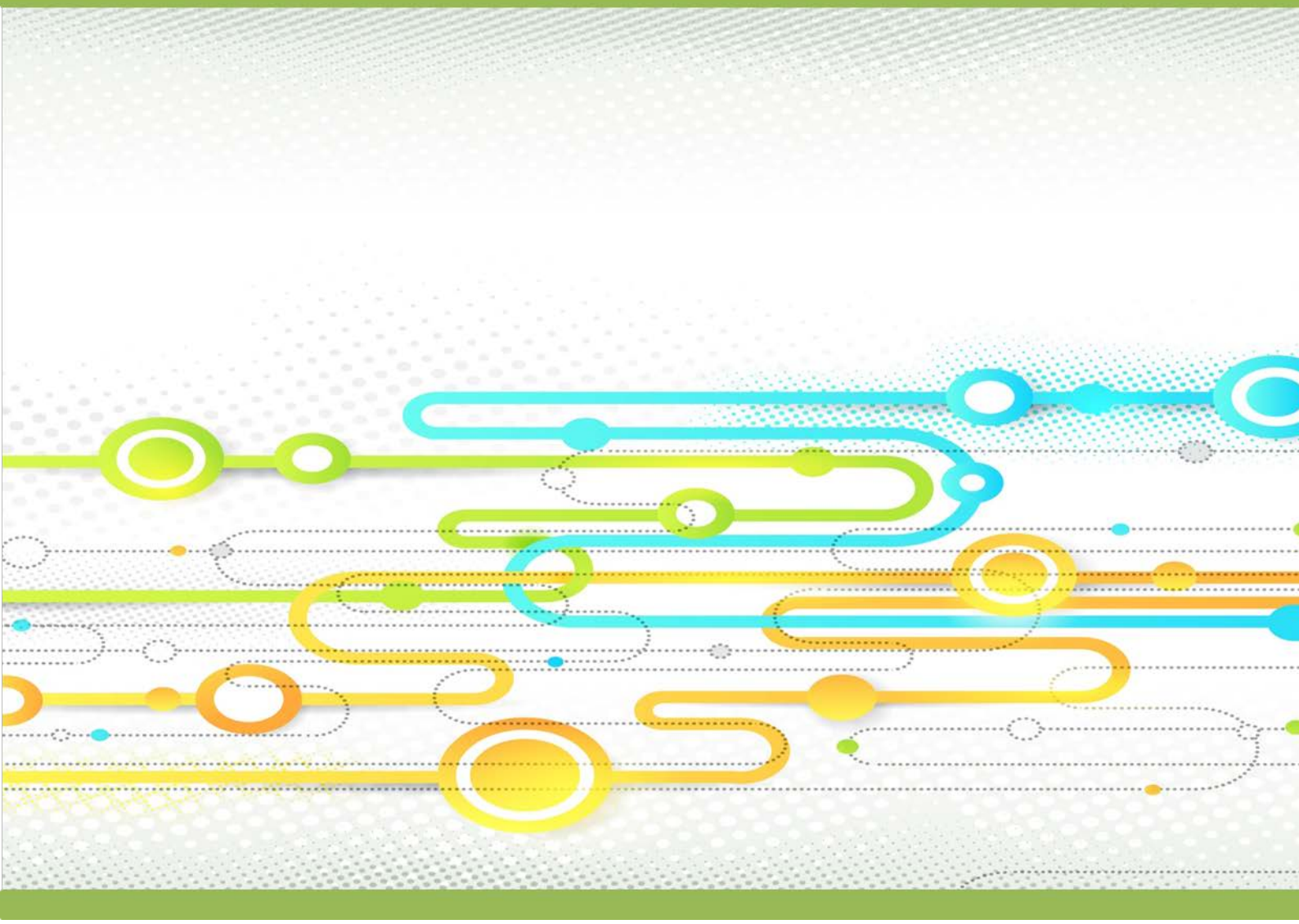
Australian Government

National Environmental Information Infrastructure Roadmap 2014-2019



Contributing to the Australian Government National Plan for Environmental Information initiative

National Environmental Information Infrastructure Roadmap 2014 – 2019. Version 2.0
Environmental Information Programme Publication Series, document no. 6

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Citing this publication

Bureau of Meteorology (2015), National Environmental Information Infrastructure Roadmap 2014-2019, Version 2.0, Environmental Information Services Publication Series, Bureau of Meteorology, Canberra, Australia, pp. 18.

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Executive Summary

The National Environmental Information Infrastructure (NEII) Roadmap provides a high-level direction on the design and build of a federated environmental information system for discovery, access and re-use of national environmental data. It is being developed under the auspices of the National Plan for Environmental Information (NPEI) initiative, which aims to improve the quality and accessibility of Australia's environmental information.

