Science Strategy 2028

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Implementation Plan

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Geoscience Australia's
Science Strategy 2028 presents
the strategic framework for
our science that underpins our
value to the nation

The performance and delivery of Geoscience Australia's *Science Strategy 2028* **is underpinned by our science and how we conduct it. It is appropriate that we have a science strategy to guide how we conduct and support our science. Our value to the nation, support to the Australian Government, and the trust in our advice is centred on the quality, timeliness and relevance of the scientific knowledge and skills we possess.**

Our Science Strategy 2028 represents a new approach to articulating the context and priorities for our science. Its main aim is to show the strategy and fundamental framework supporting the science that in turn supports Geoscience Australia's Strategy 2028.

The *Science Strategy Implementation Plan* is a companion document to the our *Science Strategy 2028*. It sets out clear and measurable objectives to achieve our strategy commitments, and explains the roles and foundations of Geoscience Australia's Office of Chief Scientist.

The *Implementation Plan* focuses on our Core Commitments and Science Principles. Bringing our core commitment to science and our key strategic commitments together, is one of the most exciting and enduring approaches to science.

The successful delivery of the Geoscience Australia S*cience Strategy 2028* is underpinned by the quality and relevance of our science and how we best conduct it. Also important will be how the nation values and engages with our science, as well as the well-being and achievement of our scientists and our community of staff working both internally and externally.

To be the strongest, most resilient and trusted organisation it can be, Geoscience Australia has identified four commitments that is needs to deliver against:

• pursuing science excellence

• making the most of our data

• ensuring supportive stakeholders

• enhancing positive organisational culture.

Each of these four core commitments influence the culture and success of how the people in Geoscience Australia are able to conduct science.

Our core
commitments

Implementation Plan

01 Pursuing science excellence

Key Implementations

A systematic pursuit of science excellence includes identifying essential knowledge domains followed by recruiting, developing and training within these domains. As the complexity and diversity of science challenges increases, we also need to foster a culture of innovation and passion for science. Greater collaboration with all stakeholders is also vital to our systematic pursuit of excellence. Our national leadership role provides in-depth knowledge of the geology and geography of the Australian continent and marine and Antarctic territories. To do this we will continue to work with our partners in State and Territory governments, other nations, the various industries we support, and academia. We will also generate new partnerships to maximise the application of our science in new frontiers, particularly over the uncertain and rapidly evolving technological challenges of the 21st century. Our knowledge underpins our ability to provide authoritative and independent advice to government and broader Australian society.

1.1 Geoscience Australia Science Evaluations

An external evaluation of Geoscience Australia's science is important to ensure that the science underpinning our value and trust with stakeholders is of the required quality and is relevant to stakeholder's needs and concerns. It will highlight our strengths as well as aspects for improvement and change.

Following the 2015–16 Geoscience Australia Science Evaluations, the Geoscience Australia Advisory Board recommended a five year cycle of evaluation of the quality and relevance of our science. For the science evaluations, the science domains will be considered according to the science required to deliver within the six impact areas of *Strategy 2028*. Although science excellence has been traditionally recognised through numerical impact of scientific publications, this evaluation will also recognise that a large part of our impact on Australian society is through the provision of data, delivery platforms, reports and advice.

The Terms of Reference for these evaluation panels will be finalised by 2021 and panel interviews and engagement are planned for the 2021–22 financial year.

The science evaluations will not only include external panel interviews addressing a terms of reference but are also an opportunity to include a preliminary series of 'deep dives' providing status reports on priority criteria as a foundation to evaluate science excellence and relevance. These include 'deep dives' for: i) science capability and capacity mapping (including digital science); and, ii) a science stakeholder framework. These are further outlined in 1.2 and 3.1.

1.2 Science capability and capacity mapping

A clearly expressed portrait of Geoscience Australia's science capability and capacity is valuable to demonstrate our strengths, gaps, overlaps and dependencies. This will depict science fields of expertise strength and by identifying gaps can be used for planning future recruitment or the need to collaborate with external expertise.

