrumental role to advance this work, from research project to its uptake and commercialisation.

Automated species identification and counting of freshly caught fish on a boat. Credit: Austral Fisheries.

INDEPENDENT AUDITOR'S REPORT

To the Minister for Industry, Science and Technology

Opinion

In my opinion, the financial statements of the Science and Industry Endowment Fund for the year ended 30 June 2020:

(a) comply with Australian Accounting Standards – Reduced Disclosure Requirements and the *Science and Industry Endowment Act 1926*; and

(b) present fairly the financial position of the Science and Industry Endowment Fund as at 30 June 2020 and its financial performance and cash flows for the year then ended.

The financial statements of the Science and Industry Endowment Fund, which I have audited, comprise the following as at 30 June 2020 and for the year then ended:

- Statement by the Trustee and Chief Finance Officer of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) as Service Provider to the Science and Industry Fund;
- Statement of Comprehensive Income;
- Statement of Financial Position;
- Statement of Changes in Equity;
- Statement of Cash Flow;
- Notes to and forming part of the financial report.

Basis for opinion

I conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. My responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of my report. I am independent of the Science and Industry Endowment Fund in accordance with the relevant ethical requirements for financial statement audits conducted by the Auditor-General and his delegates. These include the relevant independence requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants (including Independence Standards)* (the Code) to the extent that they are not in conflict with the *Auditor-General Act 1997*. I have also fulfilled my other responsibilities in accordance with the Code. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Trustee's responsibility for the financial statements

The Trustee of the Science and Industry Endowment Fund is responsible for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards – Reduced Disclosure Requirements and the *Science and Industry Endowment Act 1926*. The Trustee is also responsible for such internal control as he determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Trustee is responsible for assessing the ability of the Science and Industry Endowment Fund to continue as a going concern, taking into account whether the Science and Industry Endowment Fund's operations will cease as a result of an administrative restructure or for any other reason. The Trustee is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the assessment indicates that it is not appropriate.

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38 Sydney Avenue FORREST ACT 2603
Phone (02) 6203 7300 Fax (02) 6203 7777

Auditor's responsibilities for the audit of the financial statements

My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian National Audit Office Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with the Australian National Audit Office Auditing Standards, I exercise professional judgement and maintain professional scepticism throughout the audit. I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control;
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Science and Industry Endowment Fund's internal control;
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Trustee;
- conclude on the appropriateness of the Trustee's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Science and Industry Endowment Fund's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause the Science and Industry Endowment Fund to cease to continue as a going concern; and
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

I communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

Australian National Audit Office

Brandon Jarrett

Senior Executive Director

Delegate of the Auditor-General

Canberra

4 August 2020

SCIENCE AND INDUSTRY ENDOWMENT FUND

STATEMENT BY TRUSTEE AND CHIEF FINANCE OFFICER OF COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO) AS SERVICE PROVIDER TO THE SCIENCE AND INDUSTRY ENDOWMENT FUND

In our opinion, the attached financial report for the year ended 30 June 2020 has been prepared based on properly maintained financial records and in accordance with Australian Accounting Standards and other mandatory financial reporting requirements in Australia, and gives a true and fair view of the financial position of the Science and Industry Endowment Fund as at 30 June 2020 and of its performance for the year then ended.

In our opinion, at the date of this statement, there are reasonable grounds to believe that the Science and Industry Endowment Fund will be able to pay its debts as and when they become due and payable.

Larry Marshall

Trustee of the Science and Industry Endowment Fund

4 August 2020

Tom Munyard

Chief Finance Officer of CSIRO as service provider to the Science and Industry Endowment Fund

4 August 2020

SCIENCE AND INDUSTRY ENDOWMENT FUND

STATEMENT OF COMPREHENSIVE INCOME

For the period ended as at 30 June 2020

	Notes	2020	2019
		$	$
EXPENSES			
Scientific research grants	1	**11,546,425**	25,609,609
Service fee under services agreement with CSIRO		**578,064**	340,189
Audit and Bank fees		**15,570**	15,500
Other fees		**3**	398
Total expenses		**12,140,062**	25,965,696
LESS:			
REVENUE			
NICTA Gift	2	**5,000,000**	20,000,000
Metcalf bequest		**-**	1,037,633
CSIRO Gift	2	**5,000,000**	-
Interest	3	**1,139,994**	2,001,919
Total revenue		**11,139,994**	23,039,552
Net profit/ (deficit)		**(1,000,068)**	(2,926,144)
Other comprehensive income		-	-
Total comprehensive loss		**(1,000,068)**	(2,926,144)

The above statement should be read in conjunction with the accompanying notes.

SCIENCE AND INDUSTRY ENDOWMENT FUND

STATEMENT OF FINANCIAL POSITION

For the period ended as at 30 June 2020

	Notes	2020	2019
		$	$
ASSETS			
Current assets			
Cash and Cash Equivalents	4	**64,603,883**	65,017,563
Interest receivable	5	**428,189**	793,925
GST receivable	5	**36,834**	1,423,500
Total assets		**65,068,906**	67,234,988
LIABILITIES			
Current liabilities			
Payables			
Accrued grants payable	6	**-**	1,043,744
Shared service fee payable	6	**-**	122,270
Accrued audit fee	6	**15,500**	15,500
Total payables		**15,500**	**1,181,514**
Total liabilities		**15,500**	1,181,514
Net assets		**65,053,406**	66,053,474
EQUITY			
Contributed equity		**200,000**	200,000
Retained surplus		**64,853,406**	65,853,474
Total equity		**65,053,406**	66,053,474

The above statement should be read in conjunction with the accompanying notes.

