Submission No 234

INQUIRY INTO LONG TERM SUSTAINABILITY AND FUTURE OF THE TIMBER AND FOREST PRODUCTS INDUSTRY

Organisation: Western Murray Land Improvement Group

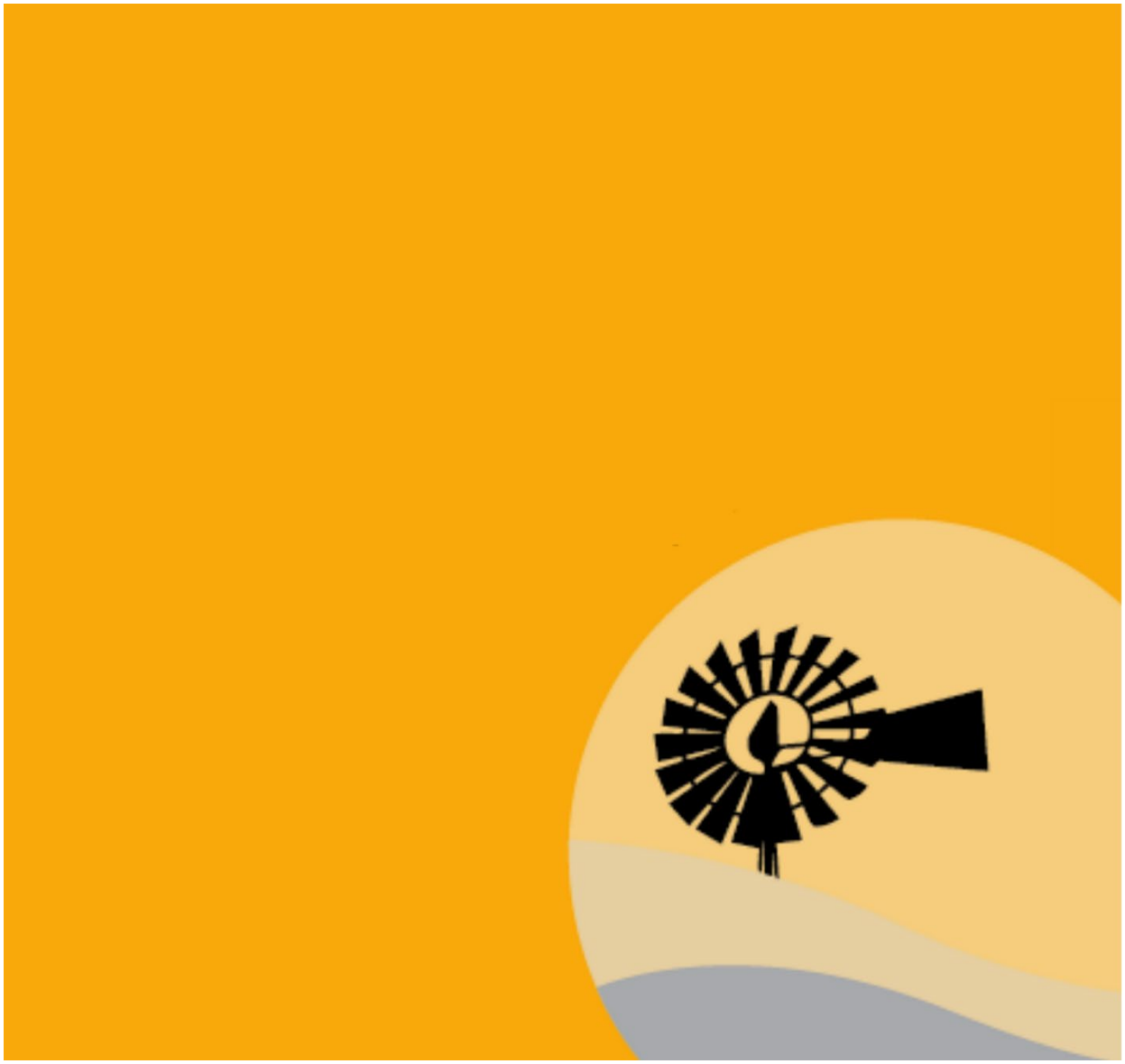
Date Received: 2 May 2022

Western Murray
Land Improvement Group

Multiple Uses of the Koondrook Perricoota Group of Forests in the Southern Riverina of NSW

Sustainability of the red gum timber and forest products industry, including social sustainability, community and Indigenous engagement and multiple uses of the forest estate and other related matters

APRIL 2022



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Forward

Western Murray Land Improvement Group (WMLIG) has convened stakeholders and recorded the agreed and preferred community way forward in regard to the management model and future uses relating to the Koondrook Perricoota (KPF) Group of Forests.

The community's agreed position is clear and calls for *"A healthy working forest where native species can flourish, and where local communities can connect and co-manage the forest for future generations.''*

The Western Murray community has been involved in consistent input into the future management and use of KPF as its current and future use and development can't be separated from the wider economic and community welfare impacts of a change in management.

The aim of this submission is to demonstrate that an engaged and empowered community can actively work with government and other stakeholders to strike a balance between job retention and creation, community benefit and environmental reform and ongoing innovation, through co-design (see co-design definition Appendix 10).

Consolidated feedback from the 2021 KP Community Vision development engagement process resulted in three vision pillars that encompass a shared objective of the KP Forest. The three pillars are:

- A healthy Forest
- A peoples' forest
- A working forest

All stakeholders agree that as a Ramsar-listed site that is culturally, recreationally, socially and economically significant, a management system that is mindful of 'wise use' and the employment of local geographic and environmental knowledge is crucial.

On the wider community's behalf, WMLIG has prepared this submission to the Inquiry into the long-term sustainability and future of the timber and forest products industry conducted by:

LEGISLATIVE COUNCIL

PORTFOLIO COMMITTEE NO. 4 – REGIONAL NSW, WATER AND AGRICULTURE

It is acknowledged that the Terms of Reference state:

No. 1- That Portfolio Committee No. 4 - Industry inquire into and report on the long term sustainability and future of the timber and forest products industry and the role of the **Forestry Corporation and other government agencies** in supporting the industry.

In respect to item 1, WMLIG is not a government agency, however WMLIG plays a vital role in bringing stakeholders together.

WMLIG has collaboration at the heart of its modus operandi and as such our group works with a range of community groups, government agencies, Indigenous Groups and the Red Gum Timber Industry to achieve social, economic, environmental and cultural outcomes, that are demonstrated in this submission.

As a stakeholder collective, there are sound governance systems in place to support stakeholder engagement processes.

There is a formalised process for community groups and Traditional Owners to work with government agencies, such as the Murray Darling Basin Authority (MDBA); NSW Department of Primary Industries and the Environment (NSW DPE); Commonwealth Environmental Water Office (CEWO); and Forestry Corporation of NSW (NSWFC) to improve environmental outcomes via the delivery of environmental water to the KP forest.

As an indication of collaboration and trust, the NSW Forestry Corporation and Murray Local Land Services have various sub-contracts with the Moama Local Aboriginal Land Council relating to Traditional Flows in the KP Forest, and associated pest and weed control, wetland enhancement and monitoring and evaluation.

WMLIG conducts services for a range of funding programs to work with traditional owners and community groups via various government funding streams such as:

- The Living Murray Program
- NSW Regional Land Partnership Program
- Murray Darling Healthy Rivers Program

These initiatives are achieving a triple bottom line outcome. We believe we have a cohesive and effective model that provides a template for well managed multiple uses in the Forest estate, whether directly or indirectly, including alignment to the 2021 KP community vision for a:

"A healthy working forest where native species can flourish, and where local communities can connect and co-manage the forest for future generations"

The 202 stakeholders engaged in the 2021 KP Community Visioning process, indicates the importance of the forest to local people.

