Submission
2016 National Research Infrastructure Roadmap
Capability Issues Paper

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General comments

DEWNR is a large state-based organisation with a broad business across all facets of natural resource management. DEWNR is highly dependent on scientific information to support decision making (policy and management decisions). While DEWNR have an excellent and significant agency-based scientific capability to meet our scientific information needs, we are placing increasing emphasis on the value of partnerships with other agencies and research institutions to support the delivery of science to support our decisions. Developing and maintaining partnerships with research institutions provides two key benefits to DEWNR:

a) it enables DEWNR to support the design of research programs that best meet the local, context-specific science needs for decision making at state, regional and local scales; and

b) provides an avenue for DEWNR to engage with the broader environmental research sector, through the national and international networks that partner research institutions provide, and thereby draw in research information that is generated outside of, but that is still relevant to, South Australia.

To best support DEWNR's data needs, we recognise that there is a need for better coordination across research institutions, government and industry to improve alignment across distributed monitoring infrastructure facilities, methodologies and standards, and data platforms. This would create better and more accessible environmental data and could facilitate a better use of limited funding by coordinated state and industry co-investment.

The research community should not be the sole decision makers for what a national research infrastructure program should contain. Federal and State governments are the policy makers and links to on ground land and coast and marine managers. National infrastructure to support sustainable development, conservation, adaptation to climate change, and regional and urban communities through environmental change is critical. Collaboration in developing the scope of these is also critical.

Question 1: Are there other capability areas that should be considered?

The development of capabilities by the National Collaborative Research Infrastructure Strategy (NCRIS) to create applied products that are based on the integration of data for management use would be highly useful additional capabilities to add to the existing infrastructure. This should also include the integration NCRIS data with other Australian Government data infrastructure such as BOM and GeoScience Australia to provide products for decision making. For example, integration

of data for management use would be beneficial for Natural Resources Management, where soil, water, climate, biosecurity, native vegetation and biodiversity data are all required.

In addition, Agriculture and Food Security should be considered as a specific capability area, under the Environment and Natural Resource Management capability. Agriculture and Food production is a critical Australian industry (> 20% GDP) and represents a significant national scientific agenda across many research organisations including the CSIRO, universities, primary industry state and territory government departments, research and development corporations, and industry.

At least four of the National Research Priorities are underpinned by Environment and Natural Resource Management infrastructure. Extending NCRIS investment to better support Environment and Natural Resource Management would strengthen almost all other NCRIS capabilities, and leverage investment in eResearch through reducing duplicative parallel investments in other Australian Government departments. In addition to supporting the Australian Government, co-investment from other beneficiaries of research undertaken, such as the states, territories and universities, is key to maximising infrastructure use and re-use.

Question 2: Are these governance characteristics appropriate and are there other factors that should be considered for optimal governance for national research infrastructure.

National research infrastructure needs to be designed to facilitate an adaptive national research capability that can address the changes, demands, and challenges the future will present. This is best achieved by ensuring the individual facilities form an interactive system of capability, ultimately enabling wide application by organisations both public and private. Hence the governance models for individual capabilities need to include consideration of effective measures for interacting with other facilities. It is also worth considering the creation of an overarching Infrastructure Council made up of senior representatives from each area to achieve greater coordination as well as engagement opportunities towards interdisciplinary application organisations.

Question 5: Should research workforce skills be considered a research infrastructure issue?

Yes – see question 7 answer.

Question 6: How can national research infrastructure assist in training and skills development?

Being more focused on user needs and uses of the knowledge create by the infrastructure and less on that of the research institutions housing the infrastructure.

Question 7: What responsibility should research institutions have in supporting the development of infrastructure ready researchers and technical specialists?

Infrastructure ready researchers and technical specialists also need to be ‘change’ or ‘evolution’ ready – institutions shouldn’t just be teaching researchers/technical specialists to be infrastructure ready, but also how infrastructure needs to change to support evolving needs. Fundamentally researchers need to work more closely with end users of the research.

Question 8: What principles should be applied for access to national research infrastructure, and are there situations when these should not apply?

National research infrastructure should put Australia at the forefront in its capability to adapt new data and technology that supports our government in addressing the 'long term' questions. In the case of NCRIS this is the environment and supporting sustainable development.

Question 10: What financing models should the Government consider to support investment in national research infrastructure?