Following a pilot capability and capacity mapping desktop study in 2019, a 'deep dive' as part of the 2021 science evaluations is planned. This will include initial staff workshops at the branch and division levels followed by a synthesis according to the six impact streams of *Strategy 2028*. This information can then be used immediately to inform the external evaluation panels about the portfolio of staff expertise available to deliver the science required for accomplishing *Strategy 2028*.

1.3 Geoscience Australia Graduate Program and growing staff capability

A strategically aligned and planned workforce is critical to ensuring high calibre and sustainable scientists at Geoscience Australia. Geoscience Australia's Office of Chief Scientist works closely with our Human Resources team in workforce planning, particularly for our science programs.

Our graduate program is a dedicated and engaging way to focus on the recruitment and development of early career scientists as part of workforce planning at Geoscience Australia. This is essential for maintaining a diverse and sustainable pathway for refreshing and developing science excellence and compliments other avenues for staff recruitment, including targeting specific high-level expertise as well as contract employment.

Following a 2019 review, the Geoscience Australia Graduate Program has been re-invigorated for a 2021 recommencement. This includes a one year graduate program with new recruitment rounds every second year. Graduates will be assigned to specific roles and placements at the start of their program, which specifically addresses targeted areas for expertise development to support their growth as scientists and as members of the Australian Public Service. The emphasis here is on recruiting graduates less than four years after graduation, where Geoscience Australia can help to develop their skills, knowledge and experience.
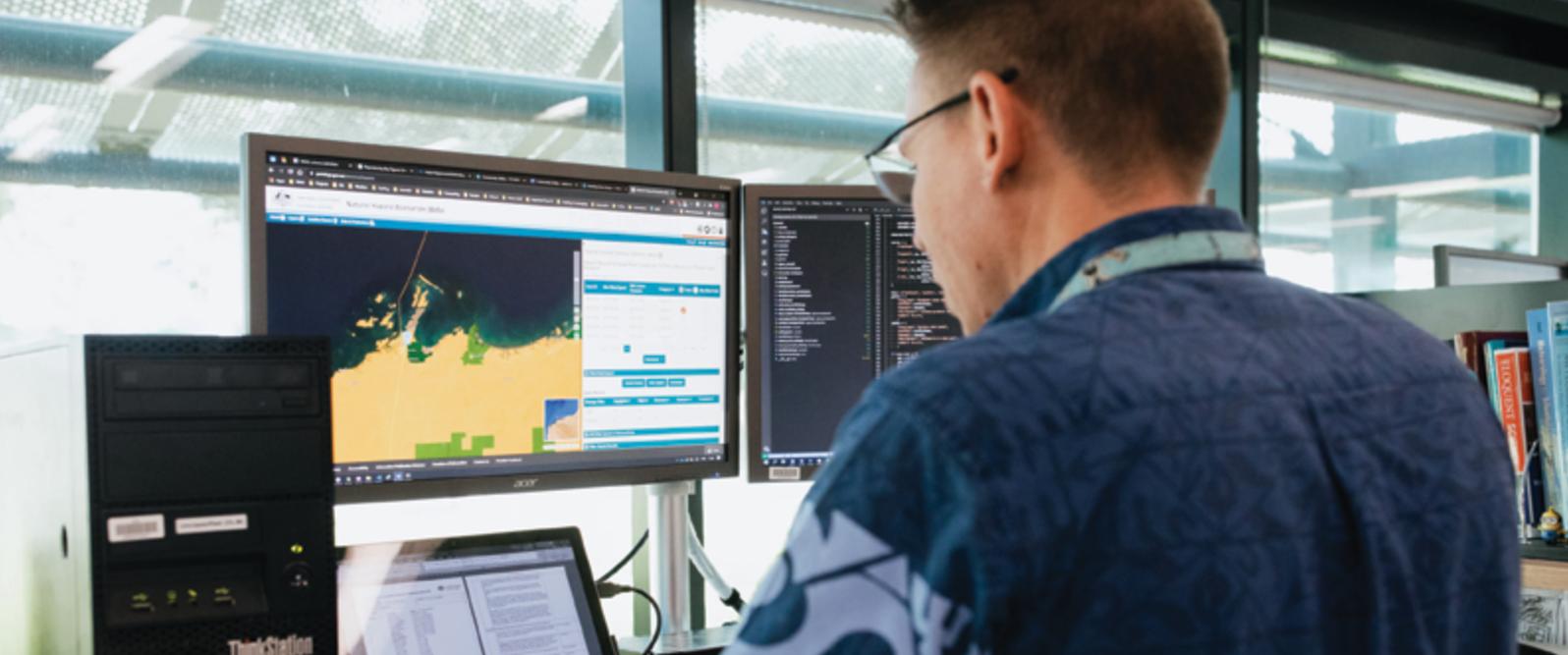
02 Making the most of our data