It also must be noted that not one participant stated that they wanted to see an end to the State Forest management model which of course provides for a 'working forest'.

The community values the economic contribution of the red gum timber industry, which provides around 100 local jobs and injects $20M annually into the regional economy.

This significant economic contribution is important considering the region that contains KPF has had major, ongoing, chronic socio-economic impacts as a result of the Murray Darling Basin (MDBC) Water reform process; the 'Millenium Drought'; the creation of Red Gum National Parks (and associated loss of timber industry jobs); and farm consolidation.

Key findings in the MDBC Wakool Community Profile analysis of the period between 2001-2016 was that the;

- Area population decreased by 45.6% (715 people)
- Total area workforce decreased by 53.7% (288 Full Time Equivalent jobs)
- Agricultural workforce decreased by 61.5% (158 FTE)
- Agricultural manufacturing workforce decreased by 44% (8 FTE)
- Non-agricultural private workforce decreased by 57.3% (96 FTE)
- Government service workforce decreased by 35.1% (34 FTE)
- Socio-economic wealth decile ranking for the town went from a wealth rating of 5 in 2001 to a wealth ranking of 2, which leads to diminished capacity for adaption or change in response to circumstances.

These outcomes are further exacerbated by MDBA findings that the area west of Deniliquin is particularly vulnerable to ongoing chronic shocks due to a combination of low rainfall and heavy sodic soils.

This has resulted in a reduction of employment opportunities, and community and government services in the area. The socio-economic wealth decile for the region has diminished considerably reducing the financial capacity for businesses to adapt to change.

Despite these findings, there was an overwhelmingly positive community response to adopting strategies that will bring about change in order to build community capabilities and capacity, create economic development and increase employment, and to be actively engaged in environmental reform in an iconic site.

From a social and recreational perspective, the community values the ability to use the forest for recreational purposes such as general wellbeing benefits, education, camping, fishing, yabbying, bird watching, horse riding, dog walking, including shooting which provides vertebrate pest control outcomes.

The freedoms afforded by State Forest land management in the KP group of forests, also provides a niche, differentiated point for tourism development and the positive flow on economic benefits to the community.

Value-adding opportunities are outlined that not only benefit existing industries but provide major opportunities in the growing biochar sector that reduce waste and deliver carbon drawdowns. (See Appendix 1 – **Wood Waste and Crop Residue Opportunities to Increase Agricultural Productivity and Reduce Environmental Impacts**).

Value adding opportunities present huge opportunities for increased jobs, complimentary agricultural sector inputs that improve environmental outcomes and reduce reliance on imported products such as fertilisers, reducing sovereign risk. Value adding opportunities have identified 45 new jobs (including 5 permanent Traditional Owner jobs), as well as stimulate up to $235M in direct and flow on economic benefits. At the same time, new innovations that utilise waste organic products have the potential draw down 123,000tns CO2 on farm, and provide long term and stable organic farm inputs for agriculture.

Adjoining landholders and farmers as forest and river custodians are also becoming increasingly engaged in biodiversity projects that don't affect agricultural production but do provide potential carbon drawdowns and environmental outcomes.

Educational opportunities also abound – ranging from pre-school to tertiary educational-engagement activities; as well as a real opportunity for non-duplication of and the collection and sharing of research outcomes.

The major projects currently underway in the KP Group of Forests and the community alliances that are outlined in this submission demonstrate that any dramatic change to accessibility to the KPF – or to the momentum of initiatives, research, projects, and ongoing strong community engagement - would have a further major economic, social, cultural and environmental impact on the entire Western Murray region.

However, another clear message from the community points to a community engagement failure on the part of government, despite the clear outcomes voiced by local stakeholders and their willingness to work with government.

Terms of Reference

This submission will address items in the Inquiry Terms of Reference that are highlighted below: Specific items being addressed are underlined.

(a) the nature of, and relationship within, the value chain between the timber and forest products industry, logistics companies, manufacturers, retailers, exporters and their relationship with timber supply and environmental management, and opportunities to enhance supply chains,

(b) the impact of external influences on the timber and forest products industry, including but not limited to drought, water, fire, regulatory structures, habitat protection and local, state and federal policies regarding climate change and plantation establishment,

(c) projections for softwood and hardwood supply and demand over the next 30 years,

(d) transparency and data reporting of timber supply,

(e) opportunities for the timber and forest products industry and timber dependent communities and whether additional protections, legislation or regulation are required in New South Wales to better support the forestry products industry and timber-dependent communities, including opportunities for value adding,

(f) the role of the government in addressing key economic, environmental, and social challenges to the industry, including funding and support to encourage improvements in forestry practices, training, innovation and automation, workplace health and safety, industry and employee support, land use management and forestry projects,

(g) the environmental impact and sustainability of native forest logging, including following the 2019/20 bushfire season,

(h) the operation, effectiveness, and outcomes of the implementation of the NSW Forestry Industry Roadmap and Bushfire Industry Recovery Package,

(i) best practices in other Australian and international jurisdictions in relation to the sustainability of the timber and forest products industry, including social sustainability, community and Indigenous engagement and multiple uses of the forest estate and,

(j) any other related matters.

About Western Murray Land Improvement Group

Western Murray Land Improvement Group (WMLIG) is an Incorporated Not-For-Profit and Registered Charity land improvement organisation founded in 2003 by a group of local community members and farmers and now supports 13 other Landcare producer and community groups.

WMLIG has a demonstrated and trusted track record of delivering effective community capacity building, NRM, environmental and agricultural programs across the region.

WMLIG specialises in being an independent conduit to convene community members, groups, organisations, and government agencies to deliver engagement processes, information and knowledge sharing, and to arrive at collaborative, outcome-driven and co-designed solutions.

The organisation has a skills-based Board, with best-practice governance.

WMLIG employs a multidisciplinary team of 12 staff with a mix of qualifications and skills including agricultural science; natural resource management; marketing and communication; business and project management; policy; quality systems and practical on ground experience. The group regularly engages First Nations Organisations (such as Moama and Deniliquin Local Aboriginal Land Council and the Joint Indigenous Group) and local subject matter experts under sub-contract arrangements to deliver specialist services, which in turn supports the local and regional economy.

WMLIG is connected to a number of other organisations and government agencies that can be called upon to provide other specialist skills and knowledge when needed.

WMLIG operates with the following core community values and objectives:

1. Build our community's capacity to address its needs through stakeholder participation
2. Empower our community through inclusion, knowledge exchange and local decision making
3. Facilitate engagement by bringing together community members with other stakeholders such as government agencies and industry groups
4. Empower our community to take informed and solutions-driven action forward for the current and long-term sustainable wellbeing of our community and its environment.
5. Act as a conduit between parties for information exchange and project development.
6. Support community empowerment by facilitating a co-design methodology that promotes inclusiveness and local decision-making.

