National Environmental Science Program

Climate Systems Hub research plan 2026 – Attachment B project plan

Version	Date of issue	Author	Comments
1	5 Aug 2025	SPS DCCEEW	Template updated
2	13 Aug 2025	Hub	Sent to steering committee for comment and endorsement
3	19 Sept 2025	Hub	First draft submitted to DCCEEW as per contract milestone
4	17 November 2025	Hub	Minor revisions following first draft assessment by DCCEEW

Contents

Project CS2.1 – Enabling best practice adaptation

Project type: • Hub research project	
Project status: • Existing project seeking amendment	
Cross-cutting initiative:	Yes Climate adaptation
Project start date: 01/07/2022	**Project end date**: 31/12/2026
Total project budget: $1,536,839 (GST exclusive)	**NESP funding:** 2023 $143,403 (GST exclusive) 2024 $172,798 (GST exclusive) 2025 $180,232 (GST exclusive) 2026 $230,000 (GST exclusive) **GAGI funding**: $0 (GST exclusive) **Co-contributions (cash and in-kind):** 2023 $83,263 (GST exclusive) 2024 $322,560 (GST exclusive) 2025 $174,583 (GST exclusive) 2026 $230,000 (GST exclusive)
Project leader details:	Name: Sarah Boulter Organisation: UTAS Phone: 03 6226 1641 Email: sarah.boulter@utas.edu.au Name: Jon Barnett Organisation: University of Melbourne Email: jbarn@unimelb.edu.au
Project summary To improve success in adapting to climate change, decision-makers need knowledge about what works and what enables success. This project is synthesising progress in adaptation planning and practice in Australia by collating and analysing a broad set of examples. But the project is much more than collating information. By analysing what has worked, and the factors that enabled success, we plan to develop a set of principles to help governments, conservation managers and communities undertake best practice adaptation. By partnering with on-ground practitioners we will work to test and improve our approach. At its conclusion, this project will publish a guide to improved approaches or new approaches for best practice adaptation, and produce Australia's first national adaptation stocktake. The project is now seeking a 12 month extension and an additional $230,000 to continue development of the Australian Adaptation Database, reporting on the data collected and disseminating research finding to stakeholders across the public and private sectors.	

Pathway to impact

Outcomes
Improved implementation and efficiency of best practice adaptation across a range of sectors.

Research-user	Engagement and communication	Impact on management action	Outputs
Interjurisdictional Adaptation Working Group (a national working group of the Energy and Climate Ministerial Council which includes representatives from each Australian jurisdiction)	Enlisted to operate as the project advisory/steering body Regular meetings (2 or more per year) will allow briefing and engagement. Out-of-session consultation will be negotiated to help co-design and co-deliver the project	Research findings will be incorporated in jurisdictional guidance and information (for example, AdaptNSW platform)	National database of adaptation activities Published case studies describing the outcome and experience of test cases Guidance materials and framework to apply and activate adaptation enablers Adaptation stocktaking community of practice
National Adaptation Policy Office (NAPO), DCCEEW	Engage as secretariat of AWG Regular meetings to update and engage on progress	Database of adaptation to inform the development of Monitoring and Evaluation of the National Adaptation Plan (NAP) Findings inform revision of National Adaptation Plan (NAP) and implementation strategy	National database of adaptation activities Published case studies describing the outcome and experience of test cases Guidance materials and framework to apply and activate adaptation enablers Adaptation stocktaking community of practice
Climate Active, Risk and Science Branch , DCCEEW	Regular meetings to update and engage on progress Engage with National Climate Risk Assessment as requested	Database of adaptation to inform the National Climate Risk Assessment	National database of adaptation activities Adaptation stocktaking community of practice
Australian Climate Service (ACS)	Potential additional investment fast-tracking database development Provide update on database progress and publication as needed	Information developed through the project feeds directly into the National Climate Risk Assessment	National database of adaptation activities Summary information/report Adaptation stocktaking community of practice
Cross-Jurisdictional Community of Practice for Climate Science (CJ CoP CS)	Participate and facilitate stakeholder engagement Regular meetings to update and engage on progress	Research findings will be incorporated in jurisdictional guidance and information Guidance used in formulating climate information at state basis	National database of adaptation activities Published case studies describing the outcome and experience of test cases Guidance materials and framework to apply and activate adaptation enablers Adaptation stocktaking community of practice
Local governments and state	Workshop participation, stakeholder engagement	Database of adaptation to inform adaptation plans	National database of adaptation activities

Research-user	Engagement and communication	Impact on management action	Outputs
associations (such as NSWLGA)		Participate in testing of framework and guidance Use guidance in implementing adaptation actions	Published case studies describing the outcome and experience of test cases Guidance materials and framework to apply and activate adaptation enablers Adaptation stocktaking community of practice
Conservation managers and land managers (for example Parks, National Parks, Indigenous Protected Areas, World Heritage Properties, Wetlands)	Workshop participation, stakeholder engagement, identification of case studies	Database of adaptation to inform adaptation plans Participate in testing of framework and guidance Use guidance in implementing adaptation actions	National database of adaptation activities Published case studies describing the outcome and experience of test cases Guidance materials and framework to apply and activate adaptation enablers
Regional and international adaptation research and practitioner communities	Publication and sharing of peer reviewed papers outlining approach and methodology Sharing of outputs with regional actors across Oceania	Leading practice on tangible approaches to adaptation stocktaking and inclusion of adaptation into climate risk assessments	National database of adaptation activities Sharing of methodology Adaptation stocktaking community of practice

Additional outputs

- Peer reviewed paper outlining the logic framework and methodology used to build the database.
- Peer reviewed paper outlining the initial findings of the database collation and analysis submitted.
- Peer reviewed paper on ‘best practice’ adaptation
- Peer reviewed paper conducting policy analysis of adaptation database.