Key Implementations

2.1   Accelerate engagement with digital and computational science

2.2   Accelerate 'FAIR' data principles and greater quantification of uncertainty of our data

2.3   Innovative geoscience information and data delivery

Geoscience Australia's vast data holdings and future data acquisition plans provide opportunities to embrace 'big data' through emerging and rapidly developing technologies, such as computational science, machine learning (ML) and artificial intelligence (AI). This will help to resolve geoscience challenges that previously could only be partially addressed using small project datasets. This is either part of, or underpinned by, the implementation of high performance data architecture, including data storage optimisation, architecture modernisation and 'FAIR' (i.e. Findable, Accessible, Interoperable and Reusable) data principles through enhanced data stewardship and management practices. This will also make our data available to a wide and diverse range of users to respond to national current and emerging challenges and answer questions that we currently may not even know about. This requires the development of improved data access platforms that are based on user needs, international standards, common vocabularies and rigorous metadata, to make our data accessible to a broader cross-section of Australian society, many of whom are not necessarily geoscience experts. This can be shown in our geoscience portals that include built-in analytics and querying tools in how it is provided to users.

The strategic priorities here further support and are informed by Geoscience Australia's *Digital Strategy 2019–22* and *Data Strategy 2018–21* as well as national data strategies

and code of conduct including *Management of Data and Information in Research: A guide supporting the Australian Code for the Responsible Conduct of Research,* published by the National Health and Medical Research Council, Australian Research Council and Universities Australia.

2.1 Accelerate engagement with digital and computational science

The science and technology associated with data storage, access and utility is evolving along with our stakeholder demand for accessible and trusted data. To address this we need to systematically assess, and where appropriate, implement emerging technologies. Geoscience Australia is presently a partner of the National Computing Infrastructure (NCI), and needs to develop a future strategic plan for new geoscience applications that best utilise this technology and its benefits. There is also a growing investment world-wide in techniques to better analyse multiple and large datasets, such as using ML and AI. Finally, the adoption of cloud-native computing is poised to further transform the ways we can develop and deliver our geoscience digitally. To improve outcomes for stakeholders and ensure we are providing the best available advice we need to ensure that we actively engage with developments, skills and opportunities in computational science.

2.2 Accelerate 'FAIR' data principles and greater quantification of uncertainty of our data

Geoscience Australia aspires to deliberately manage the data lifecycle to promote FAIR data and in turn, trusted and usable data. This means we will: i) enhance our data governance and stewardship; ii) grow, support and reward good data management and practices; iii) continually streamline and enhance our data assets to allow us to create additional value and improved exploitation; and, iv) ensure that public good data is open unless there is good reason for confidentiality.

All of our data has a degree of uncertainty, particularly when extended to different scales. Appropriate procedures, skills and knowledge may reduce this uncertainty but we still need to be comfortable and competent at understanding, measuring and communicating the uncertainty of data and interpretations, information and advice derived from it. This will be important for understanding the confidence of data outcomes, but can also help design and target future data acquisition to where it can best reduce uncertainty.

2.3 Innovative geoscience Information and data delivery

Our digital data delivery platforms need to evolve along with the needs of stakeholders, but also as a way to diversify the stakeholders that are able to access and use the nation's geoscience data. This includes developing better data platforms which provide integrated data and analysis, and in the future digital twins and new collaborative work spaces for scientific data and decision support tools that integrate data, analysis and outcomes for stakeholders and policy makers. This includes the ongoing automation of our scientific workflows, our data delivery, our digital systems and information services (consistent with Industry 4.0 seen in manufacturing and industrial processes), where there is growing machine-to-machine (M2M) connection and the internet of things (IoT) integration for increased automation, improved communication and the analysis and diagnosis of issues.