WMLIG currently works with key community stakeholder groups and Local Government consisting of:

- Koondrook Perricoota Alliance (KPA) and KPA sub-committees of:
    - Koondrook Perricoota Landholder Zone Representatives (four zones)
    - Koondrook Perricoota Group of Forests Community Working Group (governance structure in development for consideration by WMLIG Board and KPA)
- Wakool River Association (WRA)
- Joint Indigenous Group (JIG)
- Murray River Council (MRC)
- Red Gum Timber Industry
- Central Murray BestWool BestLamb Group
- Barham Landcare
- Edward Wakool Angling Association
- Moulamein Cropping Group

- Murrakool Land for Wildlife
- Young Country Networkers
- Border Flywheelers
- Barham Angling Club
- Other representative as required pending works and community engagement in different geographic footprints

Refer to the Western Murray Land Improvement website for more information:

Current cooperative activities in KPF

The following projects and alliances are currently under way in sectors of the forest group and have received grant funds, and government approval, in order to proceed.

While the current projects are a successful beginning to delivering on some aspects of the community vision - and contributing to the future on-ground management of the Crown Estate - work continues to bring together all stakeholders, including the Red Gum Timber Industry, to refine a process whereby there can be a greater from the ground up community role and input into managing this extensive and important area.

The outcomes are not only crucial for the immediately affected community, but for the state and national government management processes of the public estate into the future.

Koondrook Perricoota Alliance

The Koondrook Perricoota Alliance (KPA) was established in 2013, in partnership with the Joint Indigenous Group (JIG) and the Community Operational and Planning Assessment Committee (COPAC),to address third party impacts and ensure effective community engagement in the planning and delivery of managed environmental watering events in the Koondrook-Perricoota Forest.

The KPA is formed by community, local government and industry members that have an interest in how environmental watering is managed in the Koondrook Perricoota Forest.

Broadly, community and industry members are representatives of:

- Local landholders
- The Joint Indigenous Group (JIG)
- The Timber Industry
- Wakool River Association (WRA)
- General public/community representatives

Many of the KPA members are representatives on other groups and this provides a communication line for knowledge sharing and information pertaining to environmental water delivery to the Koondrook Perricoota Forest.

The KPA currently has one formalised Sub-Committee, the Koondrook Perricoota Alliance Zone Working Group (KPA Zone Working Group) and an informal community interest group termed the Koondrook Perricoota Community. Other sub-committees are expected to form over time on an as needs basis.

The KPA Alliance Zone Working Group is a group of members nominated by the KPA to represent property owners impacted by the Alternative Downstream Flow Option (ADFO) in four zones.

The Koondrook Perricoota Community Group was created to ensure community needs of the KP Forest are achieved. The needs have been reflected in the KP Visioning document (Appendix 2), which provides an overarching framework to deliver priority actions that deliver on community aspirations.

The vision accounts for the need to ensure local experience, expertise and advice informs planning, operations, monitoring, evaluation, and reporting of environmental watering events.

WMLIG provides the overarching governance structure for the Koondrook Perricoota Alliance (KPA), and sub committees. contact list for information sharing purposes.

As a result of questions raised during the NSW Parliamentary Inquiry Committee Tour of the Koondrook Perricoota Forest on the 7th February, 2022, the Koondrook Perricoota Alliance (KPA) has provided additional information for the Inquiry Committee's consideration (Appendix 9).

The KPA has provided additional context to the Committee lines of enquiry specifically relating to the repeated failure of environmental water delivery to the Koondrook Perricoota Forest post construction of the Koondrook Perricoota Forest Flood Enhancement Project.

(Appendix 6, KPA Members and Membership Organisations)

(Appendix 7, KPA Flow Chart)

Authority

Representatives retain the authority afforded to them by their respective organisations. This is reflected in the expected participation levels outlined in Table 2 (Appendix 3). Participation levels of representative member groups are deemed agreed upon after signing of the endorsement section of this KPA Terms of Reference by all relevant parties.

- It is expected the group participation levels are reflected in the Terms of Reference for other advisory groups that are established for the Koondrook Perricoota Forest.

Member organisations	Role	Responsibilities
Koondrook Perricoota Alliance (KPA)	Ensure successful community engagement in the planning and delivery of managed environmental watering events, downstream flow constraints and infrastructure considerations	• landholder consent coordination • landholder information sharing • Landholder consensus determination
Joint Indigenous Group (JIG)	Ensure inclusive engagement in the planning and delivery of managed environmental watering events, downstream flow constraints and infrastructure considerations.	• Protection and promotion of Aboriginal cultural heritage • determination and monitoring of cultural values • ensuring traditional and cultural responsibilities are maintained • cultural liaison • traditional / environmental flow consensus determination.
Wakool River Association (WRA)	Ensure successful community engagement in the planning and delivery of managed environmental watering events, downstream flow constraints and infrastructure considerations	• landholder consent coordination • landholder information sharing • landholder consensus determination
Red Gum Timber Industry	Ensure successful community engagement in the planning and	• timber industry advice

Member organisations	Role	Responsibilities
	delivery of managed environmental watering events, downstream flow constraints and infrastructure considerations	• information sharing
Murray River Council	Ensure KP activities comply to State and Federal Government planning controls, regulatory requirements and align to Murray River Councils Operational Plan, and Local Strategic Planning Statement	• Council advice • Murray River planning consent approval • emergency services and planning consideration • information sharing
Western Murray Land Improvement Group (WMLIG)	WMLIG is an intermediary between the community, partners, and other entities to engage and deliver programs. This is to achieve mutually respectful and beneficial outcomes based on community aspirations and deliverables for external entities	• bottom-up approach operational framework • social license determination • social and environmental services • governance and administration support • communication and engagement • facilitate activities borne out of the KP Visioning Document

Governance

The KPA is a sub-committee of WMLIG and thus provides the governance systems for the KPA. The KPA governance structure is illustrated in Figure 1. As such, WMLIG values have been embedded within the Terms of Reference of the KPA.

To maintain WMLIG's integrity, WMLIG remains an intermediary between the community, partners and other entities to engage and deliver programs. This is to achieve mutually respectful and beneficial outcomes based on community aspirations and deliverables for partner entities.

WMLIG supports community empowerment by implementing a co-design methodology that promotes inclusive and local decision-making, to ensure community members are not negatively impacted by external decision-makers now and in the future. The level of participation is dependent on the consensus of the community and is generally aligned to decisions that affect the wider social-ecological system.

To seek clarity around participation expectations from partner entities, WMLIG will clearly define expectations for all parties via facilitating the use of a participation model.

This participation model is aligned to three separate models, Arnstein's Ladder of Participation, Callon (1999) and IAP2 Model of Participation. The complimentary nature of these models provides a good basis for understanding the different levels, and all methodologies agree that higher levels of participation are desirable for more effective stakeholder engagement, as outlined in Figure 2 and Table 1[1]. Participation levels may be deemed non-negotiable by the community, and others negotiable with a final agreed position on authority and delegation expectations formally signed off as an agreement (see endorsement section).

[1] Conallin et al 2017. STAKEHOLDER ENGAGEMENT IN ENVIRONMENTAL WATER MANAGEMENT

This methodology focuses on a 'bottom-up' approach, commonly termed 'localism', that places the community at the centre of the planned process and focusses on community centred outcomes. This process has proven to be the most effective at achieving community buy in and trust, and the necessary social license to operate.

High levels of community participation in water reform, environmental water and general watershed/catchment management are recognised as being a successful model to achieve social license in many studies associated with water management (See References Section).

- Community, local government, and industry member representatives have listed their expected participation level as collaborate (Table 2). It is anticipated the group participation levels are reflected in the Terms of Reference for other advisory groups that are established for the Koondrook Perricoota Forest.

Over time WMLIG has witnessed opposing expectations during participation between community and government, which has caused conflict and a reluctance for community buy-in to a process.