SCIENCE AND INDUSTRY ENDOWMENT FUND

STATEMENT OF CHANGES IN EQUITY

For the period ended as at 30 June 2020

	Retained Surplus		Contributed Equity		Total Equity	
	2020	2019	**2020**	2019	**2020**	2019
	$	$	**$**	$	**$**	$
Opening Balance	**65,853,474**	68,779,618	**200,000**	200,000	**66,053,474**	68,979,618
Net profit/(deficit)	**(1,000,068)**	(2,926,144)	**-**	-	**(1,000,068)**	(2,926,144)
Closing Balance	**64,853,406**	65,853,474	**200,000**	200,000	**65,053,406**	66,053,474

The above statement should be read in conjunction with the accompanying notes

SCIENCE AND INDUSTRY ENDOWMENT FUND

CASH FLOW STATEMENT

For the period ended as at 30 June 2020

	Notes	2020	2019
		$	$
OPERATING ACTIVITIES			
Cash received			
NICTA Gift		**5,000,000**	20,000,000
Metcalf bequest		**-**	1,037,633
CSIRO Gift		**5,000,000**	-
Interest received		**1,505,730**	1,910,641
GST credits received		**2,717,266**	1,264,219
Total cash received		**14,222,996**	24,212,493
Cash used			
Payments to grantees		**13,992,355**	27,022,452
Other payments		**644,321**	353,316
Bank fees paid		**-**	398
Total cash used		**14,636,676**	27,376,166
Net cash provided/(used) by operating activities	7	**(413,680)**	(3,163,673)
Net increase/(decrease) in cash held		**(413,680)**	(3,163,673)
Cash at the beginning of the reporting period		**65,017,563**	68,181,236
Cash at the end of the reporting period		**64,603,883**	65,017,563

The above statement should be read in conjunction with the accompanying notes

SCIENCE AND INDUSTRY ENDOWMENT FUND

NOTES TO AND FORMING PART OF THE FINANCIAL REPORT

For the period ended as at 30 June 2020

Overview

The Science and Industry Endowment Fund (referred to as "the Fund") was established under the *Science and Industry Endowment Act 1926* with the Trustee of the Fund being the CSIRO Chief Executive and is a not-for-profit entity. An appropriation of 100 000 pounds was received at the time the Fund was established. The principal activity of the Fund is to provide assistance to persons engaged in scientific research and in the training of students in scientific research.

In October 2009 the Minister for Innovation, Industry, Science and Research announced a gift of $150 million to be donated by CSIRO to the Fund. The gift is intended to be used for scientific research for the purposes of assisting Australian industry, furthering the interests of the Australian community or contributing to the achievement of Australian national objectives. The gift was made subject to the terms of a Deed of Gift between the Trustee and CSIRO dated 15 October 2009. In June 2018 and June 2020, the CSIRO made a further gift of $10 million and $5 million, respectively, to the Fund. These gifts were also made subject to the terms of the Deed of Gift between the Trustee and CSIRO dated 15 October 2009. The total cash payments made in 2019-20 under the Deed of Gift were $4,109,348 (GST exclusive).

In June 2017, the NSW Government acting through the NSW Department of Industry provided a $25 million endowment to SIEF to create the NSW Generation STEM Program. The program will be delivered over a 10-year period and will implement activities including research, to increase the supply of STEM (science, technology, engineering and mathematics) skilled labour to meet the current and future needs of New South Wales. The total cash payments made in 2019-20 under the NSW Endowment were $97,434 (GST exclusive).

In November and December 2018, National ICT Australia Limited (NICTA), a controlled entity of CSIRO, provided two gifts to SIEF in the total amount of $20m to fund the Future National ICT Industry Platform Program. A further $5m was provided to SIEF by NICTA in December 2019. The program is a scale of research activities and projects that address challenges in the field of information and communications technology (ICT) and it is intended that the outcomes from the Program will benefit Australia by helping create new Australian technology-based industries and/or applied technology platforms that can reach global scale. The total payments made in 2019-20 under the Future National ICT Industry Platform Program were $9,099,291 (GST exclusive).

In April 2019, SIEF received a bequest from the estate of the late David Ross Metcalf for $1 million. The Trustee determined to use the bequest for industry/research engagement programs. The funds were all expended in 2018-19. There were no cash payments in 2019-20.

In any one financial year a maximum amount of $25 million exclusive of Goods and Services Tax (GST) can be disbursed from the Fund for the CSIRO GIFT (under the Deed of Gift), NSW Generation STEM Program and the Future National ICT Industry Platform Program. The total payments made under these gifts and programs in 2019-20 were $13,306,073 (GST exclusive).

Basis of Preparation of the Financial Statements

The financial statements for the Fund are general purpose financial statements and are required by:

- Section 10 of the *Science and Industry Endowment Act 1926.*

The financial statements have been prepared in accordance with:

- Australian Accounting Standards and Interpretations – Reduced Disclosure Requirements (Tier 2) issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The financial statements have been prepared on an accrual basis and are in accordance with the historical cost convention. No allowance is made for the effect of changing prices on the results or the financial position. The financial statements are presented in Australian dollars and values are rounded to the nearest dollar unless otherwise specified.

Key Judgements and Estimates

The accounting policies are set out below. Within the current financial year, there were no significant management judgements or estimates used in the preparation of the financial statements.