Project description

Project description

The climate is changing, and adaptation to avoid or reduce the risks of climate change to the well-being and prosperity of all Australians is undeniably necessary. Yet despite proliferation of adaptation processes, until recently, there had been no quantification of how much adaptation planning or action is actually underway in Australia and where and in what sectors it has transpired. This project set out to respond to key questions posed by stakeholders, capitalise on the expansion of adaptation practices across Australia, and work closely with stakeholders, to explain what enables 'best practice' adaptation in Australia. During 2023-2025 it has done this by:

ii. Evaluating progress in the implementation of adaptation in Australia

iii. Developing a framework to evaluate adaptation best practices

iii. Identifying the enablers of adaptation best practices

iv. Developing and testing an approach to enabling best practice adaptation.

A key output has been the Australian Adaptation Database. This is a repository of climate change adaptation examples across sectors and jurisdictions that was developed by the project to evaluate the progress of implementation of adaptation. Its primary purpose is to support adaptation stocktaking, a process formally recognised under the Paris Agreement. Drawing on stakeholder engagement and widespread data collection, the database currently holds over 700 examples of climate change adaptation in Australia.

The Australian Adaptation Database is a critical tool for informing national and international climate policy, identifying adaptation gaps and supporting evidence-based planning or investment decisions. It contributes to a more systematic and transparent understanding of adaptation progress across Australia.

The project is now seeking an extension of 1 year to continue development of the Australian Adaptation Database, reporting on the data collected and disseminating research finding to stakeholders across the public and private sectors.

Building on existing work, 2026 the project seeks to undertake the following activities:

- *Continued data entry* – The database contains 700 examples of climate change adaptation, however, we still have nearly 300 examples to be coded and new entries are being added every week. New entries are driven by direct engagement with stakeholders, which will be conducted to target groups underrepresented in the current data: including local government, local communities and the private sector.
- *Data analysis and reporting* – The opportunities for analysis in this database are numerous, so in 2026 the team seeks to continue this analysis and set up regular "State of Adaptation Reporting" which reports on changes to the trends and gaps arising as the dataset is expanded.
- *New methodologies for data collection, coding and analysis* – It has been identified that Python web scraping methodology could be used to expand data collection, for example by sourcing the key policy documents from the 547 local government area websites. The research team will seek additional technical support to undertake this.

With the significant rise of AI tools and methodologies, the project team will also continue to explore new methodologies for coding and analysing the data.

- *A community of practice* – The project team is launching an Adaptation Stocktaking Community of Practice: this is an opt-in quarterly meeting where stakeholders struggling with the various challenges of adaptation stocktaking can come to discuss, share lessons and help inform the direction of the Australian Adaptation Database. This is a response to requests from numerous stakeholders in Australia, and from Oceania.
- *Monitoring and evaluation practices* – Stakeholders have expressed interest in understanding the difference between adaptation stocktaking processes and other more in-depth evaluation of processes, outputs, outcomes or impact. International emphasis on evaluation of adaptation, including in the recently released UNFCCC list of indicators, demonstrates a need to understand how to apply this better in the Australian adaptation context. We will work to make the Australian Adaptation Database a resource for monitoring and evaluation practices in Australia, by contextualising it within the new National Adaptation Plan (NAP) and international processes.
- *Communicating and engagement* – The research team will continue to invest time and effort into sharing the database in a way which is informative and useful for different audiences in Australia, including by attending workshops, conferences, and though academic and popular articles.
- *Sustainability* – The Australian Adaptation Database has already demonstrated its value, however, for it to achieve its full potential as a resource will require continuity in investment, regular updates to the data, maintenance of the web-app and ongoing engagement. In 2026 the research team will develop a plan of work for beyond 2026, and seek a new long-term funding arrangement to support this.

The research team will also explore possibilities to expand the Australian Adaptation Database with further in-depth case studies of good practices, using cases from the dataset, and new methodologies for crowdsourcing additional data.

This project contributes to the Climate Adaptation Initiative and is led by the Climate Systems Hub. The outcomes are applicable across a range of sectors and underpin the initiative's activities in other research projects, including synthesis and communication, and supporting a community of practice. The Australian Adaptation Database already hosts case studies for conservation management in AdaptLog (Project CS2.7), collaborates closely with Adapt Land & Sea as it is developed (Project CS4.3) and captures Indigenous led adaptation (Projects CS2.3, CS2.4, CS4.1 and CS5.10) already being undertaken by the hub. The project has also collaborated with projects from the Marine and Coastal Hub and Resilient Landscapes hub.

Is this a cross-hub project?

No.

Does this project contribute to a cross-cutting initiative?