This disparity in expectations is due to not establishing a formal process to achieve agreed consensus on what engagement expectations are between different stakeholders.

Community members generally expect their local knowledge will be incorporated into recommendations and actions to the maximum extent possible.

Government agencies have predominantly followed an informing and consulting level of engagement to try and achieve acceptance and buy-in, which has not worked.

To ensure expectations between stakeholders are clearly understood between entities, WMLIG will continue to clearly define expectations via encouraging the use of a participation model. Appendix 3 outlines the minimum participation expectation of stakeholders.

The WMLIG participation model is aligned to three separate models, Arnstein's Ladder of Participation, Callon (1999) and IAP2 Model of Participation. These models provide a powerful tool for public engagement and has been a standard in the practice for 25 years. Built on a foundation of Arnstein's Ladder, it can support understanding, provide focus to a process, build commitment, and clarify expectations.

The complementary nature of these models provides a good basis for understanding the different levels, and all methodologies agree that higher levels of participation are desirable for more effective stakeholder engagement[2].

In WMLIG's experience when a 'localism' approach has been applied, this has always resulted in a successful and positive outcome for all parties in achieving positive environmental, cultural, economic and social outcomes.

The collaborate and empower level is a 'bottom-up' approach, commonly termed 'localism'. This approach requires more up-front resources, which is where WMLIG can assist, however results in less politically sensitive stresses later in the process because people and their local knowledge are genuinely involved in the decision-making process.

Partnering with government agencies and organisations

The following government agencies currently work with WMLIG

- NSW Department of Planning, Industry and Environment
- Forestry Corporation of NSW
- Murray Local Land Services
- Commonwealth Environmental Water Office
- Murray Darling Basin Authority
- Water NSW

[2] Conallin et al 2017. STAKEHOLDER ENGAGEMENT IN ENVIRONMENTAL WATER MANAGEMENT

- NSW Office of Water
- Murray River Council
- Other invited industry, Federal and State Government agencies representatives
- Other invited government and technical / subject matter experts.

KPA, and other local community groups are formally engaged with government agencies and corporations as part of the Koondrook Perricoota Operating Committee (KPOC). Other KPA peak member groups engaged with KPCAG are The Joint Indigenous Group (JIG), Wakool River Association (WRA), Red Gum Timber Industry and Western Murray Land Improvement Group (WMLIG). These groups are also independently represented on KPOC as member entities as they have independent organisational governance structures. The agency and community groups represented on KPOC are outlined in Table 3.

Table 3 – KPOC Agency and community representatives

Government Agency	Community Group
Forestry Corporation of NSW	Joint Indigenous Group
Water Infrastructure NSW	Koondrook Perricoota Alliance
Murray Darling Basin Authority (MDBA)	Wakool River Association
NSW Department of Primary Industries (DPIE) - Fisheries	Western Murray Land Improvement Group
NSW DPIE	
North Central Catchment Management Authority (Vic)	
Commonwealth Environmental Water Office (CEWO)	

Government 'Report Cards'

The Federal and NSW Governments and their agencies have acknowledged the ongoing impacts on the KP Forest.

The NSW Government's Water website states that "before river regulation was introduced in the early 1900s, the Koondrook-Perricoota Forest experienced regular flooding for three to five months once every four years".

In more recent times the flood frequency duration is approximately once every 12 years. "This change has meant a decline in both the productivity of the wetland and the health of the ecosystem. The forest's wetlands and floodplains provide habitat for many species of plants, fish, reptiles, birds and marsupials that are endangered".

The Murray Darling Basin Commission's Koondrook-Perricoota Forest Report Card for 2019-2020 states that the delivery of water for the environment for around 11% of KP Forest has provided some localised benefits.

"While this is a good start, the forest condition remains poor and larger scale, more frequent floods are required for the wetlands and floodplains to recover.

GHD – a global professional services company in water, energy and urbanisation - is assisting the Murray-Darling Basin Authority (through Forestry Corporation of NSW) to understand the response of the KP Forest to flooding and the application of 'environmental water.'

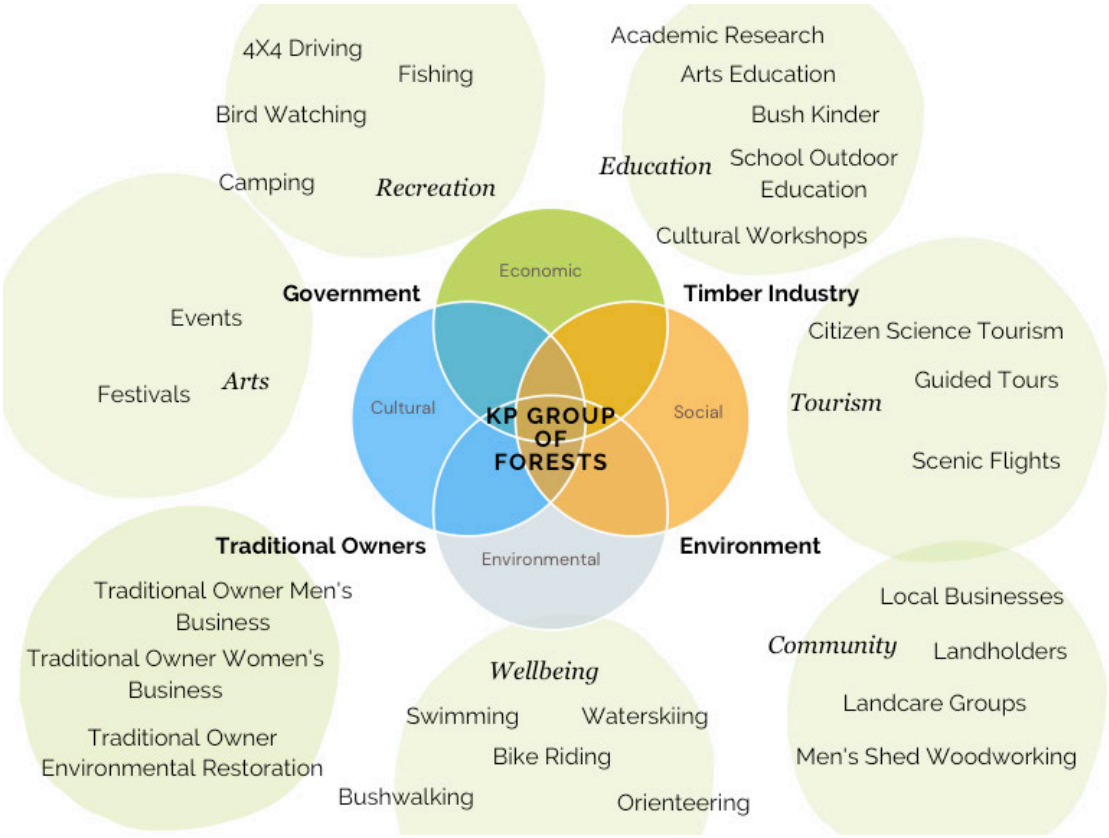
The results indicate that flooding is critical to maintain long-term forest health, while the program review helped to identify specific indicators that were crucial for tracking change in ecosystem health.

Forestry Corporation of NSW now has the ability to not only measure change over time, but to determine whether investment in environmental watering is having the desired outcome of improving forest condition.

Key Stakeholders

There are a diverse range of stakeholders that currently utilise KPF for a range of Social, Economic, Cultural and Environmental purposes providing compelling evidence of the multi-use aspect of the forest. The range of stakeholders are outlined in Figure 1 below.