New Australian Accounting Standards

All new/revised/amending standards and/or interpretations that were issued prior to the signing of these statements and applicable to the current reporting period were adopted by the Science and Industry Endowment Fund. This includes the following new amended standard:

Standard/Interpretation	Nature of change in accounting policy
AASB 2016-8 Amendments to Australian Accounting Standards – Australian Implementation Guidance for Not-for-Profit Entities and AASB 1058 Income of Not-For-Profit Entities	AASB 2016-8 and AASB 1058 became effective 1 July 2019. AASB 1058 is relevant in circumstances where AASB 15 does not apply. AASB 1058 replaces most of the not-for-profit (NFP) provisions of AASB 1004 Contributions and applies to transactions where the consideration to acquire an asset is significantly less than fair value principally to enable the Fund to further its objectives, and where volunteer services are received. The details of the changes in accounting policies are disclosed below.

SCIENCE AND INDUSTRY ENDOWMENT FUND

NOTES TO AND FORMING PART OF THE FINANCIAL REPORT

For the period ended as at 30 June 2020

Application of AASB 1058 Income of Not-For-Profit Entities

The Fund adopted AASB 1058 using the modified retrospective approach. Accordingly, the comparative information presented for 2019 is not restated, that is, it is presented as previously reported under the various applicable AASBs and related interpretations.

Under the new income recognition model the Fund shall first determine whether an enforceable agreement exists and whether the promises to transfer goods or services to the customer are 'sufficiently specific'. If an enforceable agreement exists and the promises are 'sufficiently specific' (to a transaction or part of a transaction), the Fund applies the general AASB 15 principles to determine the appropriate revenue recognition. If these criteria are not met, the Fund shall consider whether AASB 1058 applies.

In terms of AASB 1058, the Fund is required to recognise volunteer services at fair value if those services would have been purchased if not provided voluntarily, and the fair value of those services can be measured reliably.

Events after the Reporting Period

The Trustee is not aware of any other significant events occurring after the reporting date that could impact on the financial report.

Taxation

The Fund is exempt from all forms of taxation except Goods and Services Tax ('GST').

Note 1 Scientific Research Grants

	2020	2019
	$	$
Future National ICT Industry Platform Program	**7,694,540**	9,333,057
Research Infrastructure Investment	**990,000**	6,615,000
Special Research Program	**-**	1,440,000
Promotion of Science Program - Scholarships and Fellowships	**607,848**	2,810,785
Experimental Development Program	**2,254,037**	3,010,767
NSW Endowment Grant	**-**	2,000,000
Research Project Grants	**-**	400,000
Total	**11,546,425**	25,609,609

The Fund is a subsidiary entity of the Commonwealth Scientific and Industrial Research Organisation (CSIRO). For the 2019-20 financial year, the Fund has recognised $11.5m in grant expenses as transferred directly to CSIRO to support scientific research and infrastructure projects within CSIRO and/or collaborative projects with external organisations (2018-19: $25.6m).

Note 2 NICTA and CSIRO Gifts

The $5m gifts received from both NICTA and CSIRO are to be used to further SIEF's objectives, where the consideration to acquire an asset was significantly less than fair value. The cash received is recognised as a financial asset under AASB9 *Financial Instruments* as highlighted in paragraph 8 of AASB1058.

Note 3 Interest Revenue

Interest revenue is recognised using the effective interest method as set out in AASB 9 *Financial Instruments.*

SCIENCE AND INDUSTRY ENDOWMENT FUND

NOTES TO AND FORMING PART OF THE FINANCIAL REPORT

For the period ended as at 30 June 2020

Note 4 Cash and cash equivalents

	2020	2019
	$	$
Cash at bank	**14,118,883**	3,878,631
Term deposits	**50,485,000**	61,138,932
Total	**64,603,883**	65,017,563

Cash and cash equivalents include cash on hand and demand deposits in bank accounts with an original maturity of twelve months or less that are readily convertible to known amounts of cash and subject to insignificant risk of change in value. Cash is recognised at its nominal amount.

Note 5 Trade and other receivables

	2020	2019
	$	$
Interest receivable	**428,189**	793,925
GST receivable	**36,834**	1,423,500
Total receivables	**465,023**	2,217,425
Less impairment loss allowance	-	-
Total trade and other receivables	**465,023**	2,217,425

Trade receivables are financial assets held for collecting the contractual cash flows of the asset, where the cash flows are solely payments of principal and interest that are not provided at below-market interest rates. They are subsequently measured at amortised cost using the effective interest method adjusted for any loss allowance.

Note 6 Accrued Expenses

	2020	2019
	$	$
Grants Payable	-	1,043,744
Service Fee	-	122,270
Audit Fee	**15,500**	15,500
Total	**15,500**	**1,181,514**

Note 7 Cash Flow Reconciliation

	2020	2019
	$	$
Reconciliation of operating surplus to net cash from/(used by) operating activities:		
Operating surplus/(deficit)	**(1,000,068)**	(2,926,144)
Changes in assets and liabilities		
(Increase)/decrease in receivables	**1,752,402**	(1,315,724)
Increase/(decrease) in payables	**(1,166,014)**	1,078,195
Net cash from/(used by) operating activities	**(413,680)**	(3,163,673)

SCIENCE AND INDUSTRY ENDOWMENT FUND

NOTES TO AND FORMING PART OF THE FINANCIAL REPORT

For the period ended as at 30 June 2020

Note 8 Contingent Assets and Liabilities

No contingent assets or liabilities existed as at 30 June 2020 (2019: nil).

Note 9 Related Party Disclosures

The fund is a wholly controlled subsidiary of CSIRO. The trustee is the Chief Executive Officer of CSIRO who is remunerated through CSIRO and not paid an additional salary for his role as trustee of the fund. There were no transactions during the reporting period between the trustee and the fund. Related parties to this entity other than the trustee are other Australian Government entities.