Yes

This project contributes to the Climate Adaptation Initiative, and in particular delivers:

- climate change adaptation focused research, focussed specifically on how adaptation is delivered and good practice enabled (KA1)

- increase the effectiveness of decision support approaches and tools (e.g. risk management frameworks) through understanding what delivers good practice adaptation (KA3)
- support the delivery of learnings through case studies of adaptation practice (KA4).

The project will be carried out and led by the Climate Systems Hub.

Indigenous consultation and engagement

The project meets the following revised Three Category approach:	**Category 1** Indigenous led ☐	**Category 2** Co-design ☐	**Category 3** Communicate ☒

Project milestones

Milestones	Due date	Responsible person
Milestone 1 – Establish relationship with AWG as the project steering committee, revise project plan	30 Sep 2022	Sarah Boulter
Milestone 2 – Submission of project progress report	30 Aug 2022	Sarah Boulter
Milestone 3 – Development of a framework to assess adaptation best practice, submit quarterly progress report	30 Dec 2023	Tia Brullo
Milestone 4 – First draft of database of adaptation activities, submit quarterly progress report	30 Dec 2023	Tia Brullo/Sarah Boulter
Milestone 5 – Draft of an approach to activate enablers of best practice adaptation, submit quarterly progress report	30 Jun 2023	Tia Brullo
Milestone 6 – Submit quarterly progress report	30 Sep 2023, 30 Dec 2023, 30 Mar 2024, 30 Jun 2024, 30 Sep 2024, 30 Dec 2024 30 March 2026, 30 June 2026, 30 September 2026, 30 December 2026	Sarah Boulter
Milestone 7 - Apply and test approach to activate enablers, submit quarterly progress report	30 Jun 2024	Tia Brullo
Milestone 8 – Publish and disseminate findings, including case studies, guidance materials, and project summary/synthesis report	30 Dec 2025	Sarah Boulter
Milestone 9 - Quarterly “State of Adaptation” reports on new insights from the database	30 March 2026, 30 June 2026, 30 September 2026, 30 December 2026	Tia Brullo

Milestones	Due date	Responsible person
Milestone 10 - Quarterly Adaptation Stocktaking Community of Practice meetings	30 March 2026, 30 June 2026, 30 September 2026, 30 December 2026	Tia Brullo
Milestone 11 - 300+ new entries sourced, investigated, coded and added to the database	30 December 2026	Tia Brullo

Data and information management

The project will develop a data management plan that details the approach that will be taken to ensure all outputs of the project meet the FAIR data principles – Findable, Accessible, Interoperable, and Reusable. It will serve as a record of all datasets and other information used as inputs and outputs for the project, including any models and code/software. The plan will ensure consideration has been given to how the data associated with the project will be managed and that appropriate resources are devoted to data management.

The NESP data and information guidelines and Climate Systems Hub Data Management Strategy details the fundamental approach to data management and the many aspects projects need to take into account. The data wrangler will provide any guidance needed by the project lead and the project's data custodians. The data management plan is a living document, to be revised and updated as the project evolves, and outputs are identified through co-design process and generated by the project.

FAIR Data Principles

While it is acknowledged that projects may not know all the details at the outset, how and where all of the project outputs will be made freely and openly available needs to be considered. Different types of data and information will require different approaches. The principles of the Data Management Strategy on how different data types will be managed are summarised in the following table.

Project output	Data management and accessibility
All data/information products	Research data and outputs will be well-documented according to accepted and trusted standards. A key requirement for all research products generated by the hub research will be following metadata standards based on accepted best practice Data will be made publicly available whenever legally, ethically and contractually possible, under an open licence policy except in particular cases. A record of these exceptions will be kept, and exceptions reported regularly to the Department Data and other research output will be stored in repositories that are accessible to end-users and other researchers, with the choice of repository based on practicalities of the data and its likely use, and stored in such a way as to endure and remain FAIR well beyond the life of the project The project will develop its own data management plan, with identified data custodians responsible for managing the data The nature of research outputs, their formats and repositories, will be developed through a co-design process involving stakeholders and end-users to ensure data meet their requirements and are fit-for-purpose, and will evolve through ongoing consultation

Project output	Data management and accessibility
	Research outputs and data will be accompanied by documentation providing guidance to users on how best to make use of the data The hub will maintain a metadata catalogue of all research data, and all metadata will be published on other public metadata catalogues Outputs such as websites will follow the Web Content Accessibility Guidelines (WCAG), and include an accessibility statement
Scientific publications and reports	Publications and reports will be made available through the CS hub website and/or appropriate peer-reviewed scientific journals.
Application ready data sets	To be published in public repositories. Data services made available to enable ingestion into end-user models and decision-support tools.
End-user products	Published in appropriate medium such as print or a scientific journal. Captured in metadata catalogues. A copy will be stored on the hub website for public access.
Raw research data	Stored on infrastructure where generated and where they can be shared with other researchers.

Location of research

The table below describes the scale at which the project will be working, and the location(s) where most of the project research will be conducted.

Most activities will be desktop analysis conducted across various offices across Australian states, territories and capital cities such as Canberra, Hobart and Melbourne.