Digital twins are virtual replicas of physical objects or systems, typically used to run predictive simulations of different scenarios. They have traditionally been applied to human-made infrastructure and systems, however they also have major potential for geoscience and Earth systems. An Earth system digital twin allows users to predict and better understand the Earth and future changes, particularly in how we may influence our lives. Digital twins of Earth system models and ultimately our continent and surrounding seabed will be based on high-quality 4D geospatial data, models and visualisations. Although a continental digital twin is a major future aspiration, in the meantime, it is important that our scientific outlook, data formats and systems are compatible with this aspiration.

03 Ensuring supportive stakeholders

Key Implementations

3.1   Develop a Geoscience Australia science stakeholder framework

3.2   Develop and deliver a framework and workflow towards best practice in land and marine access for our geoscience programs

3.3   Deliver a scientific outreach program of geoscience information and engagement including increasing delivery of geoscience into schools and other communities

We need to work to maintain the support we have from existing stakeholders whilst also engaging with potential new stakeholders to expand the application of our science to new frontiers. We can do both by employing systematic and deliberate approaches to our stakeholder engagements, focusing on understanding their experiences and needs as consumers of our knowledge, information and data. Critical to this is regularly seeking feedback and user analytics, to help us plan for and deliver greater benefits for Australia.

We have a long tradition of delivering national scale benefits for Australia's economy, environment and society, we continue to augment this. Alongside these positive impacts is the sheer wonder and breadth of the geoscience that we pursue on a daily basis. These three factors—wonder, breadth and positive impact—provide opportunities to raise our profile with a broader range of Australian society while also supporting the Australian Government's broader objectives. We do, however, need to balance these endeavours with our core efforts to pursue scientific excellence and to make our knowledge, information and data available.

3.1 Develop a Geoscience Australia science stakeholder framework

As part of the science evaluations, a 'deep dive' collation of our stakeholders and their characteristics will be undertaken. This framework reflects Geoscience Australia's commitment towards a strategic, consistent, and effective best-practice in how we engage our stakeholders. Sustaining, building and developing new relationships and trust with our stakeholders is vital to the ongoing sustainability and value of our work. It ensures that we are undertaking appropriate science to meet the needs of these stakeholders and that our trusted delivery of scientific data and information is fit-for-purpose.

Importantly, the framework will balance prescriptiveness (such that a consistent approach is adopted) with flexibility (such that the dynamic and individualistic nature of many stakeholder relationships are respected). The framework will firstly provide an awareness of our stakeholders and then principles and priorities for how we will engage with them. This overarching framework can then be linked to specific stakeholder engagement strategies for Geoscience Australia.

3.2 Develop and deliver a framework and workflow towards best practice in land, air and marine access for our geoscience programs

To conduct our science and further our understanding of the Earth, we regularly require land, air and marine access across Australia. This requires navigating complex legislative frameworks and building trusted relationships with stakeholders. To help facilitate this, Geoscience Australia's Land, Air, Marine Access (LAMA) team will guide future land and marine access, ensuring that stakeholder relationships are managed consistently across the organisation and in line with world's best practice. LAMA will work closely with internal stakeholders, other government agencies, land and sea country owners and other stakeholders to provide consistent, evidence-based advice and guidance to facilitate our activities in the field. LAMA will deliver access arrangements that balance our legislated requirements, standards, and policies as a Commonwealth entity, with the access processes and policies of our collaboration partners and the requirements and customs of traditional owners and other land holders.

In the short term LAMA aims to produce guides, templates and protocols to guide our activities in this area, ensuring that Geoscience Australia's approach to fieldwork and stakeholder engagement is consistent and coordinated. The success of LAMA is directly linked to the uptake and increased efficiency from the tools that we provide. These tools will assist the project teams in gaining timely land access, ensuring the success of the field work program and lasting positive public relationships.

3.3 Deliver a scientific outreach program of geoscience information and engagement including increasing delivery of geoscience into schools and other communities

The communication of our scientific data and information needs to demonstrate its value to stakeholders. This includes communication to our Minister and other parts of Government as well as broad communication consistent with Geoscience Australia's overarching mission. There is also the need for more specialised scientific outreach into the community, industry and researchers. As highlighted in Australia's National Science Statement, "the benefits of science can be fully realised only when society is fully engaged with science and science actively engages with society."