Significant transactions with related parties can include the payment of grants, the purchase of goods and services. In considering relationships with related entities, and transactions entered into during the reporting period by SIEF, it has been determined that there are no related party transactions required to be separately disclosed. Grants are awarded based on assessment against a set of established selection criteria prior to approval. All eligible applications are assessed equally.

Note 10 Schedule of Commitments

The below table shows the monies SIEF is committed to pay on its executed grant funding agreements as at 30 June 2020, subject to grantees meeting funding milestones.

	2020	2019
	$	$
BY TYPE		
Grants commitments payable	**38,557,048**	34,639,956
GST receivable on grants payable	**(3,505,186)**	(3,149,087)
Total net commitments by type	**35,051,862**	31,490,869
BY MATURITY		
Grant commitments payable		
One year or less	**13,270,964**	11,163,299
From one to five years	**18,851,084**	15,831,657
More than five years	**6,435,000**	7,645,000
Total grants payable	**38,557,048**	34,639,956
GST commitments receivable		
One year or less	**(1,206,451)**	(1,014,845)
From one to five years	**(1,713,735)**	(1,439,242)
More than five years	**(585,000)**	(695,000)
Total commitments receivable	**(3,505,186)**	(3,149,087)
Net commitments by maturity	**35,051,862**	31,490,869

SCIENCE AND INDUSTRY ENDOWMENT FUND

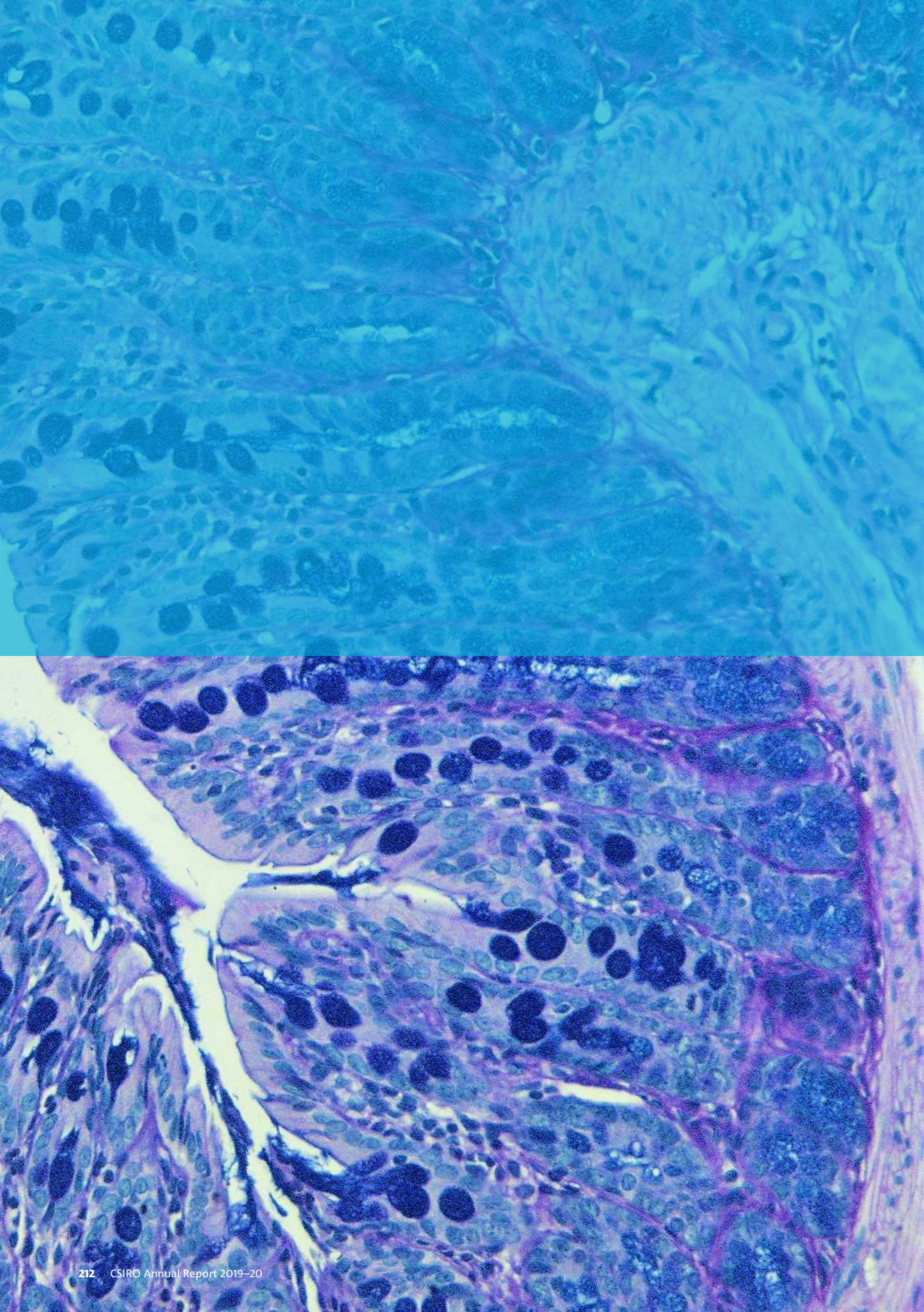
NOTES TO AND FORMING PART OF THE FINANCIAL REPORT

For the period ended as at 30 June 2020

Note 11 Financial Instruments

	2020	2019
	$	**$**
Categories of financial instruments		
Financial assets under AASB 9		
Financial assets at amortised cost		
Cash and cash equivalents	64,603,883	65,017,563
Interest receivable	428,189	793,925
GST receivable	36,834	1,423,500
Total financial assets at amortised cost	**65,068,906**	**67,234,988**
Total financial assets	**65,068,906**	**67,234,988**