The Roadmap documents the high-level drivers for an NEII, provides an overview of the NEII, and outlines the planned deliverables and their timing. It is framed around five focus areas: (i) communication, (ii) engagement, (iii) policies and frameworks, (iv) data management, and (v) the build of operational IT components. The NEII Roadmap sets a 5 year path for the NEII for the period 2014-2019 and will be revised annually along with the NEII programme plan with guidance and input from the NEII Reference Group.

1 Introduction

Governments, industry and the community need access to comprehensive, trusted and timely environmental information to inform assessments and decisions about how development of Australia's natural resources might proceed and what impact development and use might have on our environmental assets. The National Plan for Environmental Information (NPEI) initiative was established in 2010 to improve the quality and accessibility of Australian environmental information. The initiative is being jointly implemented by the Bureau of Meteorology (the Bureau) and the Department of the Environment. A core activity under the initiative is the development of a National Environmental Information Infrastructure (NEII) to improve discovery, access and re-use of national environmental data.

This Roadmap describes the high-level drivers for an NEII, provides an overview of the NEII, and outlines the initial programme of activities required to develop the NEII over the period 2014-2019. These activities are framed around five focus areas: (i) communication, (ii) engagement, (iii) policies and frameworks, (iv) data management, and (v) the build of operational IT components.

Figure 1 outlines the core elements of the NEII Roadmap, including the vision for the NEII (the what), the benefit (the why) and a high level overview of the programme of activities to be undertaken (the how and who).