During the course of the project, in-the-field activities will be performed in the following locations:

Year 1: Melbourne and Canberra

Years 2-3: Melbourne, Canberra, Adelaide, Perth, Hobart, Sydney

Year 4: Melbourne, Canberra, to be determined in consultation with users

At which spatial scale is the project working	**National** ☒	**Regional** ☐	**Local** ☐
Location(s) – gazetted region /place name	Canberra, Hobart, Melbourne		
Aboriginal or Torres Strait Islander nation or traditional place name(s)	Ngunnawal Country, Nipaluna, Naarm		

Project-specific risks

Risk	**Potential impact on project**	**Likelihood (rare, unlikely, possible, likely, highly likely)**	**Consequence (minor, moderate, high, major, critical)**	**Risk rating (low, medium high, severe)**	**Treatment to reduce or manage risk**
No funding to continue Australian Adaptation Database	Discontinuation of dataset, outdated data, no funding to maintain web-portal	*possible*	*High*	*High*	Work on relationships with state governments, DCCEEW & private sector. Build support from ministers
Misrepresentation or misuse of information from Australian adaptation database	Underrepresentation of the adaptation work of certain jurisdictions or actors if data is misused before the dataset is considered representative, and without recognition of this limitation in the data.	*Possible*	*Moderate*	*Medium*	Clear communication about the representativeness of the database, no publications or talks highlighting findings that cannot be justified by the dataset, and that do not also recognise limitations. Ongoing communications and engagement with stakeholders, regular updates, attendance at workshops, conferences and AWG meetings.
Staffing changes	Delays to milestone	*possible*	*moderate*	*medium*	Draw on staffing resources from other areas of the Hub as needed. Adjust milestone dates.

Project keywords

Adaptation, good practice, evaluation, adaptation options, communities.

Project contacts

Researchers and other hub personnel

1. This section details hub researchers and personnel involved in the project.

Name	Organisation	Project role	FTE* (hub funded)	FTE* (in-kind)	Staff type
Sarah Boulter	University of Tasmania	Researcher/Co-lead	0.2		1
Jon Barnett	University of Melbourne	Researcher/Co-lead		0.2	1
Tia Brullo	University of Melbourne	Postdoc	1		3
Elissa Waters	Monash University	Researcher		0.1	2

Notes:

* Full time equivalent;
Staff type: 1=Senior researcher; 2=Mid-career researcher; 3=Post-doc or early-career researcher; 4=PhD student; 5=Indigenous researcher

Research-users

This section identifies the research-users for the project and describes user type.

Research-users (organisation/ program /section/branch/division)	Name(s)	Email
Primary research-users		
Climate Active, Risk and Science Branch , DCCEEW	Chris Johnston	Chris.Johnston@dcceew.gov.au
National Adaptation Policy Office, DCCEEW	Nicole Mitchell	nicole.mitchell@dcceew.gov.au
Climate risk strategy section, Climate Change Policy, Adaptation and Risk Division, DCCEEW	Miriam Mcmillan	Miriam.MCMILLAN@dcceew.gov.au
Australian Local Government Association (ALGA)	Eleanor Robson	eleanor.robson@alga.asn.au
Western Australian Climate Directorate	Leah Rheinberger	leah.rheinberger@dwer.wa.gov.au

Research-users (organisation/ program /section/branch/division)	**Name(s)**	**Email**
Tasmanian ReCFIT	Nikki Krushka	nikki.krushka@recfit.tas.gov.au
SA Local Government Association	Andrew Nesbitt	andrew.nesbitt@lga.sa.gov.au
Victorian Council of Social Services	Julianne Tice	julianne.tice@vcoss.org.au
NSW Department of Primary Industries and Regional Development	Jane Kelly	jane.kelley@dpi.nsw.gov.au
Secondary research-users		
Investors Group on Climate Change	Kate Simmonds	kate.simmonds@igcc.org.au
Climate Change Authority	Nevena Kosarac	Nevena.Kosarac1@climatechangeauthority.gov.au
PEERS Oceania	Matt De Boer	matt.deboer@adapterra.co.nz

Project CS5.6 - Extreme rainfall in compound events

<table>
<tr><td colspan="2">Project type:
• Hub research project</td></tr>
<tr><td colspan="2">Project status:
• Existing project seeking amendment</td></tr>
<tr><td>Cross-cutting initiative:</td><td>Yes
Climate Adaptation Initiative</td></tr>
<tr><td>Project start date: 01/01/2025</td><td>Project end date: 31/12/2026</td></tr>
<tr><td>Total project budget:
$1,432,733(GST exclusive)</td><td>NESP funding:
2025 $313,732 (GST exclusive)
2026 $292,450 (GST exclusive)
2027 $90,944 (GST exclusive)

Co-contributions (cash and in-kind):
2025 $343,162 (GST exclusive)
2026 $300,072 (GST exclusive)
2027 $92,373 (GST exclusive)</td></tr>
<tr><td>Project leader details:</td><td>Name: Acacia Pepler
Organisation: Bureau of Meteorology
Phone: 02 9296 1568
Email: Acacia.Pepler@bom.gov.au
Name: Chiara Holgate
Organisation: ANU
Email: Chiara.holgate@anu.edu.au</td></tr>
<tr><td colspan="2">Project summary