	2020	2019
	$	$
Financial liabilities		
Financial liabilities at amortised cost		
Grants payable	-	1,043,744
Shared service fee payable	-	122,270
Accrued audit fee	15,500	15,500
Total financial liabilities at amortised cost	**15,500**	**1,181,514**
Total financial liabilities	**15,500**	**1,181,514**



Part 7

Appendices and indexes

Data templates

Appendix A: Management of human resources

All ongoing employees current report period (2019–20)

	MALE			FEMALE			INDETERMINATE			TOTAL
	Full-time	Part-time	Total Male	Full-time	Part-time	Total Female	Full-time	Part-time	Total indeterminate	
NSW	407	21	428	189	77	266	–	–	–	694
QLD	370	10	380	208	61	269	–	–	–	649
SA	95	6	101	86	30	116	–	–	–	217
TAS	196	8	204	92	23	115	–	–	–	319
VIC	669	24	693	359	18	477	1	–	1	1,171
WA	242	5	247	90	39	129	1	–	1	377
ACT	479	18	497	309	96	405	–	–	–	902
NT	4	1	5	2	3	5	–	–	–	10
Overseas	–	–	–	–	–	–	–	–	–	–
Total	**2,462**	**93**	**2,555**	**1,335**	**347**	**1,782**	**2**	**–**	**2**	**4,339**

All non-ongoing employees current report period (2019–20)

	MALE			FEMALE			INDETERMINATE			TOTAL
	Full-time	Part-time	Total Male	Full-time	Part-time	Total Female	Full-time	Part-time	Total indeterminate	
NSW	110	13	123	51	22	73	–	–	–	196
QLD	111	16	127	49	18	67	1	–	1	195
SA	25	2	27	21	5	26	–	–	–	53
TAS	30	5	35	22	7	29	–	–	–	64
VIC	93	11	104	73	19	92	1	–	1	197
WA	52	7	59	37	7	44	–	–	–	103
ACT	83	10	93	57	13	70	–	1	1	164
NT	2	–	2	1	–	1	–	–	–	3
Overseas	3	–	3	2	–	2	–	–	–	5
Total	**509**	**64**	**573**	**313**	**91**	**404**	**2**	**1**	**3**	**980**

All ongoing employees previous report period (2018–19)

	MALE			FEMALE			INDETERMINATE			TOTAL
	Full-time	Part-time	Total Male	Full-time	Part-time	Total Female	Full-time	Part-time	Total indeterminate	
NSW	415	24	439	204	69	273	0	0	0	712
QLD	365	10	375	196	67	263	0	0	0	638
SA	97	3	100	89	34	123	0	0	0	223
TAS	197	7	204	91	23	114	0	0	0	318
VIC	679	24	703	352	118	470	0	0	0	1,173
WA	249	7	256	83	43	126	1	0	1	383
ACT	499	22	521	326	97	423	0	0	0	944
NT	5	1	6	1	3	4	0	0	0	10
Overseas	1	0	1	1	0	1	0	0	0	2
Total	**2,507**	**98**	**2,605**	**1,343**	**454**	**1,797**	**1**	**0**	**1**	**4,403**

All non-ongoing employees previous report period (2018–19)

	MALE			FEMALE			INDETERMINATE			TOTAL
	Full-time	Part-time	Total Male	Full-time	Part-time	Total Female	Full-time	Part-time	Total indeterminate	
NSW	138	47	185	75	66	141	0	0	0	326
QLD	135	55	190	75	44	119	0	0	0	309
SA	25	11	36	23	19	42	0	1	1	79
TAS	38	17	55	27	11	38	0	0	0	93
VIC	111	36	147	96	41	137	2	0	2	286
WA	54	7	61	49	25	74	0	0	0	135
ACT	100	36	136	78	59	137	0	1	1	274
NT	2	0	2	0	3	3	0	0	0	5
Overseas	3	0	3	2	0	2	0	0	0	5
Total	**606**	**209**	**815**	**425**	**268**	**693**	**2**	**2**	**4**	**1,512**

Appendix B: Accountable authority

Details of accountable authority during the current report period (2019–20)

NAME	QUALIFICATIONS OF THE ACCOUNTABLE AUTHORITY	EXPERIENCE OF THE ACCOUNTABLE AUTHORITY
Mr David Thodey AO	BA FAICD	Mr Thodey is a business leader and Company Director focused on innovation, technology and digital, with more than 30 years' experience including as Chief Executive Officer of Telstra and Chief Executive Officer of IBM Australia and New Zealand. An experienced board director and chair, his current positions include Director of Ramsay Health Care, Tyro, Vodafone Group, Xero and Deputy Chair of the National COVID-19 Coordination Commission.
Dr Larry Marshall	BSc (Hons) PhD GAICD FTSE	Dr Marshall is a scientist, technology innovator and business leader with over 25 years' experience in creating new value and impact with science. He founded six successful companies in biotechnology, photonics, telecommunications and semiconductors in the United States, and has served on 20 boards of high-tech companies operating in the United States, Australia and China.
Ms Shirley In't Veld	BCom LLB FAICD	Ms In't Veld is an experienced Company Director with extensive senior executive experience including as Managing Director of Verve Energy for five years. Previously she held senior commercial, legal and marketing positions with Alcoa, WMC Resources Ltd, Bond Corporation and BankWest. Ms In't Veld is on the boards of the National Broadband Network, Northern Star Resources and Australian Pipeline Limited.
Dr Michele Allan	BAppSc MMgtTec MCommLaw DBA FAICD	Dr Allan is an experienced Company Director with significant skills and competencies in the university, private and public sector and domain expertise in food and advanced manufacturing. Her background is in biomedical science, management and law. Dr Allan is an experienced board Chair including Chair of the boards of Charles Sturt University, Apple and Pear Australia, Food and Agribusiness Growth Centre and Defence CRC for Trusted Autonomous Systems (FED).
Mr Drew Clarke AO PSM	BAppSc (Surveying) MSc GAICD FTSE	Mr Clarke is an experienced Company Director offering valuable applied science, public policy and government administration expertise from over 20 years in senior roles in the Australian Public Service, including as Secretary of the Department of Resources, Energy and Tourism and Chief of Staff in the Office of the Prime Minister. He is Chairman of the Australian Energy Market Operator Board, Director on the NBNCo Board and Chair of ACOLA Working Group developing a research plan for the Australian energy transition.