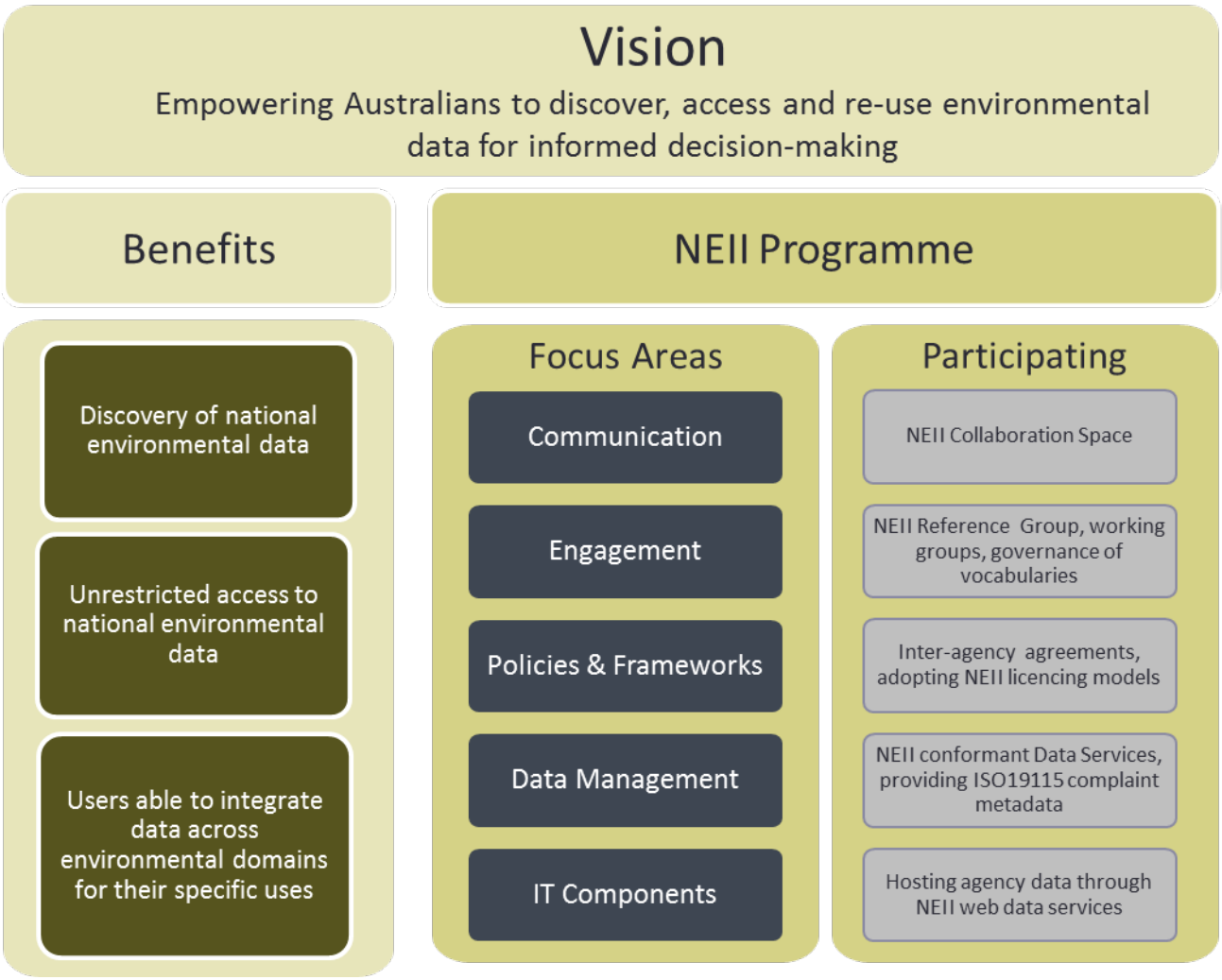

Figure 1: NEII – Vision, benefits and programme focus areas

2 Why is a National Environmental Information Infrastructure necessary?

Australia invests significant resources in environmental data acquisition, management and publication through the activities of many organisations. At the commonwealth level this includes the breadth of weather, climate and water data managed by the Bureau of Meteorology; earth science and national mapping data from Geoscience Australia; and other data from agencies including the Department of Agriculture and Water Resources and the Department of the Environment. State and Territory agencies are also major producers and custodians of environmental data including for example soil mapping, air quality and ecological observations; and land use mapping. These data are often typically aggregated at a national scale to produce compendium data products. Investment in environmental data acquisition also occurs through other national programs, for example by:

- research and research infrastructure investment supported by the CSIRO, the National Collaborative Research Infrastructure Strategy (NCRIS), the National Environmental Science Program (NESP); and the Cooperative Research Centres (CRC) programme
- catchment management authorities through developed natural resource management grants

Although environmental data are abundant, users are typically hampered by an inability to discover, access and re-use the data. It often exists only within individual agencies to support internal business requirements or within individual environmental domains. Consequently, enabling discovery, access, and re-use across domains (e.g., air, land, oceans, and water) remains challenging. Where data can be found, gaining access can introduce new challenges because not all data custodians are equipped for data provision and outreach services; data may utilise proprietary file formats; or large data volumes makes delivering data difficult. Finally, the absence of standards introduces a challenge when users attempt to re-use data and lack the domain specific understanding to make informed decisions around its quality and fitness-for-purpose.

Ultimately improved discovery, access and re-use of environmental data will improve our ability to address a suite of major environmental management and decision-making requirements. Foremost of these is our ability to efficiently address our nation's legislative responsibilities around State of the Environment (SoE) reporting in a manner that is informed by timely, consistent and accessible environmental data. Beyond SoE reporting there are other major environmental management requirements that will benefit from an effective NEII. This includes monitoring and evaluation requirements underpinning national environmental stewardship programmes, and supporting compliance activities under the Environmental Protection and Biodiversity Conservation Act. Benefits of a functional NEII will extend beyond commonwealth government requirements to a suite of applications in industry, research and education.

The breadth of national and international use-cases for improved discovery, access and re-use of environmental data across sectors are further detailed in the Statement of Australian Government Requirements for Environmental Information (AG-EIAG, 2012).

3 Benefits

The benefits to be realised from a distributed environmental information infrastructure for Australia include:

- data available directly from the data custodian through web data services improves user confidence in the results from any analysis
- more informed decision-making that uses the best available environmental data from multiple domains
- legal and policy obligations, public safety and business needs can be better met through the delivery of interoperable data across environmental domains
- providing better public access to government environmental data supports the development of new industries, such as new software applications
- real-time delivery of data without delays and/or interruptions which are associated with manual processes or out of date technologies
- reduction in resources required to process data on a regular basis
- eliminates duplication of data storage
- improved discovery and access provide users space to focus on analysis and synthesis activities.

4 Broader Information Context

Development of the NEII recognises the importance of improving transparency and access to government data and information. Its objectives align with those of the international Open Government Partnership and Australia's activities in this space including the recent Declaration of Open Government; data.gov.au; Gov 2.0; The Australian Government's Big Data Strategy; and principles championed through the Office of the Australian Information Commissioner's Principles on Open Public Sector Information.

Related activities across government including the Foundation Spatial Data Framework are also important given their focus on standards, interoperability and governance to improve spatial data delivery. From an environmental context, the NEII is also well positioned to support the Government's streamlining of environmental approvals through the provision of consistent high quality environmental data to stakeholders. The national and international focus on data and information transparency will play a defining role in the organisational, policy and technical implementation aspects of the NEII.