Figure 1 – Stakeholder map of users in the KPF



The Red Gum Timber Industry

The red gum timber industry is integral to this cooperative approach, given its economic significance to the community and extensive knowledge of the landscape.

The industry works with WMLIG and provides expert input on the ongoing management of what is today a highly modified landscape with multiple uses ranging from timber harvesting to a range of recreational uses and potential future uses and value-adding opportunities.

Largely regrowth forest, this footprint requires active and expert interventionist management for forest regeneration, good health and longevity.

All stakeholders agree that as a Ramsar-listed site that is culturally, recreationally, socially and economically significant, a management system that is mindful of 'wise use' and the employment of local geographic and environmental knowledge is crucial.

The Red Gum Timber Industry currently harvests in 36,000 hectares of this group of forests.

The industry has shown itself to be adaptive and wanting to actively drive best practice.

Its current and significant investment in the area is around $30 million, with 100 full-time employees drawn from local communities and a significant $20 million a year flow-on effect for other businesses.

In a widespread rural region with a largely agricultural base, the industry plays a crucial economic role.

As environmental projects are carried out and potential future uses of the forest group are explored, the Red Gum Industry's knowledge and experience in the landscape is invaluable.

As forest stewards, they carry out thinning programs to promote healthy growth and to drought-proof the bush in a highly drought-prone region.

The industry keeps forest roads accessible and in good condition, as well as contributing to fire risk management and fire fighting services.

The industry is also currently engaged in ecological monitoring that aims to demonstrate the potential to accommodate both timber harvesting and flora/fauna outcomes.

The current industry operators work mostly under 5 year agreements, with those expiring in 2024, 2025 and 2030.

The companies operating in this group of forests support the concepts of E-water and cultural watering in principle and have declared and demonstrated their willingness to work with government and community groups to help scope these works.

Impacts on the industry of flooding events are taken into account and will continue to be fully considered in any future proposals

The red gum timber industry are passionate about seeking to add value to their products and/or businesses to create further economic stimulus. One business has a value-add proposition in which a 2 million dollar investment could create 10-15 further jobs in the community.

The use of waste wood from the industry also provides a valuable add-on for the industry, in concert with the agricultural industry, to be repurposed for farm compost and the resultant soil improvement and water retention outcomes; as well as an important element in biochar processes as an alternative energy source. (Appendix 1 – Appendix A - **Utilisation of wood waste and dairy manure for compost.**

Traditional Owner Participation

The purpose of the Joint Indigenous Group (JIG) is to represent the interests and aspirations of member Aboriginal organisations, communities and people regarding the management and operation of Koondrook-Perricoota Group of Forests and other lands influenced and impacted by the forest activities.

Membership of the JIG is extended to four parties who are acknowledged as Traditional owners and LALC with connection to the Koondrook Perricoota Forest (KPF), and was collectively determined and agreed at the inaugural meetings in Barham and Moama on the 22nd and 23rd of March 2010. These are:

1. Barapa Barapa people
2. Yorta Yorta people
3. Deniliquin Local Aboriginal Land Council
4. Moama Local Aboriginal Land Council.

The JIG works collaboratively with government agencies, local groups, organisations and individuals in co-designing management practices and activities to;

1. protect and promote the integrity of our culture, heritage, and traditional practices and
2. achieve cultural and employment opportunities to benefit local Aboriginal peoples.

The JIG also provides management leadership, guidance, recommendations and endorsement on the following;

- processes for managing Cultural Heritage Sites and items both known and unknown;
- KP forest management
- KP watering events
- recruitment of JIG work crews and staff;

- Cultural Heritage Awareness training of the project teams, contractors and construction workers;
- Promotion of long-term economic and employment opportunities;
- Cultural activities relating to the project;
- Opportunities to undertake sharing of information;

  The JIG will work within the guidelines of the Indigenous Partnership Agreement May 2013.

The advice, guidance and recommendations provided by the JIG will represent the views of the local Aboriginal community, developed in a culturally appropriate context.

Adjoining Landholders

Stewardship payments extending KP Forest's natural, social and financial value.

Landholders on the edges of the Koondrook-Perricoota Forest and WMLIG have taken the lead in co-designing a farmer-owned environmental goods and services broker, Regen Farmers Mutual, to facilitate ecosystem services contracts.

By extending biodiversity corridors from the forest into agricultural land, creating adjoining carbon sinks with biodiverse plantings and achieving green provenance certification (for food and fibre), landholders and NRM groups like WMLIG can gain access to funding to improve environmental outcomes for not only a working forest, but the land around it.

The results indicate that flooding is critical to maintain long-term forest health, while the program review helped to identify specific indicators that were crucial for tracking change in ecosystem health.

Forestry Corporation of NSW now has the ability to not only measure change over time, but to determine whether investment in environmental watering is having the desired outcome of improving forest condition.

Current cooperative activities in KPF

The following projects are currently under way in sectors of the forest group and have received grant funds in order to proceed.

Swan Lagoon

Swan Lagoon is located on the Murray Riverbank at the upstream end of 32,000ha, RAMSAR listed, KP Forest and is the critical, initial entry point for floodwaters into the Forest.

WMLIG were recently notified of the successful application for a grant funded by the Australian Government Department of Agriculture, Water and the Environment's Murray-Darling Healthy Rivers Program Small Grants (Round 2).

This funding is providing the means to complete rehabilitation for the first time in the Swan Lagoon.

Wetland degradation, erosion, loss of critical bank/instream vegetation habitat and sedimentation is leading to a deterioration in water quality and ecology of our wetlands, which are now some of the most degraded habitats in the world.

As such it is of upmost importance to the local community that wetlands within the KP Group of Forests are not only preserved, but enhanced.

The project aims to revegetate Swan Lagoon with locally sourced, suitable native species to increase vegetation diversity, increase habitat, remediate erosion, and improve cultural values.

Planting will be undertaken by experienced crews from partner organisations the MLALC and DLALC which include members of both Traditional owners, the Barapa Barapa and Yorta Yorta people.

Specialist technical advice will be provided by local Wetland ecologists.

Little Forest

The Little Forest Working Group project was initiated in December 2020 with a Traditional Flows watering event currently underway that commenced in October 2021.

By all accounts the watering event thus far has been a great success.

The watering event has been project managed by WMLIG in conjunction with independent Environmental Consultant JIG representative and Working Group Chair Forestry Corporation NSW and; the Little Forest Stakeholder group.

Key objectives for the event were developed from meetings with the Working Group.

Through co-design all stakeholders were able to provide their input and have their own opinions heard. As such, the outcome has been a truly co-managed watering event.

This has built considerable trust within the community; both within the Working Group and in the broader community including Traditional Owners. The project includes the use of 2 private irrigation pumps to deliver water to a 70ha wetland.

Pollack Swamp

The Pollack is a 700 hectare flora reserve that forms part of the KPF and falls within the Gunbower Koondrook-Perricoota Forest, an internationally protected Ramsar-listed Icon site.

The Forestry Corporation of NSW (FCNSW) has a requirement under the *Forestry Act 2012* to review and prepare a new draft plan provided to FCNSW in December 2020 for Pollack Flora Reserve (the Pollack), dedicated as part of Koondrook State Forest in 1918 and established as a Flora Reserve in 1992.

The Pollack is located on the country of the Barapa Barapa First Nations people and contains rich archaeological evidence of Aboriginal occupation.

The Pollack Swamp site has been rehabilitated by undertaking multiple individual projects at the site to date.