Research has highlighted that in Australia extreme rainfall is becoming more intense. But not all extreme rainfall events are the same, and some extreme events have much larger impacts on Australians. This might be when the rainfall covers a large spatial extent, when it interacts with other hazards such as extreme winds, or when several extreme events occur in close succession, including clusters of heavy rainfall events or rapid transitions between from periods of extreme drought and fire to periods of intense rainfall.
In this project we will work with stakeholders to understand the extreme rainfall events that matter most to them and identify a small number of case studies to pursue. Informed by these case studies, we will develop new metrics for the identified high impact compound rainfall events, and test their effectiveness with stakeholders in capturing the events which matter most. Using these new methods, we can map the occurrence of some types of high impact compound rainfall events across Australia, and assess how these critical events are changing. This will provide information that better resonates with the identified case study stakeholders and the decisions and plans they need to make.</td></tr>
</table>

Pathway to impact

Outcomes
Via a number of case studies, the project will develop and deliver innovative definitions and risk hazard datasets of some types of temporally compounding and multivariate compound rainfall events associated with major impacts, such as drought-breaking rainfall events, clusters of extreme rainfall, and compound wet/windy events. The project will deliver new methods including well-documented code around the frequency and drivers of rainfall hazards of high impact to the case study communities, including compound and clustered rainfall events. These will be used to provide more detailed and useful maps and datasets of projected changes in hazardous rainfall events to support planning and decision-making. The case studies will be chosen via discussions with the Research Users listed below and the list narrowed accordingly.

Research-user	Engagement and communication	Impact on management action	Outputs
Climate Science DCCEEW	Engage in co-design to identify key case studies and rainfall hazard types. Identify opportunities to lead intercomparison projects through the National Partnership for Climate Projections Findings and outputs to be communicated via meetings, workshops, project update emails and presentations.		Milestone 8 & 12 Synthesis products and guidance notes on changes in impactful rainfall events
Other CS projects and other Hubs	Collaborate on identifying key case studies with the projection verification and extreme sub-daily rainfall products Methods developed in this project will be used to assess new modelling from the Projection Verification and Uncharted Futures projects Results feed into capacity-building and adaptation projects		TBC - Co-designed project plans and collaborative research, including providing data and guidance material produced by this project to them.

Research-user	Engagement and communication	Impact on management action	Outputs
Australian Climate Service (ACS)	ACS models and expertise including the NCRA will inform projections in this project Methods and code developed in this project will be applied to ACS models and supplied to the ACS to support future NCRA work	Improved risk information on extreme and compound rainfall hazards available in ACS portals and documentation	Milestone 10 - Code and methods Datasets of future changes to feed into ACS data portals Model evaluation to support future regional model development
State, territory and local government groups in the water and emergency sectors including VIC DEECA (including VIC Catchment Management Authorities) Gold Coast, Noosa and Sunshine Coast LGAs NSW Reconstruction Authority Hunter Water QLD SES QFES	Engage in co-design through stakeholder workshops to identify key case studies and rainfall hazard types. Briefings of research progress and findings. Key partners identified to develop specific case studies of high local importance and advise on indices and methods	Future planning for water supply management that balances short-term flood control with longer-term storage to meet the needs of communities, industry and the environment. Flood and wet/windy emergency response measures that account for changing compound event hazards	Milestone 8 - Co-designed research outputs including data sets and synthesis reports to support planning and decision-making. TBC -Informing the Co-designed applications of future climate projections for decision-making (NEMA funded UTAS-led companion project)
Energy sector including, Ausgrid, Energy QLD, Energy team in DEECA	Engage in co-design through stakeholder workshops to identify key case studies and rainfall hazard types. Briefings of research progress and findings.	Planning for the location of future power infrastructure, which is sensitive to wet/windy events.	Milestone 8- Co-designed research outputs including data sets and synthesis reports.
Webinar attendees from session on extreme rainfall.	Subset of attendees engaged early in determining appropriate case studies. Developed indices/metrics circulated to full list for comment via a briefing note or webinar	With chosen users, a deep investigation into case study events including historical climatologies and identified long-term changes, to inform user in developing their adaptation options.	Milestone 8- Co-designed research outputs including data sets and synthesis reports.

Research-user	Engagement and communication	Impact on management action	Outputs
Additional outputs • At least 3 research papers establishing new methods and the current state of specific high-impact compound events in Australia • New methods and documented code, for easy adoption by secondary users, including the ACS and collaborators within academia • Presentations of research outcomes and implications for hazard and risk in both research forums (for example, AMOS) and forums relevant to key stakeholders, such as the MODSIM or HWRS for drought-breaking rainfall and flood hazard, or the Catastrophe and Risk Symposium for wet/windy compound events. • Plain English synthesis/summary of research findings for publication on hub website			

Project description

Project description

The negative impacts of extreme rainfall events are exacerbated when they occur in conjunction with a related hazard such as extreme winds (“multivariate compound event”) or occur as part of a series or cluster of individual events (“temporally compounding event”) such as drought-breaking rains. These compound extreme rainfall events result in impacts that are greater than the sum of the parts, such as from enhanced flooding or widespread tree falls which cause damage to property and power infrastructure. The co-design process in the RP2022-24 NESP Climate Systems Hub project CS2.5 Regional climate projections for local action demonstrated that there is unmet stakeholder appetite for understanding changes in these impactful rainfall events, such as clusters of extreme rainfall and the impact of antecedent conditions; interactions between heavy rainfall and other hazards such as strong winds; or particularly widespread or long-duration events.