Case Study: Land use mapping, Department of Agriculture and Water Resources

To compile the Catchment scale land use of Australia, the Department of Agriculture and Water Resources retrieves data files provided by the states in a variety of ways: email, DVD, hard drive, FTP, etc. The data is then taken through a well-defined quality assurance process. Thanks to the standards developed by the Australian Collaborative Land Use and Management Program and adhered to by its partners, the Department is able to minimise the effort required to compile data from all providers into a common format. The data is analysed and stored for internal use. The Department then compiles data annually into a national composite releasing it publically as a downloadable dataset and map in a number of ways including as NEII conformant web data services, via data.gov.au and the websites Land use and management information for Australia and the Australian Soil Resources Information System.

"*It is likely that data usage will increase and cost of delivery will decrease by making national land use data available through an NEII data service. It will create an authoritative source of data which has appropriate version control, provides a single point of truth and continues to establish the Department as the national custodian of land use mapping data. The more our clients access and use our data, the greater the benefits the product will deliver."* Department of Agriculture and Water Resources, 2015

5 What is a National Environmental Information Infrastructure?

The NEII is a framework to improve the effectiveness and efficiency of finding and using environmental data. Its primary focus is on the discovery and re-use of national environmental data that is already well-managed, but that currently has limited application beyond its original business purpose. The NEII is envisioned as a federation of environmental data nodes adopting standards for interoperability. In common with spatial data infrastructures, the NEII encompasses common data models, exchange formats and standard network protocols along with federated catalogues of uniform metadata descriptions. What it adds to this suite of enablers is standardised models for describing environmental measurements, monitoring sites and methods used to observe the environment. These design elements are more fully described in the NEII Reference Architecture (Bureau of Meteorology, 2014).

6 Who is Building the NEII?

The Bureau of Meteorology is leading the development of the NEII, working in partnership with a number of Australian Government organisations through the NEII Reference Group. The Bureau's role is to provide the core coordination and integration infrastructure as well as the governance and collaboration framework for its development and operation. Other essential roles in the NEII include data providers, service providers, domain authorities and information users.

The vision for the NEII can only be realised through strategic collaborations with the broader environmental information community. In particular, this includes those agencies that produce and manage environmental data or use environmental information to support their business needs.

7 NEII Programme Objectives

- To improve discovery, access and re-use of national environmental data.
- To develop a standards-based federated environmental information platform for Australia that can support multiple application use cases.
- To establish partnerships, policies and frameworks, and governance arrangements for coordination, adoption and sustainability of the NEII.

Case Study: Australian Gridded Solar Climatology, Bureau of Meteorology

Solar exposure is the total amount of solar energy falling on a horizontal surface. The Bureau of Meteorology has been measuring a range of solar parameters for several decades. The development of a new high quality observation system, which first became operational in 1993, has also facilitated the measurement of one minute solar statistics.

Prior to the implementation of a NEII conformant web data service, solar data were available from the Bureau of Meteorology through manual approaches such as: request for data for a cost-recovery charge; free downloadable ASCII format files suitable for ingestion into a Geospatial tool; and manual provision of data to Geoscience Australia to upload to the Australian Solar Energy Information System Online.

Having an NEII conformant web data service now provides benefits to users of the data who can more efficiently download a range of the latest gridded solar climatologies directly into a GIS tool for analysis. The user group extends to applications such as the Australian Renewable Energy Mapping Infrastructure (AREMI) who will access the Bureau-hosted data directly through their portal.

The NEII Viewer and NEII Catalogue provide access of the Australian Gridded Solar Climatology NEII data services.

8 NEII Programme Focus Areas

8.1 Communication

Communicate the strategic and technical dimensions of the NEII to create partner awareness and capability to participate

The NEII vision is complex, consisting of multiple stakeholders, modular ICT components, a range of environmental information types and a long-term vision to develop a federated environmental information system for Australia. Developing effective communication processes and strategies will be critical to garner stakeholder input, secure involvement, influence change within organisations and inspire potential collaborators with the NEII vision. Communication activities under the NEII will aim to:

- build a shared vision for an NEII
- raise awareness and understanding of what the NEII is doing
- stimulate coordinated and/or collective action to build and sustain an NEII
- seek feedback, and systematically build confidence amongst stakeholders.

Key activities under this focus area include the development of stakeholder communication material including overview documents such as the NEII Roadmap, information sheets and conceptual graphical overviews to communicate NEII principles to non-experts. The primary deliverable will be an NEII web and collaboration space to provide a central point of access to NEII resources. In addition to hosting core-NEII communication material, the web and collaboration space will allow partner organisations to contribute and maintain content through web enabled collaboration tools.