Examples here include our Education and Outreach program's efforts to grow geoscience awareness with students and teachers. We also conduct activities, events and exhibitions to promote our vast mineral and fossil collections from across Australia. This also includes geoscience information, events and publications supported by the library.

A key measure of success here includes an increase in the understanding of our roles, capabilities and expertise, and therefore a more focused demand for our geoscience data, information, digital platforms, engagement and advice. This activity requires close internal collaboration, particularly between Geoscience Australia's Corporate Division and the Office of the Chief Scientist.

04 Enhancing positive organisational culture

Key Implementations

4.1   Actively support diversity and inclusive science and scientists

4.2   Embrace indigenous science and its exchange with traditional science

4.3   Science and scientist engagement across generations from early career and into retirement

The sustained health and performance of any team is dependent on its culture, particularly during periods of change. Increasingly our geoscience is being utilised to address more complex challenges, including digital disruption, accessible and big data and social licence concerns (in both how our science is applied as well as how we conduct it). We need to embrace these changes as opportunities. To remain relevant and successful in this changing environment, Geoscience Australia must develop a culture of unity based on embracing a common purpose, change and collaborative approaches to our work, in particular, our science.

We must continue to nurture an inclusive culture, to ensure that all of us feel we can belong, that we are valued for who we are including our scientific knowledge, skills and experience, as well as provide equal opportunities to participate, contribute and progress. To maximise our opportunities for success we need to tap into the full breadth and diversity of expertise, people and talent that we possess across Geoscience Australia and our science partners. This not only makes us a better people and a better place to work but also improves scientific outcomes and innovations, such as through contributions from our cognitive diversity and the novel questions, new discoveries, and greater networks and connections that come from that.

Ensuring a safe work place is important to help our staff bring their best person as well as their best science into

the workplace. Physical as well as psychological safety and well-being is a high priority and this includes how we conduct our science. This includes how we interact with each other, authentic leadership, transparency and empowerment.

Safety also applies to how we collect and deliver our data and information in the field, the laboratory, the office environment and with external stakeholders. The way that we conduct our science can also create a range of mental challenges that require support for resilience.

4.1 Actively support diversity and inclusive science and scientists

The national challenges that require geoscience to address also requires the positive engagement of all of our staff to the best of their abilities. A key part of our strategy involves developing our diverse and inclusive workplace and drawing from the full pool of human talent. This is not only a key part of our *Strategy 2028* but is recognised in our *People Strategy 2017–22* and *Diversity and Inclusion Strategy 2019–22*.

Diversity is about accepting our individual differences and acknowledging the unique blend of knowledge, skills and perspectives each of us bring to the workplace. Diversity can include characteristics such as cultural background and ethnicity, age, gender, gender identity,

disability, cognitive difference, sexual orientation, culture, religious beliefs, language, mindset and education. Further diversity in science may come from characteristics such as professional skills, working style, location and life experiences. An inclusive culture is one whereby everyone feels valued and respected and is able to fully contribute. It is about removing barriers to make sure everyone can fully participate in the workplace and have equal access to opportunities. Inclusion is about empowering people to contribute their skills and perspectives for greater team performance and outcomes.

Our active support here includes taking opportunities to raise awareness of and promote diversity and inclusion in our science and the benefits that this brings. This includes building on our Inclusive Culture Program and supporting communities, such as within Science in Australia Gender Equity (SAGE), Gender Equity Network Geoscience Australia (GENGA) and our Reconciliation Action Plan (RAP) Working Group. We are committed to ensuring that new staff feel welcome and encouraged to engage and that we show an interest and value in the life experiences that they bring to our workplace. Success here will be expressed as greater employee engagement, improved performance, greater innovation, retention of talent, improved employee wellbeing and lower levels of behaviours in conflict with our values and APS Code of Conduct, such as harassment and discrimination. Diversity in our stakeholders, including how Geoscience Australia engages with diverse audiences is an important external-facing consideration. Examples of this is the Education and Outreach team's engagement with and participation in Science Technology Australia's Girls in STEM program, as well as education programs extending into aboriginal and remote communities.