		PERIOD AS THE ACCOUNTABLE AUTHORITY OR MEMBER WITHIN THE REPORTING PERIOD		
	POSITION TITLE/POSITION HELD EXECUTIVE/NON-EXECUTIVE	COMMENCEMENT DATE	CESSATION DATE	NUMBER OF MEETINGS ACCOUNTABLE AUTHORITY ATTENDED
	Chairman Non-executive	15 October 2015	14 October 2020	9 of 9 meetings
	Chief Executive Executive	1 January 2015	30 June 2023	9 of 9 meetings
	Deputy Chair Non-executive	28 June 2012	27 June 2020	7 of 9 meetings
	Member Non-executive	5 May 2016	4 May 2024	8 of 9 meetings
	Member Non-executive	24 August 2017	23 August 2022	9 of 9 meetings

NAME	QUALIFICATIONS OF THE ACCOUNTABLE AUTHORITY	EXPERIENCE OF THE ACCOUNTABLE AUTHORITY
Professor Edwina Cornish AO	BSc (Hons) PhD FTSE AICD	Professor Cornish is an experienced director with significant senior executive experience in the research and higher education sector. She brings vast experience in the interface between government, research, science and the higher education sector and provides strong business, industry and financial skills. Professor Cornish played a key role in building one of Australia's first biotechnology companies, Florigene Limited, which developed and successfully commercialised the world's first genetically modified flowers. She is on the Council of La Trobe University, a member of the South Australian Productivity Commission (for an inquiry into the State's Health and Medical Research Performance) and the Chair of the University of Queensland - Indian Institute of Technology Delhi (UQ-IITD) Academy Strategic Research Advisory Council.
Ms Kathryn Fagg AO	BE (Hons) Chem Eng MCom (Hons) FTSE GAICD	Ms Fagg, an experienced director, senior executive and engineer, has worked in logistics, manufacturing, resources, banking and professional services, including with Linfox, BlueScope Steel and the ANZ Banking Group. Her current board positions include Chair of Boral and Breast Cancer Network Australia and member of the boards of Myer Foundation, National Australia Bank and Djerriwarrh Investments. Formerly Ms Fagg was on the Board of the Reserve Bank of Australia (2013–18).
Mr David Knox	BSc (Hons) Mech Eng MBA FIE Aust FTSE GAICD	Mr Knox, an experienced executive with background in oil and gas, is the Chair of Snowy Hydro among other positions. He was Managing Director and Chief Executive of Australian Naval Infrastructure (until 3 April 2020), Chief Executive Officer and Managing Director, Santos Limited (2008- 2015). He is Chair of The Australian Centre for Social Innovation, and a Director of Migration Council Australia, Adelaide Festival Board, Redflow and Micro X.
Professor Tanya Monro	BSc (Hons) PhD FAA FTSE FOSA FAIP GAICD	Professor Monro is the Chief Defence Scientist. She was previously Deputy Vice Chancellor Research and Innovation and an Australian Research Council Georgina Sweet Laureate Fellow at the University of South Australia. Her experience at senior levels in industry and educational institutions includes research in photonics focusing on sensing, lasers and new classes of optical fibres. Professor Monro is a director of Red Chip Photonics, Science Patron of the National Youth Science Forum, a member of the South Australian Premier's Economic Advisory Council and National Committee for Physics.
Dr Peter Riddles AM	BSc (Hons) PhD Grad Dip Bus FAICD	Dr Riddles is an experienced Company Director and advisor to various international science organisations including in the United States and the United Kingdom. He has worked as a research scientist in molecular biology in the public sector including CSIRO, on commercialisation and new venture creation and government policy development and strategy. Dr Riddles' expertise is in biotechnology and entrepreneurship in the higher education and research sectors. His other roles include member of the Science and Industry Endowment Fund Advisory Council, advisor to the Queensland Government on the next generation of the Boggo Road Precinct and Advisory Board member of the Circular Economy Laboratory.

		PERIOD AS THE ACCOUNTABLE AUTHORITY OR MEMBER WITHIN THE REPORTING PERIOD		
	POSITION TITLE/POSITION HELD EXECUTIVE/NON-EXECUTIVE	COMMENCEMENT DATE	CESSATION DATE	NUMBER OF MEETINGS ACCOUNTABLE AUTHORITY ATTENDED
	Member Non-executive	26 November 2015	25 November 2020	9 of 9 meetings
	Member Non-executive	2 August 2018	1 August 2023	8 of 9 meetings
	Member Non-executive	5 May 2016	4 May 2024	8 of 9 meetings
	Member Non-executive	25 February 2016	24 February 2021	6 of 9 meetings
	Member Non-executive	24 April 2014	23 April 2022	9 of 9 meetings