Milestones	By
Release of the Consultation Draft of the NEII Reference Architecture and initiate a Consultation Process	**Q1 2014**
Publication of the NEII Reference Architecture	**Q2 2014**
Release a draft Roadmap for NEII development	**Q2 2014**
Launch the NEII web site as the key communication and collaboration mechanism	**Q2 2015**
Release collaboration tools under the NEII web site	**Q2 2015**
NEII user guides and technical documentation published online with component build schedule (e.g., NEII data service user guides for specific services)	**Q1 2016**

8.2 Engagement

Establish and sustain cross-agency partnership to develop and sustain a functioning NEII

The NEII will be initially designed, championed and managed by the Bureau's Environmental Information Services Program. However, its ongoing impact will only be realised through technical and strategic engagement with the environmental information community. This includes engagement with policy and operational agencies, and the research sector. Combined with the NEII's federated approach to information systems development, collaborations will be central to delivering a functional and sustainable infrastructure. The NEII will develop formal collaborations early in its inception to:

- test and demonstrate value in applied settings
- jointly establish a strategic agenda
- build a sustainable model for ongoing deployment.

The primary formal engagement mechanism for the NEII will be the NEII Reference Group. The purpose of this group is to (a) provide implementation advice to the Bureau of Meteorology's NEII Programme, (b) provide a cross-agency forum to assist in the development and implementation of a strategic agenda for the NEII, (c) establishing a community of practice to support agencies to implement NEII, and (d) form working groups to address specific issues arising from the NEII programme. The reference group will report regularly to the Australian Government's Environmental Information Advisory Group.

Milestones	By
Establish a NEII Reference Group. Inaugural meeting held in September 2014, with on-going commitment to quarterly meetings	**Q3 2014**
Report on activities of the NEII Reference Group to meetings of the Australian Government's Environmental Information Advisory Group	**Twice yearly**
Undertake analysis with stakeholders to identify and document NEII use cases and user stories	**Q2 2015**
Establish working groups under the NEII Reference Group to address specific issues such as architecture, governance, information models, and licencing	**As required**

8.3 Polices and Frameworks

Clear policies, strategies, and frameworks to support a federated environmental information system

The development of a federated environmental information system introduces a suite of challenges not necessarily present when adopting a centralised model. Integral to the success of the NEII are the non-technical tools and enablers to support an operational NEII, including elements such as:

- licensing policies
- governance models
- service level agreements for data supply
- data maintenance agreements
- IP arrangements.

The first step in the delivery of this focus area will be the completion of an environmental-scan of other national and international initiatives that adopt a federated model. Examples include mature related spatial data infrastructures (SDI) in Europe, Canada and the UK and domestic examples such as the Australian National Data Services and Atlas of Living Australia. Lessons from these will be invaluable in both identifying the key policy and framework issues, and ultimately developing the instruments and tools to support an operational NEII. Where tools already exist, such as through the data licencing work of the Australian Governments Open Access and Licensing Framework, these may be leveraged as an approach for NEII.

The second pertains to the development of the policies, tools and arrangements that are required to support partner participation in the NEII. Foremost is the development of an NEII conformance framework to provide partners specificity around what is required to deliver, for example an NEII data services node for their nationally significant data. The conformance framework will provide guidance at the technical level (e.g. type of OGC services), and in regard to user-centred practical considerations such as data licencing, availability of data documentation including quality statements, and some indication of the service levels users can expect from the data, catalogue or vocabulary service.

Milestones	By
Complete a study exploring the non technical enablers required to support a federated environmental information system (Social architecture project)	**Q3 2014**
Develop and release an NEII web and collaboration space user guide	**Q2 2015**
NEII licensing principles and model released (realised through conformance framework)	**Q1 2016**
Release the NEII conformance framework	**Q1 2016**

8.4 Data Management

Ensuring effective operational supply and maintenance of data

The Data Management focus area will develop the processes to enable data to be published through the NEII. This includes populating and maintaining the core NEII components hosted by the Bureau (e.g. updating the data delivered through NEII services, and ingest and update of data held in the National Environmental Monitoring Sites Register), in addition to ensuring data services hosted by partners have appropriate metadata and are visible through the NEII metadata catalogue. Establishing arrangements for metadata federation across metadata catalogues, for example to data.gov.au and ands.org.au, will be coordinated though catalogue owners and through engagement with the NEII Reference Group. This may also require the establishment of operational level agreements to ensure ongoing data updates.