This project will work with stakeholders and other NESP projects including Projection Verification and High-Resolution Rainfall Extremes to identify case studies of compound extreme rainfall events with high impacts. These case studies will be assessed to understand the critical factors that enhanced their impacts such as spatial extent, antecedent conditions, clustering, or compounding with other hazards such as strong winds. These case studies and the accompanying stakeholder engagement will be used to identify key types of compound extreme rainfall events with large impacts, and develop and test innovative thresholds and indices for capturing these events that are impact-informed and co-designed. The innovative definitions and methodologies developed will be evaluated in collaboration with users and used to evaluate the relative frequency of these hazards across Australia, including areas where such events might be expected to occur in the future.

In addition, the project will use a range of weather system datasets to identify the key atmospheric processes involved in these high-impact case studies, noting that the likelihood of such high-impact, compound rainfall events is highest in cases where multiple driving factors co-occur. It will assess the capacity of models and reanalyses to accurately simulate these patterns and the sensitivity of results to the dataset used, to highlight gaps in current model skill for future development and event types which may not be well represented in current projections. The new methods developed will be application-ready and able to be adopted by future rounds of the Australian Climate Service (ACS) National Climate Risk Assessment or similar programs how these hazardous events are changing in a changing climate

This project will focus on extreme rainfall events at daily to multi-day timescales and will complement research on short-duration rainfall extremes using high-resolution modelling in project CS5.7, High-Resolution Rainfall Extremes.

In the first three months of the project, a small number of stakeholders with strong interest in compound extreme rainfall events will be approached from a list of interested parties generated in NESP2.5. In collaboration with these stakeholders, a small number of case studies of compound extreme rainfall events will be identified, and used to inform the co-development of new indices of the relevant impactful extreme event.

Once these indices have been established and tested, they will be used to inform a range of project outputs including:

- new methods, codes and datasets for at least two types of compound extreme rain events that can be provided to the Australian Climate Service for their further development and delivery via climate portals, and will be made easily accessible for other interested parties.
- model evaluation of key processes that generate, and are related to, extreme rainfall events, which will inform future regional modelling development for Australia that better captures extreme compound and interacting rainfall hazards.
- identification of the current risk of impactful concurrent and compound extreme rainfall events, to help inform current planning and event readiness, particularly in the emergency management sector
- assessment of how the risk of some types of impactful and compound rainfall hazards are changing in a warming climate
- increased capacity of key stakeholders to identify and manage the rainfall events of most relevance to their communities through stakeholder workshops and targeted presentations.
- synthesis products including at least one briefing note to communicate project results to key stakeholders and the broader public, including providing relevant material for the Adapt Land & Sea website.

Throughout the project an ongoing process of stakeholder engagement will be undertaken and the project will evolve in response. The co-design and stakeholder engagement processes will be supported by the Hub knowledge brokers building on the process started under in the RP2022-24 NESP Climate Systems Hub project CS2.5 Regional climate projections for local action, and other projects including State and Federal Government led initiatives.

- Recent stakeholder engagement exercises conducted by both the hub and the Bureau of Meteorology have identified a large number of stakeholders with interest in understanding compound extreme rainfall events, as well as potential case studies. This list of stakeholders will be engaged throughout the project through stakeholder workshops and briefing notes, but we will primarily focus on our chosen case studies as examples.
- From the larger stakeholder group, we will identify two or three priority stakeholders with overlapping areas of interest for in-depth co-design, with priority given to stakeholders or case studies that are relevant to multiple hub projects. These stakeholders will include state and/or local governments, who have local knowledge on the complex hazard interactions with large impact
- We will work closely with these selected stakeholders to co-design up to two case studies co-developing new methodological approaches and ways to translate research findings into decision-ready information. The case studies will demonstrate how these co-developed project outputs (for example, datasets and synthesis products) can be used to help inform future planning, and results will be communicated to the broader stakeholder group.
- The Australian Climate Service is a key partner for this project, and the project will respond to knowledge gaps emerging through the program and be informed by developing code and data standards. This will allow outputs and insights to be easily integrated into ACS products and portals, while addressing hazards that are beyond the immediate scope of ACS work.

- The project will work with the knowledge broker team to engage in meaningful co-design with end users, and to inform the development of project outputs and communication that can be used by stakeholders to inform decision-making.

Update to RP2025

DCCEEW feedback on RP2025 requested the Hub to provide an update on the project's case studies in R2026. Details are provided below.

Project 5.6 has undergone extensive stakeholder engagement during the first half of 2025, and each of the three sub-projects now has `one or two focus regions and links with several interested stakeholders who are beginning to supply information around key events, datasets for further analysis in combination with climate data, and insights into aspects of the events that are important for them to understand.

For the subproject on wet/windy events there are two key study regions. South-east Queensland is prone to thunderstorm-related events, and we are already receiving relevant data on impactful events from Energy Queensland, the Queensland SES and QFES. This is supplemented by insights from the Victorian energy sector, which are being provided by the Energy team within DEECA.