WMLIG works in partnership with Murray Local Land Services (MLLS), Forestry Corporation of NSW (FCNSW), JIG, the Barapa Barapa people, and Murrakool Land for Wildlife to maintain and improve the condition of the Pollack.

The ongoing MLLS Pollack Wetland Enhancement Project is currently in its fourth year.

This project has been a catalyst for wider community engagement and resulted in a community vision for the KPF - “A healthy working forest where native species can flourish, and where local communities can connect and co-manage the forest for future generations”.

Recently WMLIG has been successful in receiving a grant funded by the Australian Government Department of Agriculture, Water and the Environment’s Murray-Darling Healthy Rivers Program Small Grants (Round 1).

This funding will allow for a further 47ha of revegetation work to take place in the Pollack to enhance the floodplain riparian woodland.

Fish Screens

Under the recent round of grants available through the Australian Government Department of Agriculture, Water and the Environment’s Murray-Darling Healthy Rivers Program: Large Grants, WMLIG have received funding to be able to exercise a fish screening program within the Little Forest site.

WMLIG intends to use the funds to establish a demonstration site at the Little Forest (LF) which is rich in Indigenous heritage as a part of the RAMSAR site.

WMLIG will install fish exclusion screens on the irrigation pumps, to prevent pest species such as European Carp, Oriental Weather Loach and Eastern Gambusia (Mosquito fish) from entering the wetland.

The screens retain native fish in natural waterways and accelerate the recovery of their populations when water is diverted from the Murray River. Community will be actively involved in native fish recovery.

First Nations Partnerships are a priority in this project, whereby the LF Working Group brought landholders and agencies together for an agreed and inclusive process that was chaired by a Traditional Owner (TO).

The site is close to Barham and readily accessible by the public. The wetland site being rehabilitated will have complemented education regarding fish exclusion screens – a major initiative for native fish recovery.

The modern screen will provide best-practice guidance to Murray Valley private diverters and industry and facilitate a collaborative approach to modernising water management.

The Living Murray Program

A community group collaborative approach along with Forestry NSW in regard to pest and weed management, communications/marketing, workshops, education.

Under The Living Murray (TLM) project, which is coordinated by the Murray Darling Basin Authority, The Gunbower-Koondrook-Perricoota Forest is recognised as an Icon Site.

In April 2018, Commonwealth, state and territory Environment Ministers agreed to a Strategy for a common national approach to environmental-economic accounting.

The project's Inter-jurisdictional Steering Committee determined that the Gunbower-Koondrook-Perricoota Forest Icon Site (GKP) would be an ideal first case study for developing ecosystem accounts for the policy priority of water management.

WMLIG is contracted under Forestry Corporation NSW to project and contract manage the condition and intervention monitoring.

By doing this WMLIG is able to ensure that the monitoring is undertaken by local experts in the field and that the local community is engaged as necessary.

This allows for the TLM project to be delivered in a transparent and well-regarded process where local community engagement and knowledge gain is not only facilitated, but encouraged.

WMLIG engages locally based Environmental Consultants to ensure that the work is completed to a rigorous standard.

WMLIG doesn't only engage in the monitoring aspects under the TLM project, but also strives to engage in 'active conservation' including, but not limited, to pest and weed management.

Pest and weed management in the Koondrook-Perricoota footprint coordinated by FCNSW is undertaken alongside MLLS, MLALC and DLALC.

Furthermore, WMLIG engages a rigorous communications strategy to ensure transparency and education opportunities are made available to the surrounding community.

Community led native fish recovery

A community-initiated program of fish recovery work to support small-bodied native fish in the Koondrook Perricoota Forest.

This work follows 12 months of community engagement by the WMLIG to better understand their priorities and vision.

Small bodied fish are important for many reasons, including their cultural significance to First Nations communities as a food source, their role in controlling mosquitoes, carp and gambusia, and their place in the food web to support larger predators like the Murray Cod.

Wild populations are very sensitive to drought and climate change. Five of the 12 species expected to live in the Koondrook Perricoota Forest are threatened with extinction, and six remain unrecorded since monitoring began in 2010.

Plans are being developed to rehabilitate culturally and environmentally significant lagoons in the forest, including habitat improvement and carp control strategies.

Wetlands managed by community volunteers at Deniliquin, Finley, Jerilderie and Moulamein are already being used to breed threatened species for re-populating new refuges. Small-bodied fish have also bounced back at Pollack Lagoon after almost a decade of community action.

The community-initiated fish recovery program will be run under the guidance of local fisheries expert, Dr John Conallin.

General environment works considerations

There is well documented ecological change in the KP Forest as the original forest was described as 'park like' by early explorer diary entries (Mitchell 1836).

Considering the enormous evidence of Indigenous occupation in the forest - given the number and size of ovens and other cultural sites and archaeological evidence - there would not been much fuel left as course woody debris.

The timber industry is directly engaged in some forest rehabilitation works, particularly in regard to balance.

Due to past interventionist practices, and the reduction in annual flooding, tree removal is required to restore the environmental balance.

The timber industry and Traditional Owners are also exploring collaboration in regard to log jam removal within creek systems and the employment of cultural burning practices.

NSW Government legislation requires increased course woody debris to be left behind after a logging coup.

It is understood that these levels are around 70tn/ha left on the ground. These quantities are likely to cause crown fires which is a major concern for fire risk to the community and the Indigenous community as a fire would destroy culturally important trees, such as birthing trees and scar trees.

The coarse woody debris is also picked up in floods and causes log jams in flood runners, thus altering the pattern of the extent and timing of flood waters through the forest.

This fills water holes with debris. Many waterholes are culturally significant and increased depth is important from a forest water refugia perspective. Traditional Owners want intervention to remove and utilise problematic log jams.

Other research projects that have been, or are being carried out, in the KPF and which WMLIG has full access to are included in the research section of this submission.

Value-adding

Timber Enquiry reference:

(a) opportunities for the timber and forest products industry and timber dependent communities and whether additional protections, legislation or regulation are required in New South Wales to better support the forestry products industry and timber-dependent communities, including opportunities for value adding,

Biochar and potential benefits

Biochar is a form of solid residual black carbon derived from the thermo-chemical decomposition of renewable biomass feedstock such as wood, crop residues, manures or leaves, heated in a closed container at relatively lower temperature (<700 degrees C) under oxygen limited condition and specifically prepared for soil amelioration and Carbon (C) sequestration.

In general, extensive literature is available on biochar formation, characterisation and its potential applications as a soil ameliorant, adsorbent, impact on soil biota, impact on bioremediation of contaminated soil and GHG emission reduction focusing on wood as a feedstock material.

Over 15,000 tonnes of red gum wood waste is available from the Red Gum Timber Industry in the Western Riverina of NSW.

Additionally, Traditional Owners have shown interest in reducing coarse woody debris fuel loads in the forest, as they are at a level not seen for thousands of years, putting important cultural heritage sites at risk of fire (e.g. birthing and other culturally significant modified trees).

See Appendix 1 for the business case on Wood Waste and Crop Residue Opportunities to Increase Agricultural Productivity and Reduce Environmental Impacts for the Enquiry's consideration.

Collaboration anticipated with partners and stakeholders

All regions have the opportunity to convert organic wastes into useful products and inputs for agriculture. Converting wastes to biofertilisers reduces reliance on chemical inputs, lifts biological soil health.

This addresses regional waste management issues, provides opportunity for land rehabilitation, carbon sequestration and associated carbon market and local produce branding opportunities.