Finally, a core-element of the NEII re-use objective is the role of information modelling for specific environmental domains. Community-agreed information models can support more efficient data transfer between users; improve a software application's ability to rapidly leverage a data-service; and make assumptions about data explicit to users to allow them to effectively re-purpose data. The role of information modelling is a major challenge for NEII given their domain-specific nature.

Milestones	By
Source data identification including a list of candidate data services, vocabularies and National Environmental Monitoring Sites Register (NEMSR) for inclusion in NEII core components	**Ongoing**
NEII information modelling discussion paper	**Q2 2015**
NEII Catalogue – federation and harvesting processes to other catalogues	**Q2 2016**
Inventory of NEII conformant data services	**Q2 2016**

8.5 Build

Build operational IT components to improve the discovery, access and re-use of environmental information

The ICT Build focus area aims to build the core components documented in the Engineering Viewpoint described in the NEII Reference Architecture (Bureau of Meteorology 2014). Initially the Bureau of Meteorology plans to build the central components of the NEII data platform (e.g. Catalogue and the National Register of Environmental Monitoring Sites). This is in addition to the Bureau's contribution to delivering observations and geographies through web data services including in the first instance a release of the Australian Hydrologic GeoFabric and Solar Data Products as operational products. These two services will complement the earlier release of the gridded water quality data underpinning the eReefs Marine Water Quality Dashboard that are already available as NEII services (http://www.bom.gov.au/marinewaterquality/).

The Bureau will work with stakeholders to encourage their build of NEII components and in particular the delivery of nationally significant observations and geographies through web data services to ensure that users have access to authoritative data maintained where possible at-source.

Milestones	By
Release an online, publically available, metadata catalogue for harvesting from multiple Government agencies and NEII conformant Bureau metadata records for its core products and services suite	**Q2 2015**
Australian Government datasets available via NEII conformant standards (hosted by the Bureau or through individual agency infrastructure) and discoverable through the NEII Catalogue	**Q2 2015**
Publication of long term monitoring datasets with redirection to observational data, where available (National Register of Environmental Monitoring Sites)	**Q4 2016**
Publication of governed vocabularies hosted across environmental domains on production infrastructure within the Bureau	**Q4 2017**
Public release of an Observing Methods dataset	**Q2 2018**
NEII Architecture review and forward strategy	**Q2 2018**

9 Timeline and Milestones

Major NEII milestones are mapped against a five year timeline in Figure 2. These include confirmed deliverables under the NEII Programme until late 2016, in addition to proposed deliverables and outcomes planned into 2019. Additional milestones will be incorporated into the Roadmap as outcomes of iterative reviews of the NEII programme plan; assessment of the benefits and learnings arising from the initial implementation of the NEII; technical developments emerging from informatics and ICT domains; and potentially new focus areas and activities mapped into the Roadmap in response to the requirements of our stakeholders. Future milestones and activities might include:

- developing NEII to become a repository for nationally significant environmental information, and in particular for historical information
- extending the information types documented under the NEII Reference Architecture to encompass a broader suite of data
- achieving a greater alignment between the NEII and related international federated information systems (e.g., GEO)
- development of applications for specific use cases that leverage the base NEII infrastructure
- the Domain Authority playing a leadership role within specific environmental domains for example in the development of information models or governed vocabularies
- evolution of the NEII Reference Architecture to describe additional components, for example a digital object identifier service.