4.2 Embrace indigenous science and its exchange with traditional science

Indigenous science incorporates traditional knowledge and perspectives that have built on thousands of years of observation and experimentation with more conventional scientific methods. Indigenous science is typically expressed as know-how, practices, skills and innovations. Though mostly recognised in applications for agriculture, land management, ecology and medicine, indigenous science has emerging potential in geoscience. It is important for us to commit to the exchange and integration of science skill and knowledge between indigenous communities and Geoscience Australia's science programs and projects.

Examples here may include knowledge of environmental change on long and short timeframes, the location and distribution of attributes of country such as water, Earth materials and linkages with flora and fauna. It is also important to acknowledge indigenous data sovereignty, such as part of the Global Indigenous Data Alliance's CARE principles (Collective benefit; Authority to control; Responsibility; and, Ethics) and the *Australian Institute of Aboriginal and Torres Strait Islander Studies Act 1989* for

ethics and protocols relating to Aboriginal and Torres Strait peoples and collections.

The outcomes here are closely aligned with our *Reconciliation Action Plan (RAP)* as well as our *Diversity and Inclusion Strategy*. It especially acknowledges that there are diverse ways of observing the Earth and accounting for its characteristics and processes, and that there is value in all of these perspectives.

4.3 Science and scientist engagement across early career and into retirement

Our contributions to science come from people across all stages of their careers and life experience, ranging from school and university students, through our staff at all levels and experience, and for people heading towards and after retirement from paid work.

Examples include the Education and Outreach program that includes formally trained educators and science communicators, as well as a diversity of scientists at all career stages involved in outreach activities. Our volunteer program is also incredibly diverse, spanning those at the beginning of their careers through to retired and emeritus staff. In managing Geoscience Australia's staff capability, this applies to the early career intake of our Graduate program as well as recognising the contributions and legacy of our more experienced scientists.