For the subproject on consecutive (clustered) extreme rain our key study region is in NSW, which has experienced many extreme flood events in recent years, and we are building partnerships with the NSW Reconstruction Authority and Hunter Water including discussions of rainfall clustering on a range of different timescales.

For the subproject on drought to flood transitions we have been talking closely with the catchments group in Victorian DEECA, who have provided some past events to investigate. This is supported by a strong cross-project engagement with the Northern Rivers project of the NESP Resilient Landscapes Hub.

Is this a cross-hub project?

No. But one component of this project (drought to flood transitions) will feed into the Northern Rivers project of the Resilient Landscapes Hub (RL 3.19 Climate-resilient landscapes: an adaptation case study in NSW's Northern Rivers region and the Wet Tropics of Queensland).

Does this project contribute to a cross-cutting initiative?

Yes. This project contributes to the Climate Adaptation Initiative.

Many decision-makers are looking to understand their future climate risk in considering how to respond. Compounding and cascading risks present a particular challenge for practitioners. Understanding where and when these compound extreme events might occur will be important for considering scenarios of risk.

Co-development and co-delivery of synthesised findings through summary factsheets and workshop/webinar will target increasing stakeholder capacity, uptake and application of research into adaptation processes and thinking

Indigenous consultation and engagement

The project meets the following revised Three Category approach:	**Category 1** Indigenous led ☐	**Category 2** Co-design ☐	**Category 3** Communicate ☒

This project is a category 3 project under the updated NESP 3 category approach.

This project is aligned to the hub's Indigenous partnerships strategy and adheres to the NESP Indigenous Partnership Principles. These principles will strengthen relationships but also foster positive Indigenous engagements. These engagements will allow for trust, transparency and respect to be strengthened over time. The adoption of these approaches will ensure maintenance of appropriate Indigenous engagement throughout the project's lifecycle, and that the project legacy is available to communities engaged with, and more widely as suitable. Project Indigenous engagement will be measured through the hub's monitoring and evaluation framework and process.

Every Indigenous community in Australia is different. Informed partnership processes reflect responsible and transparent engagement underpinned by Indigenous people having the right to their Indigenous Cultural and Intellectual Property (ICIP), and Free, Prior and Informed Consent (FPIC).

The incorporation of the updated NESP 3 category approach to Indigenous partnerships - Indigenous led, Co-Design and Communicate - during the engagements will optimise the project outcomes and outputs thus allowing for project success to be achieved.

The Climate Systems Hub in partnership with the National First Peoples Platform on Climate Change have called for collaboration with climate scientists. This request is for, but not limited to, current understanding and future projections of seasonal patterns that are impacting or anticipated to impact both natural and cultural indicators within Indigenous knowledge systems.

The project team will seek advice from the Platform to consider pathways through which to communicate the outcomes of this research which may include via organisations suggested by DCCEEW. We note that the Platform has existing links to the Indigenous Desert Alliance and SEED (who participated in the Gathering).

The scientific field work (outside scope of this project) conducted through the various communities will provide valuable data for Indigenous people, thus allowing for adaptation measures to be implemented in caring for Country. Incorporating the National First Peoples Platform on Climate Change in elements of the co-design process will support scientists in the development of specific case-studies.

Project milestones

Milestones	Due date	Responsible person
Milestone 1 – Project workplan approved by the NESP CSH program management team	15 March 2025	Acacia Pepler
Milestone 2- Determine case studies and complete initial Co-design	31 March 2025	Acacia Pepler
Milestone 3 – Resubmission of project plan to RP26 to detail chosen case studies and stakeholders in pathway to impact section	19 September 2025	Acacia Pepler
Milestone 4 – presentation to stakeholders highlighting preliminary results and informing priorities for year 2	30 October 2025	Acacia Pepler
Milestone 5 – 1st draft research paper on methods for defining one impactful or compound rain hazard prepared	31 December 2025	Chiara Holgate
Milestone 6 – 2nd draft research paper on the characteristics of one impactful or compound rain hazard prepared	31 January 2026	Pallavi Goswami
Milestone 7 – Online workshop or AMOS special session on Compound events	28th February 2026	Acacia Pepler
Milestone 8 – Co-designed product on projected changes in impactful extreme rain events prepared for broad audience	30 September 2026	Acacia Pepler
Milestone 9 – Project outcome presentation to stakeholders	31 October 2026	Chiara Holgate
Milestone 10 – project code published and documented on github	31 November 2026	Chiara Holgate
Milestone 11 – 3rd draft research paper on the drivers of one impactful or compound rain hazard prepared	30 November 2026	Chiara Holgate
Milestone 12 – Synthesis report approved by NESP CSH Project Management Team	15 December 2026	Acacia Pepler

Data and information management

The project will take an approach to ensure all outputs meet the FAIR data principles – Findable, Accessible, Interoperable, and Reusable – in conjunction with the CARE principles for any Indigenous Cultural and Intellectual Property (ICIP) – Collective benefit, Authority to control, Responsibility, and Ethics. Together, these aim to ensure all data are easily shared and reused, but also used ethically. The project will adhere to principles of ICIP and acknowledge data sovereignty elements in all project outputs for any ICIP.