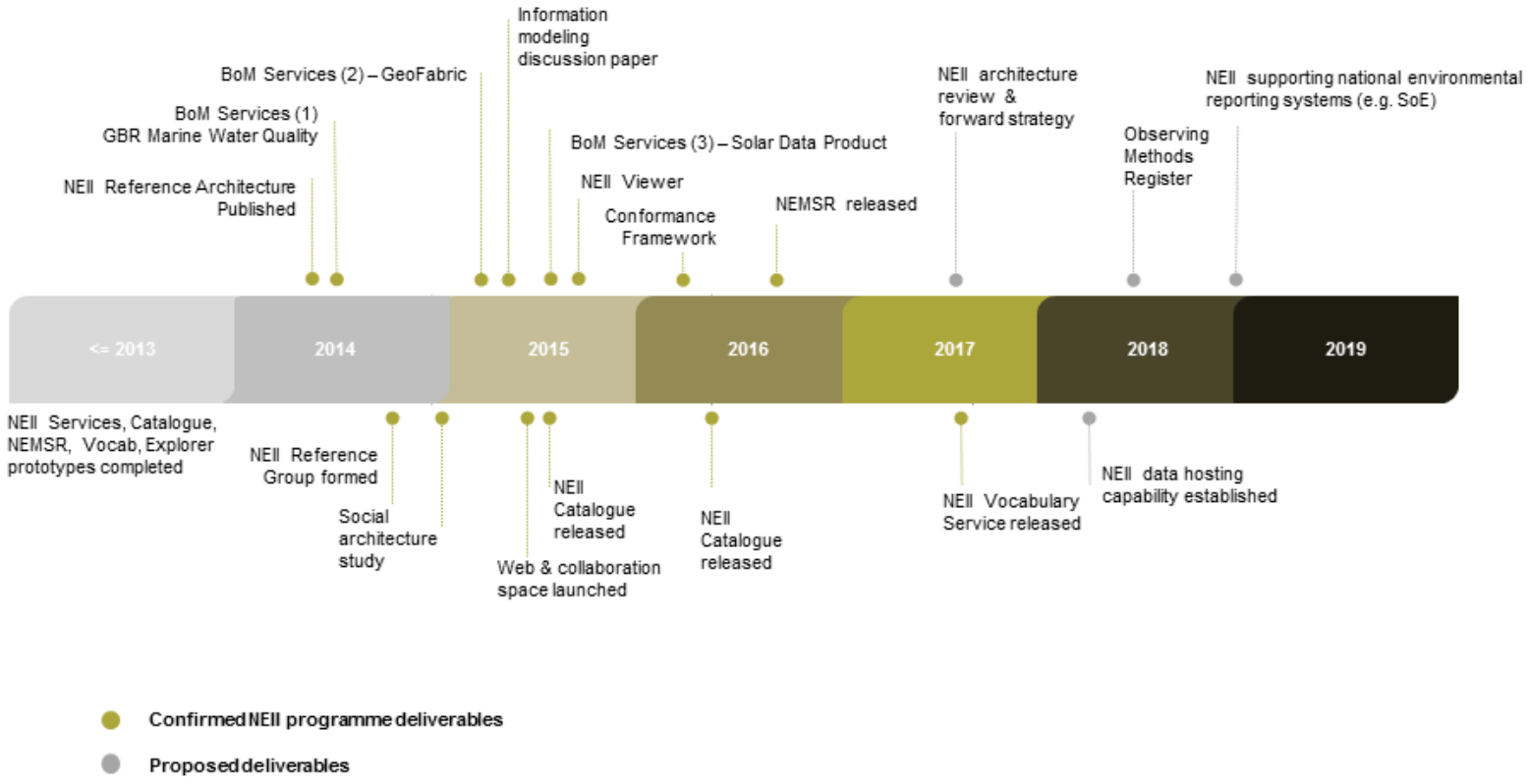

Figure 2: NEII timeline

10 Governance

Effective governance structures provide the consistent and cohesive guidance, policies and processes needed across a programme of work to realise goals for an area of responsibility. Successful programmes, small and large, are built on the foundation of good governance. Responsibility around the NEII ultimately rests with both the Bureau's Environment and Research Division Programme Management Board and the NPEI initiative Joint Steering Committee (jointly represented by Executive members of the Bureau and the Department of the Environment) (Figure 3). The NEII Reference Group and the Australian Government Environmental Information Advisory Group enable a whole-of-government approach to the delivery of an operational NEII.

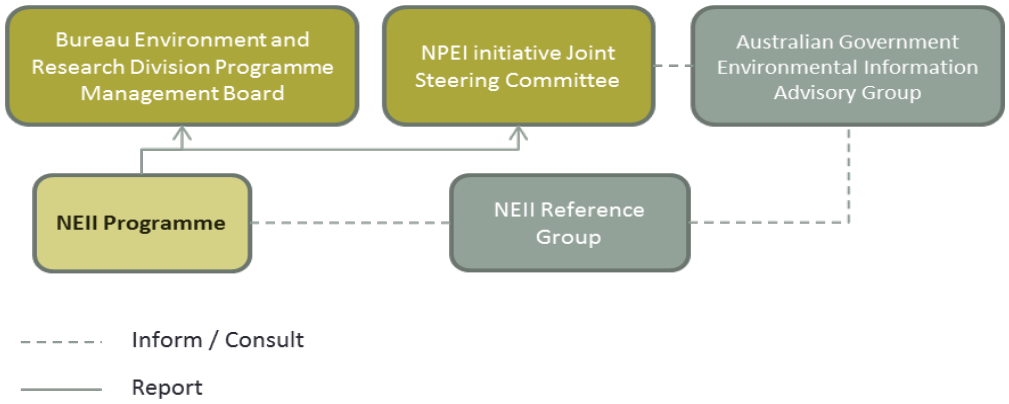

Figure 3: NEII governance model

11 Participating

The NEII is a long term vision and participation can take multiple forms ranging from the strategic (involvement in the NEII Reference Group and subordinate technical Working Groups) to the operational by providing other stakeholders access to NEII information types (e.g., geographies, vocabularies, observation methods). The NEII Reference Architecture (Bureau of Meteorology 2014) provides a comprehensive treatment of the information types currently in-scope for the NEII.