Appendix C: CSIRO Board Audit and Risk Committee

MEMBER NAME	QUALIFICATIONS, KNOWLEDGE, SKILLS OR EXPERIENCE (INCLUDE FORMAL AND INFORMAL AS RELEVANT)	NUMBER OF MEETINGS ATTENDED/TOTAL NUMBER OF MEETS	TOTAL ANNUAL REMUNERATION
Dr Michele Allan	BAppSc MMgtTec MCommLaw DBA FAICD Significant experience as director and senior executive in private, public and tertiary sector	5/5	$8,160 per annum (Remuneration Tribunal determination)
Mr Drew Clarke AO PSM	BAppSc (Surveying) MSc GAICD FTSE Valuable mix of skills and experience in applied science, public policy and government administration	5/5	$8,160 per annum (Remuneration Tribunal determination)
Professor Edwina Cornish AO	BSc (Hons) PhD FTSE AICD Valuable skills and experience as a senior executive in the tertiary and commercial sector	5/5	$8,160 per annum (Remuneration Tribunal determination)
Ms Shirley In't Veld (term ended on 27 June)	BCom LLB FAICD Extensive experience as a senior executive including as Managing Director, Verve Energy with responsibilities for financial management Member of NBN Co Audit and Risk Committee	5/5	No additional remuneration as Ms In't Veld was the Deputy Chair of the CSIRO Board
Dr Peter Riddles AM	BSc (Hons) PhD Grad Dip Bus FAICD An experienced director to diverse organisations including biotechnology start-up companies, industry organisations and University Commercial Offices	5/5	$8,160 per annum (Remuneration Tribunal determination)
Ms Kathryn Fagg AO **Appointed as member of BARC on 30 August** **Appointed as Chair of BARC on 28 June**	BE (Hons) Chem Eng MCom (Hons) FTSE GAICD Highly regarded director currently on the NAB Board and Chair of Boral. Brings skills and experience from the private and public sector	5/5	$8,160 per annum (Remuneration Tribunal determination) pro rata from 30 August 2019 to 27 June 2020. $16,320 per annum from 28 June 2020 pro rata (Remuneration Tribunal determination)

Acronyms

AAHL	Australian Animal Health Laboratory
ACDP	Australian Centre for Disease Preparedness
ALA	Atlas of Living Australia
ANAO	Australian National Audit Office
APS	Australian Public Service
ASKAP	Australian Square Kilometre Array Pathfinder
ASX	Australian Securities Exchange
ATCA	Australia Telescope Compact Array
ATNF	Australia Telescope National Facility
CDSCC	Canberra Deep Space Communication Complex
CEPI	Coalition for Epidemic Preparedness Innovations
CERC	CSIRO Early Research Career
CGMB	Centre for Genomics, Metabolomics and Bioinformatics
CPRs	Commonwealth procurement rules
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DISER	Department of Industry, Science, Energy and Resources
EDP	Experimental Development Program
ET	CSIRO Executive Team
FOI Act	*Freedom of Information Act 1982*
FSP	Future Science Platform
FTE	Full-time equivalent
GISERA	Gas Industry Social and Environmental Research Alliance
ICT	Information and communication technology
IP	Intellectual property
LiDAR	light imaging, detection and ranging
MCC	Male Champions of Change
MEP	Medium Equipment Program
MNF	Marine National Facility
MOU	Memoranda of understanding
NASA	National Aeronautics and Space Administration
NCI	Normalised Citation Index
NCRIS	National Collaborative Research Infrastructure Strategy
NPS	Net Promoter Score
NRCA	National Research Collections Australia
PGPA	*Public Governance, Performance and Accountability Act 2013*
PID Act	*Public Interest Disclosure Act 2013*
PV	Photovoltaic
R&D	Research and development
SAGE	Science in Australia Gender Equity
SIEF	Science and Industry Endowment Fund
SIR Act	*Science and Industry Research Act 1949*
SME	Small to medium-sized enterprise
STEM	Science, technology, engineering and mathematics
WLAN	Wireless local area network

Glossary

Granted patents: Once a patent application has been examined and satisfies various patentability criteria, it becomes a granted patent. It remains a granted patent until the end of the patent period (normally 20 years), provided renewal fees are paid.

Inventions: Inventions where one or more patent/applications are current. Accordingly, an invention might include a granted patent that is near the end of its life (for example, 20 years), or it might include a provisional patent application that has only recently been filed. Further, one invention might relate to a patent application in one country only, or it might relate to over 20 patents/applications in different countries covering the one invention.

Journal articles: Includes journal articles and other items published as part of a journal (for example, an editorial or book review).

Live patent cases: A live patent case is where either a patent application or a granted patent exists. It does not include cases that have lapsed, expired or been withdrawn. Applications may include provisional applications, Patent Cooperation Treaty (PCT) applications and applications pending in Australia or foreign jurisdictions.

New inventions: This is the number of new inventions where an application (normally an Australian provisional application) is filed for the first time to protect that invention. A major implication of filing the provisional application is that it provides the applicant with an internationally recognised priority date. A small percentage of CSIRO's new inventions are filed as United States provisional applications.

PCT applications: International PCT applications are a 'temporary' phase in any international patenting process and these have a life span of 18 months. This type of application is very common in major international corporations and is used by CSIRO when it considers its invention may have wide commercial application. In view of the 18-month time span, it is reasonable to approximate that two-thirds of the reported number were filed in the previous 12-month period.

Pulsar: A rotating neutron star that emits a focused beam of electromagnetic radiation.

Science excellence: An assessment of the competitiveness of CSIRO's research capabilities. It recognises CSIRO's science (for example, total citations) and excellence (for example, citation rates). It tends to be output-oriented and includes lagging metrics relating to research publication performance (bibliometrics), esteem measures, such as awards, and expert-peer reviews.