A data management plan will serve as a record of all datasets and other information used as inputs and outputs for the project, including any models and code/software. The plan will ensure consideration has been given to how the data associated with the project will be managed and that appropriate resources are devoted to data management.

The NESP data and information guidelines and the Climate Systems Hub Data Management Strategy detail the fundamental approach to data management and the many aspects projects need to consider, including dealing with ICIP. The Data Wrangler will provide any guidance needed by the Project Lead and the project's Data Custodians.

FAIR Data Principles

While it is acknowledged that projects will not know all the details at the outset, how and where project outputs will be made freely and openly available needs to be considered. Different types of data and information will require different approaches. The principles of the Data Management Strategy on how different data types will be managed are summarised in the following table, noting that not all data types are applicable to every project.

Project output	Data management and accessibility
All data/information products	• Research data and outputs will be well-documented according to accepted and trusted standards, including principles of ICIP. A key requirement for all research products generated by the hub research will be following metadata standards based on accepted best practice • Data will be made publicly available whenever legally, ethically and contractually possible, under an open licence policy except in particular cases, with particular. A record of these exceptions will be kept, and exceptions reported regularly to the Department • Data and other research output will be stored in repositories that are accessible to end-users and other researchers, with the choice of repository based on practicalities of the data and its likely use, and stored in such a way as to endure and remain FAIR well beyond the life of the project • The project will develop its own data management plan, with identified data custodians responsible for managing the data • The nature of research outputs, their formats and repositories, will be developed through a co-design process involving stakeholders and end-users to

Project output	Data management and accessibility
	ensure data meet their requirements and are fit-for-purpose, and will evolve through ongoing consultation • Research outputs and data will be accompanied by documentation providing guidance to users on how best to make use of the data • The hub will maintain a metadata catalogue of all research data, and all metadata will be published on other public metadata catalogues • Outputs such as websites will follow the Web Content Accessibility Guidelines (WCAG), and include an accessibility statement.
Scientific publications and reports	• Publications and reports will be made available through the CS hub website and/or appropriate peer-reviewed scientific journals.
Application ready data sets	• To be published in public repositories. • Data services made available to enable ingestion into end-user models and decision-support tools.
End-user products	• Published in appropriate medium such as print or a scientific journal. • Captured in metadata catalogues. • A copy will be stored on the hub website for public access.
Raw research data	• Stored on infrastructure where generated and where they can be shared, as appropriate under ICIP considerations, with other researchers.

Location of research

The table below describes the scale at which the project will be working, and the location(s) where most of the project research will be conducted.

At which spatial scale is the project working	**National** ☒	**Regional** ☐	**Local** ☐
Location(s) – gazetted region /place name	**Sydney, Canberra, Melbourne**		
Aboriginal or Torres Strait Islander nation or traditional place name(s)	**Dharug/Eora nations** **Ngunnawal-Ngambri land** **Kulin Nations – Bunurong Country**		

Project-specific risks

Risk	Potential impact on project	Likelihood (rare, unlikely, possible, likely, highly likely)	Consequence (minor, moderate, high, major, critical)	Risk rating (low, medium high, severe)	Treatment to reduce or manage risk
Schedule slippage	Project deliverable delays	Possible	Moderate	Medium	More time allocated to planning project Establish a high performing team early in the project lifecycle.
Insufficient compute time at NCI	Slow progress	Unlikely	Moderate	Low	Leverage organisational allocations to get more compute time
Insufficient data storage at NCI	Slow progress	Possible	Major	Medium	Leverage organisational resources to get more data storage
Staff Turnover	Reduction in project deliverables	Possible	Moderate	Medium	Ensure positive postdoctoral experience with appropriate mentoring and engagement with Climate College.

Project keywords

Extreme rain, flood, winds, compound hazards, climate projections

Project contacts

Researchers and other hub personnel

This section details hub researchers and personnel involved in the project.

Name	Organisation	Project role	FTE* (hub funded)	FTE* (in-kind)	Staff type
Acacia Pepler	Bureau of Meteorology	Researcher	0.2	0.2	2
Chiara Holgate	ANU	Researcher		0.2	2
ANU postdoc	ANU	Researcher	1.0		3
Ailie Gallant	Monash	Researcher		0.1	1
Pallavi Goswami	Monash	Researcher	1.0		3

Notes:

* Full time equivalent;
Staff type: 1=Senior researcher; 2=Mid-career researcher; 3=Post-doc or early-career researcher; 4=PhD student; 5=Indigenous researcher

Co-contributors

This section lists contributors to the project who are not already identified above as researchers or other personnel.

Name	Organisation	Contribution
Nerilie Abram	ANU	Research guidance, postdoc supervision/management
Hamish Ramsay	CSIRO	Collaboration on tropical extreme rainfall events including tropical cyclones, provision of TC data
Andrew Dowdy	University of Melbourne	Collaboration on aspects related to convective storms and wind extremes

Research-users

This section identifies the research-users for the project and describes user type.

Research-users (organisation/ program /section/branch/division)	Name(s)	Email
Primary research-users		
Vic DEECA (Water and Catchments Team)	Sandra Dharmadi	Sandra.Dharmadi@deeca.vic.gov.au
Vic DEECA (Water Emergency Management)	Julian J Smith (DEECA)	Julian.Smith@deeca.vic.gov.au
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