Under the Communication Focus Area, the NEII programme will also conduct a business analysis to better understand stakeholder interests and needs from an operational NEII. This process will document the thematic scope, and stakeholder interests and roles in the NEII. As examples, opportunities for participating in the NEII could include:

NEII Reference Group – The Reference Group provides the key engagement mechanism with our partners. Each member of the Australian Government's Environmental Information Advisory Group nominates a representative on the NEII Reference Group. Representing your organisation on the Reference Group, or working closely with the respective NEII Reference Group member provides an opportunity to learn from and shape the implementation of the NEII.

Hosting web data services for existing environmental data – Web data services such as those described under NEII Services (Bureau of Meteorology, 2014) allow software applications and users to access data in federated environments. The nature of environmental data means that it should continue to be maintained at source by custodial agencies that have appropriate domain understanding and business process to curate the information. Partners are encouraged to commence adopting web data services by adopting an NEII Services approach (Bureau of Meteorology 2014).

Web-based metadata catalogue – This NEII catalogue provides an important gateway for discovery of environmental data held within individual agencies. The NEII Catalogue (a) stores metadata about environmental data resources within the NEII, (b) provides a web-based interface allowing users to search the NEII, and (c) enables discovery and access across other relevant catalogues (e.g., data.gov.au, ands.org.au). Developing metadata according to IS019115 standards for key environmental data provides a first step to improving discovery. Partners with more mature ICT capability may also consider hosting their own metadata catalogue through instances of GeoNetwork (Bureau of Meteorology, 2014) to support a federated NEII approach to metadata discovery.

National Environmental Monitoring Sites Register (NEMSR) – The NEMSR will provide a register of Australia's significant environmental monitoring sites. The Bureau has some understanding of the current monitoring network for certain domains such as the national climate, water, tidal, air quality and seismic networks. However, for other domains partners are encouraged to make the Bureau aware of candidate monitoring sites and, where appropriate, develop the data for each dataset to populate the NEMSR data model.

Vocabulary Services – These are lists of clearly defined terms (words or phrases) that are governed and maintained by knowledge domains to enable more effective information discovery, access and re-use. The use of governed, or controlled, vocabulary in information systems reduces the ambiguity commonly introduced by human language. Most agencies maintain domain specific vocabularies to support their business processes. Examples can include soil and land use classifications, forest types and water data dictionaries. The NEII approach for environmental vocabularies will be to work closely with governance communities of practice to identify those domain vocabularies critical to agency business requirements as possible candidates for an NEII Vocabulary Service. Identifying these vocabularies early in the genesis of the NEII will help the Bureau scope the breadth of requirements for an NEII Vocabulary Service**.**

12 Revising the Roadmap

This Roadmap will be reviewed annually to align with the Bureau's strategic planning timetables and ensuing budget processes. Updates and revisions will also occur in response to recommendations emerging from meetings of the NEII Reference Group and learning's from Bureau and partner contributions to the NEII.

13 References

Australian Government Environmental Information Advisory Group (2012), *Statement of Australian Requirements for Environmental Information,* Bureau of Meteorology, Canberra. pp. 86

Bureau of Meteorology (2014), *National Environmental Information Reference Architecture Version 1.0*, Environmental Information Programme Publication Series Document No. 4, Bureau of Meteorology, Canberra, pp. 56.

Bureau of Meteorology (2015), *Information Modelling Discussion Paper,* Environmental Information Programme Publication Series Document No. 5, Bureau of Meteorology, Canberra, pp. 13.

Appendix Glossary of Terms

AG EIAG	Australian Government Environmental Information Advisory Group
AGIMO	Australian Government Information Management Office
ANDS	Australian National Data Service
Bureau	Bureau of Meteorology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
GEO	Group on Earth Observation
IP	Intellectual Property
NCRIS	National Collaborative Research Infrastructure Strategy
NEII	National Environmental Information Infrastructure
NERP	National Environmental Research Programme
OAIC	Office of the Australian Information Commissioner
NPEI	National Plan for Environmental Information initiative
OGC	Open Geospatial Consortium
OSP	Office of Spatial Policy, Department of Communications
PSI	Public Sector Information
SDI	Spatial Data Infrastructures
TERN	Terrestrial Ecosystem Research Network

www.neii.gov.au