Critical infrastructure needs to have longevity of support and business owners need to be identified. In the case of research institutions like CSIRO and Terrestrial Ecosystem Research Network (TERN) hubs, some minimal operational funding needs to be guaranteed to ensure that the infrastructure is managed. Many partners invest in NCRIS infrastructure and the lack of long term security will reduce the effectiveness, uptake and co-investment of these systems.

A transparent process for determining which infrastructure projects continue is required. This should be based on criteria that includes the usefulness of this infrastructure for government policy and decision making, as well as production of products used by stakeholders for decision making.

The financing model also needs to include criteria around research infrastructure that allows effective access to enable research capability by all who can use it - not just the provision of collections of equipment.

The approach to funding national research infrastructure through the NCRIS programs has been effective in providing access and in attracting significant cash and in-kind co-investment from state and territory governments, government agencies, universities and research institutes. It has also reduced waste by enabling implementation of agreed infrastructure without costly duplication.

Funding models can encourage application of 'enabling' infrastructure by funding outward facing business analyst/intelligence that assesses how a facility might best be incorporated into a work flow or business application. This attracts partner investment and ensures the usefulness of the infrastructure.

Environment and Natural Resource Management

Question 18: Are the identified emerging directions and research infrastructure capabilities for Environment and Natural Resource Management right? Are there any missing or additional needed?

Fit for purpose data

In local, state and Australian government, the transition to open data for transparency and re-use presents particular challenges regarding fit for purpose data. For example, policies, plans, actions, and targets require data and monitoring to be aligned to specific purposes. This means data infrastructure is more than just a means of storing and sharing data, but needs to ensure everyone can understand the usability of the data irrespective of its origin and initial purpose.

Some of these challenges include:

- Government needs for ecosystem science data resources vary from those of research/academia and this creates challenges.

- Data for science/research does not equal data for policy/reporting, despite often both drawing on the same sources or informing each other.
- Open data for purposes unknown and new science, is different to open data for purposes known and transparent.
- Governments have different legacy systems and different capacities to maintain and evolve them.

Considerations or opportunities for improving infrastructure capabilities with regard to fit for purpose data:

- Programs such as NCRIS must be leveraged by public agencies as well as academia.
- Communities of data management best practice must be fostered as 'social infrastructure' to 'make the most of data resources'. Availability of technology is only part of the story for developing science data with long term capabilities.
- Open data policies can help inform and design interoperability through encouraging good data and metadata management.

Importance of integrated research infrastructure

The emerging demand for natural resource data integration and synthesis requires the establishment and long term maintenance of a diverse array of research infrastructure capabilities, and specific resourcing for integration. This will result in whole-of-system thinking to enable interdisciplinary problem-solving that manages our emerging and increasingly complex future environmental risks.

The foundations for much of this essential integrated environmental research infrastructure and synthesis capacity have already been built through previous NCRIS investment in Terrestrial Ecosystem Research Network (TERN). Examples of this long term investment that have been beneficial for DEWNR include:

- enabling Australian researchers to take a leading role in the development of the international IUCN Red List of Ecosystems and enabling the Australian Government to meet its reporting commitments for this process
- helping Australia meet its Sustainable Development Goals through remote sensing and better estimating Australia's carbon and water fluxes at the continental scale
- enabling more accurate reporting to the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto, and measure progress against emissions targets, by coordinating the establishment of Australia's Biomass Plot Library
- North Australian Fire Information (NAFI) system which uses remote sensing data to help manage fire
- ensuring Australia has an influential role in two major international FAO programs, the Global Drylands Assessment and the Global Forest Survey
- sharing data with NASA which helps deliver precise information on the water and carbon exchanges everywhere on Earth's surface, vital for climate change forecasting

- Identification of the relative sensitivity of South Australia's six biodiversity hotspots to the impacts of climate change, under the first-ever systematic mapping of the State's plant biodiversity using a composite of TERN data and state herbarium records

DEWNR partners in many data sharing networks at the national level across most of our NRM data themes. Many of these are overseen by national coordinating groups. Importantly, they provide an avenue for common agreement on data standards and sharing that enables Open Data to be delivered in a way that is mutually acceptable at a state and national level.

Ongoing support and recognition of the importance of long term Environment and Natural Resource Management research infrastructure is a key concern for DEWNR, as a contributor that relies upon these systems. This is discussed in further detail under the themed headings below.