The project presents opportunities for food and fibre manufacturing industries. Process products/bi products such as bioenergy, waste heat, CO2, could be used to create new industries or used for processing local agricultural commodities.

Technology will need engineering, research and infrastructure solutions that provide opportunities for 1BCRC partners to transfer learnings, and IP to other regions to assist them to respond to emerging climate, water and other emerging issues such as rising input costs.

1. **Deliver the capacity for communities, government and industries to respond to emerging climate, water and related changes in business and planning decisions.**

The project delivers the capacity for community, government and industries to respond to emerging climate, water and related changes in business and planning decisions.

The outputs from the project will assist producers here and in other parts of the Basin (via knowledge sharing) to use waste organics as biofertilisers improve soil health and water holding potential, reduce dependence on imported chemicals, and helps the community become more self-reliant. Primary producers have an opportunity to value-add waste organic products (e.g. rice straw and wood waste) via a new value-add income stream providing a buffer against commodity price cycles.

If WMLIG could receive an income by making a profit from the process, this will be re-invested into the community to help with future trail work, as well as assist businesses with change management and planning decisions as part of its NRM, agricultural productivity and community capacity building charter.

2. **Develop engineering and digital water infrastructure solutions that contribute to a resilient Basin.**

The project requires engineering infrastructure solutions regarding different elements of the project.

Some off the shelf proprietary solutions exist such as pyrolysis units, however the project is seeking to scope a range of other options.

In summary engineering solutions would be required through various concept stages, as well as a blue sky, long term holistic approach infrastructure needs perspective.

3. **Enable adaptation by farm enterprises and rural communities to global trends and drivers.**

Outputs from this project reduce dependence on chemical inputs, such as fertilisers. Many of these are imported into Australia.

4. **Build collaborations to tackle the emerging basin management opportunities and risks.**

This project is based on a hub and spoke model whereby a community can link with other stakeholders from outside the region to realise solutions to problems and adoption of research to create positive on ground impact.

Because the Western Murray Catchment region is so far from existing research institutions, it has been an aspirational and strategic goal of WMLIG and Murray River Council.

In 2020, WMLIG and MRC collaborated on an Agri-innovation Precinct scoping paper. This project is a first step in creating an agri-innovation demonstration project.

The ‘’Community Adaptability Engagement Research Final Report’’, Fortunato, June 2017, report outlines the need for development of sound, tailored, community futures actions for on-ground projects that deliver innovative and transformational activities.

To support delivery of these activities, the community needs economic resources and technical expertise to support the process of institutional innovation, and facilitate capacity building in ways that enable innovation and adaptation across the community that;

- Creates a safe space for constructive dialogue about how to best adapt to environmental change as a community through the formation of formal and informal groups for deliberation, discussion and innovation.
- Develops institutional innovations by forming and strengthening new relationships between community and government, and new processes for working with government entities to solve local problems in a coordinated community effort.
- Implements new opportunities for ongoing local education about adaptability, change management, and community-based innovation.
- Fosters the creation of local processes for identifying and applying for funding to address community needs, not limited to water management.

5. Train the future leaders across basin businesses, communities and governments.

The co-design nature of this project allows people to connect with a broader range of stakeholders from other fields of expertise.

This networking allows infusion of ideas and allows people to step up as leaders. The community produced a document titled the Wakool Region Adaption Strategy in 2019. In this document, the following objectives and needs were identified:

Desired Objective:

- The community moves from an incremental change problem solving approach, to a future with proactive businesses and leaders that have the knowledge and tools to manage risk and implement agile, transformational activities.
- Identify local collaborative projects, infrastructure and resource needs via a co-designed and integrated engagement process.
- Build community resilience by feeding community based needs into skill/capability development for the broader community.

Desired Outcome:

- The community has supported leadership and a ‘can do’ attitude that can unleash its innovative capacity to readily adapt to new and emerging challenges.
- Leadership initiatives to achieve the objectives were: Support leadership/ mentorship programs. ‘’Foster an environment where young people have ongoing opportunities to fill skills gaps and participate in think tanks’’ (Dr Jo Newton, Chair of Youth Voices Leadership Team, The Land, January 2019)
- Create forums for the exchange of ideas related to diversification, including entrepreneurship, social enterprise, on line business, social media, youth leadership, education programs for schools.
- Connect people to Leadership programs
- Encourage positive attitudes and support for change.

This project provides opportunities for community members to achieve this leadership goal, as well as other stakeholders involved in the process via a cross industry collaboration process.

6. Establish a strong regionally based innovation system supporting an entrepreneurial outlook by regional communities and businesses

This project supports a strong innovation ecosystem and leverages a great foundation provided by funding via the Murray Darling Basin Economic Development Program which funded two projects, known as the Capacity Building program and Agrisystem Program.

As a result of the program, two entrepreneurial focus groups were established comprising of a biochar cluster group and an industrial hemp cluster group and trail work is being conducted which provides initial information for this project.

Since the project has been initiated from the ground up, it also provides strong buy in to move to more advanced stages that increase entrepreneurial opportunities for the community in the long term.

How could the outcomes of this project scale?

Every Basin community generates waste products and needs innovative solutions to improve resource use efficiency and reduce reliance on external farm inputs.

This project supports a regionally based innovation solution to a waste problem that generates products and inputs that can be used for the benefit of agriculture, food and fibre manufacturing, and contribute to regional economic growth and climate change goals.

Importantly the project can be transferable to any regional community as part of a circular economy.

Australia has a high potential for low cost carbon drawdown provided by pyrolysis and gasification technologies. Increasing uptake of biochar and bio-sequestration bioenergy technologies aligns to the 2030 National Bioenergy Roadmap. There is a need to apply this to larger scale demonstrations and provide broader awareness of benefits will help accelerate the industry and provide regional economic, environmental, cultural and social outcomes.

Opportunities for communities for Land remediation and rehabilitation, Sustainable and profitable regenerative agriculture, Rural and Regional employment, including substantial multiplier effects in upstream (biomass supply etc) and downstream (markets) industries provide opportunities for businesses in the new carbon economy. Opportunities for indigenous employment as part of land management solutions also present themselves.

Education

According to the United Nations Food and Agriculture Organisation (FAO), there are worldwide deficiencies in the way that forest-related issues are taught, and environmental education is generally inadequate and insufficient.

According to the FAO, environmental education should be part of the standard curriculum.

Joelle Grandjean, who is responsible for the FAO environmental education program, says that from a young age, “it is important for children to understand the relations between the forests and the livelihoods of their families and communities, and how to ensure that the generations to come can also benefit from all the resources that forests provide”.

In Australia, there are numerous educational and outdoor education movements – such as the Forest School movement – that deliver models in which students visit natural spaces to learn personal, social and technical skills.

Forest school uses forests as a means to build independence and self-esteem in children and young adults. Topics are cross-curriculum (broad in subject) including the natural environment, for example the role of trees in society, the complex ecosystem supported by a wilderness, and recognition of specific plants and animals.

However, the personal skills are considered highly valuable, such as teamwork and problem solving.[2] The woodland environment may be used to learn about more abstract concepts such as mathematics and communication.

Forest school provision is also called *nature schools*.

In Victoria, a number of education and childcare services have included the ‘Bush Kinder’ program.

These services predominantly operate from the education and care service's premises with a small part of the program delivered at the bush kinder site.

Bush kinders are generally located in natural environments away from the education and care service and provide valuable opportunities for children to explore the natural environment and to extend the educational program.