Scope 1, 2 and 3 greenhouse gas emissions: Greenhouse gas emissions are organised into scopes to avoid double-counting emissions and indicate those that organisations can control (Scope 1) versus those that they can influence (Scope 3). Scope 1 are emissions from sources that are owned or controlled by the organisation. Scope 2 are emissions from the consumption of purchased electricity, steam, or other sources of energy generated upstream from the organisation. Scope 3 are emissions that are a consequence of the operations of an organisation, but are not directly owned or controlled by the organisation.

Sponsored students: Students are deemed to be sponsored if they receive a full or partial scholarship paid from CSIRO funds to pursue a research project leading to a PhD, Master's or Honours degree. This excludes CSIRO employees, whose study expenses are considered to be training and development.

SIEF Ross Metcalf STEM+ Business Fellowship program: Run through the Science and Industry Endowment Fund, the program embeds early career researchers into an industrial workplace over a two-to-three-year period.

Supervised students: Students are deemed to be supervised if they have a CSIRO staff member appointed officially by the university as a co-supervisor for their research project. Normally, CSIRO staff are joint supervisors in conjunction with a university academic.

Technical reports: Includes individually authored chapters as well as whole reports that are subject to peer review and usually publicly released.

Telehealth: The use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration.

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PGPA RULE REFERENCE	PART OF REPORT	DESCRIPTION	REQUIREMENT
17BE	Contents of annual report		
17BE(a)	124	Details of the legislation establishing the body	Mandatory
17BE(b)(i)	124	A summary of the objects and functions of the entity as set out in legislation	Mandatory
17BE(b)(ii)	14	The purposes of the entity as included in the entity's corporate plan for the reporting period	Mandatory
17BE(c)	124	The names of the persons holding the position of responsible Minister or responsible Ministers during the reporting period, and the titles of those responsible Ministers	Mandatory
17BE(d)	125	Directions given to the entity by the Minister under an Act or instrument during the reporting period	If applicable, mandatory
17BE(e)	124	Any government policy order that applied in relation to the entity during the reporting period under section 22 of the Act	If applicable, mandatory
17BE(f)	124	Particulars of noncompliance with: (a) a direction given to the entity by the Minister under an Act or instrument during the reporting period; or (b) a government policy order that applied in relation to the entity during the reporting period under section 22 of the Act	If applicable, mandatory
17BE(g)	34–117	Annual performance statements in accordance with paragraph 39(1)(b) of the Act and section 16F of the rule	Mandatory
17BE(h), 17BE(i)	124	A statement of significant issues reported to the Minister under paragraph 19(1)(e) of the Act that relates to noncompliance with finance law and action taken to remedy noncompliance	If applicable, mandatory
17BE(j)	34 126–127 216–219	Information on the accountable authority, or each member of the accountable authority, of the entity during the reporting period	Mandatory
17BE(k)	122–123	Outline of the organisational structure of the entity (including any subsidiaries of the entity)	Mandatory
17BE(ka)	214–215	Statistics on the entity's employees on an ongoing and non-ongoing basis, including the following: (a) statistics on fulltime employees; (b) statistics on part time employees; (c) statistics on gender; (d) statistics on staff location	Mandatory
17BE(l)	121	Outline of the location (whether or not in Australia) of major activities or facilities of the entity	Mandatory
17BE(m)	125–127	Information relating to the main corporate governance practices used by the entity during the reporting period	Mandatory

PGPA RULE REFERENCE	PART OF REPORT	DESCRIPTION	REQUIREMENT
17BE(n), 17BE(o)	129	For transactions with a related Commonwealth entity or related company where the value of the transaction, or if there is more than one transaction, the aggregate of those transactions, is more than $10,000 (inclusive of GST): (a) the decision making process undertaken by the accountable authority to approve the entity paying for a good or service from, or providing a grant to, the related Commonwealth entity or related company; and (b) the value of the transaction, or if there is more than one transaction, the number of transactions and the aggregate of value of the transactions	If applicable, mandatory
17BE(p)	20–21	Any significant activities and changes that affected the operation or structure of the entity during the reporting period	If applicable, mandatory
17BE(q)	133	Particulars of judicial decisions or decisions of administrative tribunals that may have a significant effect on the operations of the entity	If applicable, mandatory
17BE(r)	133, 134	Particulars of any reports on the entity given by: (a) the Auditor General (other than a report under section 43 of the Act); or (b) a Parliamentary Committee; or (c) the Commonwealth Ombudsman; or (d) the Office of the Australian Information Commissioner	If applicable, mandatory
17BE(s)	n/a	An explanation of information not obtained from a subsidiary of the entity and the effect of not having the information on the annual report	If applicable, mandatory
17BE(t)	131	Details of any indemnity that applied during the reporting period to the accountable authority, any member of the accountable authority or officer of the entity against a liability (including premiums paid, or agreed to be paid, for insurance against the authority, member or officer's liability for legal costs)	If applicable, mandatory
17BE(taa)	125, 220	The following information about the audit committee for the entity: (a) a direct electronic address of the charter determining the functions of the audit committee; (b) the name of each member of the audit committee; (c) the qualifications, knowledge, skills or experience of each member of the audit committee; (d) information about each member's attendance at meetings of the audit committee; (e) the remuneration of each member of the audit committee	Mandatory
17BE(ta)	170–173	Information about executive remuneration	Mandatory

Science and Industry Research Act 1949		
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Made from recycled material.

ISSN 1030-4215
Printed in Australia by New Millennium Print.

As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology.

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B&M | 20-00135