Soils

- Proposed national sensor networks in the issues paper do not address the full range of needs and uses for improved soil information, which underpin a variety of other scientific disciplines and social and economic outcomes. This is an area that Australia has fallen behind the rest of the world and has a substantial need to improve.
- Our national soil information system is underrepresented in the issues paper. Recent investment in the TERN Soil and Landscape Grid of Australia Facility has provided valuable development, demonstration and delivery of next-generation finer-resolution, more user-friendly soil attribute mapping. However these represent Version 1 products and ongoing support for capability and infrastructure is required to improve information and knowledge of soils, which ultimately support diverse science, management and policy outcomes.
- South Australia contributes our soil site data to Australian Soil Resource Information System (ASRIS), managed by CSIRO, for open access and for use in generating Australia's digital soil mapping SA is in negotiations with CSIRO who manage the National Soil Archive on how SA soil specimens could be housed in the National Archive or for our state data to be included in the National Virtual Soil Archive (similar to that which exists for State Herbaria AVH).
- The era of 'Big Data' has arrived for soils. There is a need for an infrastructure capability and protocols to be able to utilise the wealth of information being collected on soils through precision agriculture by private individuals and companies to develop new analyses and products that improve our understanding of soils and how to use them to their full potential while managing them for the long term. These needs are captured in the ***National Soil Research, Development and Extension Strategy*** (https://soilstrategy.net.au/wp-content/uploads/National-soil-RDE-strategy.pdf) and align with priorities of the Ecosystem Science Long-Term Plan.

Biodiversity and Vegetation Data

- DEWNR is reliant on the following biodiversity and vegetation data infrastructure and supports their continuation:
    - Atlas of Living Australia (ALA) a public data portal – DEWNR delivers SA biological observations data to the ALA regularly and relies on it as an additional delivery platform.

- Australia's Virtual Herbarium (AVH) – Through the Australian Government Heads of Australian Herbaria (CHAH), DEWNR is committed to supplying collection data to Australia's Virtual Herbarium which is hosted on ALA.
- Australian Ecological Knowledge and Observation System (AEKOS) – DEWNR has a partnership agreement with Adelaide University as part of NCRIS and funded TERN program. This results in detailed SA Biological Survey and Roadside Vegetation data (not accessible through ALA) being openly accessible through the AEKOS portal
- National Vegetation Information System (NVIS) – DEWNR contributes our native vegetation mapping data under open access licencing into the federated national vegetation information system. The Australian Government Department of Environment manages this program.

Landuse

DEWNR shares a memorandum of understanding with all states, Australian Government Department of Agriculture, CSIRO, Geoscience Australia (GA), Bureau of Metrology (BoM), Australian Bureau of Statistics (ABS), TERN to compile and share catchment scale land use data through ACLUMP as well as maintain the Australian Land Use and Management (ALUM) classification. SA Government Chairs (NCLUMI), the national coordinating group that provides strategic direction for ACLUMP.

Water

In the context of existing collaborations WIRADA should be acknowledged - http://www.bom.gov.au/water/about/waterResearch/wirada.shtml, which is a BOM/CSIRO research partnership.

- Data and information supplied to BOM is re-used where possible by other Australian Government agencies, such as the Murray Darling Basin Authority, to meet their data requirements.
- DEWNR provides Geoscience Australia with detailed stream information in GIS format for integration with the Geofabric dataset for Australia.

Question 19: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

Marine environment modelling and simulation capabilities need to be maintained and built in partnership with international research organisations that hold specialist experience in this research capability space, such as *The Nature Conservancy* (see 6.2.2).

The US Administration has recently issued a call to action, highlighting the need for better soil information systems to help secure the future of its soil for food production, climate mitigation, among other critical roles. New investment in remote sensing and national sensor networks to gather soil information should be integrated with investment in more traditional expertise that could be funnelled through a revamped Australian Soil Resource Information System (ASRIS) (see 6.2.3).

Data for Research and Discoverability

Question 33: Are the identified emerging directions and research infrastructure capabilities for Data for Research and Discoverability right? Are there any missing or additional needed?

Chapter 11 highlights the importance of data as research in its own right. The ability to access and utilise these data outputs are essential for government and industry as well as the research community. The capabilities required to enable such access and use, is a key requirement of future capabilities – in addition to the data and technology elements this will also need to cover licensing/conditions of use, etc.

A full suite of data models and metadata tools are needed for research themes and topics discussed in section 11.3. While this would be immense, the full suite could be considered infrastructure. At the moment its 'piece meal' topic by topic – do we have everything covered and relatable? Ideally this would occur along the line of the 'mapping' shown in Attachment C.