Key measurables
for this strategy
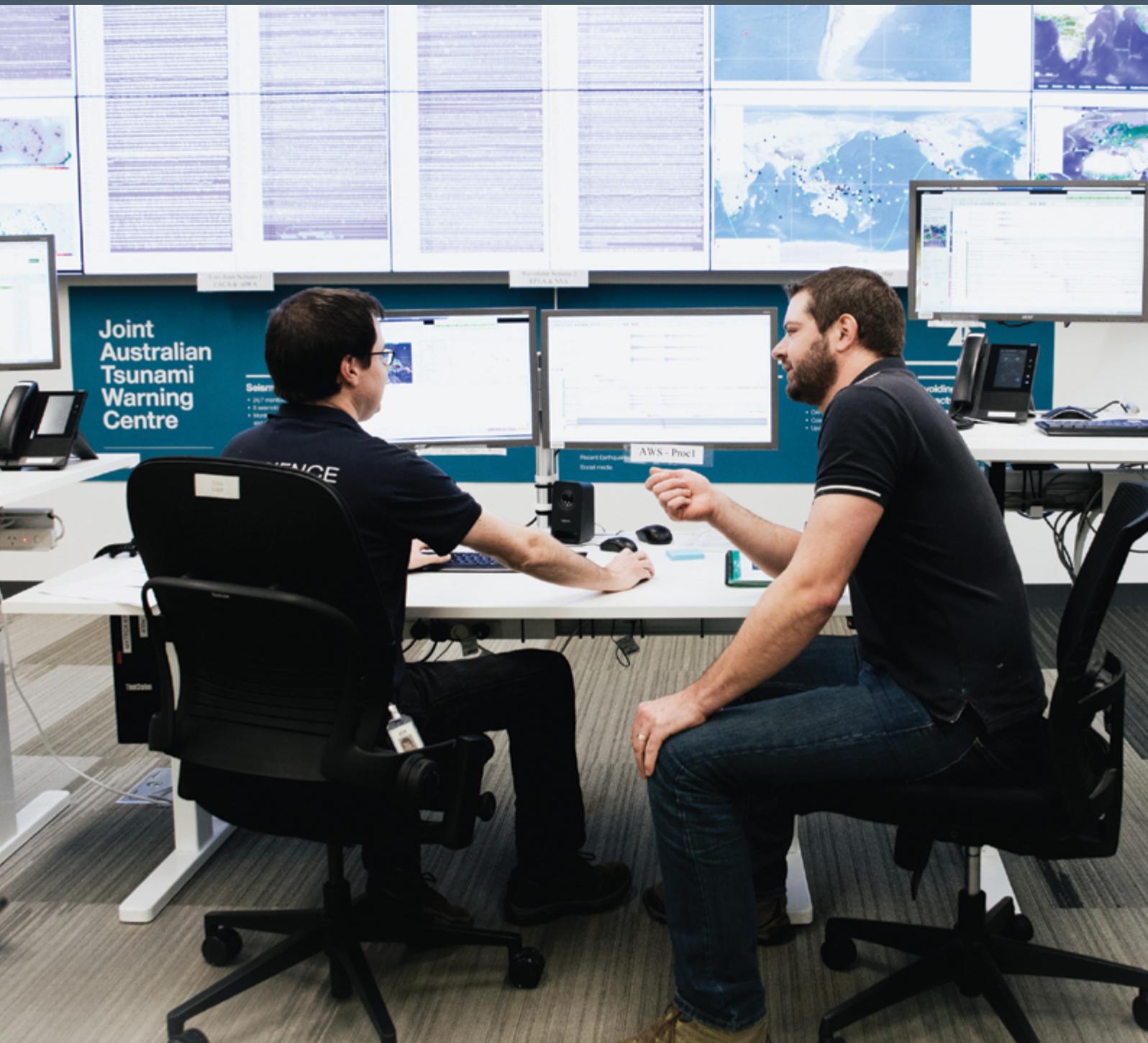
Science Strategic Priority	Key Measurable (output and outcome)	Timing
1.1 Geoscience Australia Science Evaluations	• Report on the quality and relevance of our science • improved and sustainable science	2021–22 and 2026–27 with lead-in preparation
1.2 Science capability and capacity mapping	• Report and mapping of our science capability and capacity • Identified gaps, overlaps and dependencies for science capability	2021 and 2026
1.3 Geoscience Australia Graduate Program and growing staff capability	• Recruitment and completion of satisfied early graduates and graduates • Appropriate skill and knowledge of scientists	Every 2nd year from 2021 onwards
2.1 Accelerate engagement with digital and computational science	• Digital science 'deep dive' report • Adoption and geoscience leadership of digital and computation science applications	Ongoing but with 2021 and 2026 'deep dives'
2.2 Accelerate 'FAIR' data principles and greater quantification of uncertainty of our data	• Standardised expression of uncertainty for more useful data	Ongoing
2.3 Innovative geoscience information	• Increasing access to data platforms and automation of scientific workflows, data delivery, digital systems and information services	Ongoing
3.1 Develop a Geoscience Australia stakeholder framework	• Report and mapping of our key stakeholders • A ten-fold increase in engagement with stakeholders across Geoscience Australia's digital platforms	Ongoing but with 2021 and 2026 "deep dives"
3.2 Develop and deliver a framework and workflow towards best practice in land, air and marine access for our geoscience programs	• Clearly articulated workflows with program of staff training and awareness and universal adoption • Increasingly cited and recognised best practice land and marine access framework to protect Geoscience Australia's social licence and benefits of Geoscience Australia's science outcomes	Ongoing with annual review
3.3 Deliver a scientific outreach program of geoscience information and engagement including increasing delivery of geoscience into schools and other communities	• Program of new material releases with site and Geoscience Australia visits from schools and communities • Ensure all teachers are equipped with knowledge and resources to increase the participation of future generations in science, technology, engineering and mathematics	Ongoing with annual review
4.1 Actively support diversity and inclusive science and scientists	• Leadership and engagement in national programs • Improved staff wellness and science quality	Ongoing
4.2 Embrace indigenous science and its exchange with traditional science	• Awareness and engagement of indigenous science and Geoscience Australia's RAP • Two-way expressions and combination of science perspectives for our country	Ongoing
4.3 Science and scientists engagement across generations from early career and into retirement	• Ongoing programs of volunteers, citizen science, and respectful retirements.	Ongoing