Services conducting a bush kinder include regulations for the full assessment of sites, risks, child safety, supervision and the educational and development needs of the children.

This educational program also concentrates on teaching children cultural heritage.

Victorian Department of Education and Training

https://www.education.vic.gov.au/childhood/providers/regulation/Pages/bushkinders.aspx

There are numerous opportunities to develop educational opportunities in KPF, based on its future as a healthy, peoples', working forest and as an integral major community asset that will require ongoing community management input.

Research

As outlined above, an important body of research is ongoing in KPF.

This research is often a collaboration between numerous groups that are either being coordinated by groups such as WMLIG; universities, the CSIRO and other research institutions.

Some projects are standalone.

There is enormous potential for research outcomes, trials and business models to be shared – as well as for funding to not be duplicated on similar projects.

This growing body of knowledge, if well shared and coordinated, forms an ongoing repository for use in other locations both statewide and nationally.

Research projects being carried out in the KP Forest include:

Experimental ecosystem accounting project in the Gunbower-Koondrook-Perricoota Forest icon site, that was initiated in April 2018 when Commonwealth, state and territory environment ministers agreed to a strategy 'for a common national approach to environmental-economic accounting'.

The project's Interjurisdictional Steering Committee determined that the Gunbower-Koondrook-Perricoota Forest Icon Site (GKP) would be an ideal first case study for developing ecosystem accounts for the policy priority of water management.

This case study aims to:

- improve approaches to development of ecosystem accounts.
- increase capacity to develop high-quality ecosystem accounts across multiple government agencies in Australia.
- demonstrate the value of ecosystem accounting to leaders.
- increase uptake of ecosystem service assessment and valuation by Government. Aust Government, MDBC, CSIRO
- **Ecosystem accounts** present environmental, social, cultural and economic information about ecosystems. These dynamic communities of plants, animals and microorganisms and their physical environment provide a range of ecosystem services that our wellbeing and economy depend upon.

The entire icon site is a Ramsar-listed wetland, contains the second largest extent of river red gum forests in Australia, and is a nesting site for internationally protected migratory waterbirds. GKP is also one of six icon sites that are regularly monitored for ecological health under The Living Murray program.

Forestry Corporation Review

The Forestry Corporation of NSW (FCNSW) has a requirement under the *Forestry Act 2012* to review and prepare a new management plan for Pollack Flora Reserve (the Pollack), dedicated as part of Koondrook State Forest in 1918 and established as a Flora Reserve in 1992.

The Pollack is also part of the NSW Central Murray Forest Ramsar Site.

The Pollack covers a total area of 710 hectares and consists of two compartments of Koondrook State Forest located six kilometres north of the township of Barham.

The Pollack lies within the Traditional Country of the Barapa Barapa people. It contains an unusually large concentration of archaeological evidence of pre-colonial Indigenous occupation and is culturally significant to the local Indigenous community.

It is for this reason and its significance as a waterfowl breeding area that the area was set aside as a Flora Reserve.

FCNSW's management of Pollack Flora Reserve has been consistent with the first Working Plan prepared in 1992, however significant advances in environmental and cultural understanding over the last 30 years support a much more interventionist approach to conservation management.

Further, several important changes directly or indirectly impacting the Flora Reserve have occurred in that time, including:

- The NSW Central Murray State Forests (including Koondrook-Perricoota and Pollack Flora Reserve) have collectively been designated as a Wetland of International Importance under the Convention on Wetlands1
- Environmental water delivery, via the privately-owned Bringan Irrigation Trust, was introduced in 2003.
- The Koondrook-Perricoota Forest Flood Enhancement Works (a suite of infrastructure designed to allow managed water delivery to Koondrook - Perricoota) were constructed in 2012 but are not yet fully operational, due to unresolved third-party impacts.
- Through the Murray-Darling Basin Plan, developed in 2012, approximately 2,100 GL water has been recovered to meet the environmental needs of the catchment. The associated *Constraints Management Strategy 2013 to 2024* outlines priorities for third party impact mitigation (to use water for the environment more effectively) in the Yarrawonga to Wakool Junction Reach, inclusive of Koondrook-Perricoota Forest and the Pollack.
- The Natural Resources Commission recommendation of active management regimes including ecological thinning to achieve conservation goals.2
- The significance of Barapa Barapa cultural heritage at the Pollack has been linked with ecological productivity at the site3. Recognition of the cultural values of the site and traditional owner engagement in its management have increased substantially since the 1992 plan for the Pollack. FCNSW acknowledges the past occupation, use and management of the Pollack by the traditional owners and seeks to encourage their participation in the on- going adaptive management of the reserve.
- Broader community engagement in the Reserve has also increased, primarily through the work of Western Murray Land Improvement Group and Murray Local Land Services, funded by the Australian Government's National Landcare Program. Increased community awareness of water management and associated risks, such as hypoxic blackwater events, has increased markedly in recent years.

Soil research

As one of the driest habitable continents on earth, and with some of the poorest soils, ongoing research into soil improvement is not only vital for our agricultural industries, but also for the environmental health of the crown estate.

Research recommendations for the KP Forest include:

1: Future modelling of blackwater risk should take into account the litter loads and carbon leachate of the different types of leaf litter and vegetation from different inundation zones within KP Forest.

2: To avoid the risks of hypoxic blackwater outflows and poor ecological outcomes downstream of KP Forest, it is important to optimise the magnitude of flows through KP Forest and avoid scenarios where water stands for long periods of time.

This is especially important during the warm months when carbon leaching can increase and have a detrimental effect on dissolved oxygen concentrations. Inundation scenarios that commence earlier, and/or have longer duration (60 -120 days) or higher inflows have lower risk of hypoxia.

3: The water quality entering the forest from upstream sources should be taken into consideration when considering the downstream water quality impacts of the delivery of environmental water to Koondrook-Perricoota Forest.

4: The impact of controlled burns on litter load needs to be further examined through experimental trials. These trials must examine the potential risks on water quality from toxins that leach from ash following inundation.

5: A study be undertaken to improve knowledge about the impacts of wetting/drying, droughts and inundation on litter loads in red gum forests.

Other research projects where outcomes and knowledge have been shared include:

- Bat populations
- Bird species diversity
- Carbon sources
- Soil research

Social wellbeing

A great deal of research has been carried out globally to quantify the benefits of spending time outdoors and the value of being able to interact with the natural world.

Whether it's a stroll in a park or a day spent hiking in the wilderness, exposure to nature has been linked to a host of benefits, including improved attention, lower stress, better mood, reduced risk of psychiatric disorders and even upticks in empathy and cooperation.

Most research so far has focused on green spaces such as parks and forests.

As the research is fine-tuned, scientists are charting a course for policymakers and the public to better tap into the healing powers of Mother Nature.

"There is mounting evidence, from dozens and dozens of researchers, that nature has benefits for both physical and psychological human wellbeing", says Lisa Nisbet, PhD, a psychologist at Trent University in Ontario, Canada, who studies connectedness to nature.

"You can boost your mood just by walking in nature. And the sense of connection you have with the natural world seems to contribute to happiness even when you're not physically immersed in nature" (Amercian Psychological Association).

These positive benefits not only benefit the immediate community but are an increasing attraction to tourists and new residents seeking a less urbanised environment.

Researchers have proposed a number of ideas to explain such findings, as Nisbet and colleagues described in a review of the benefits of connection with nature.

The biophilia hypothesis argues that since our ancestors evolved in wild settings and relied on the environment for survival, we have an innate drive to connect with nature.

The stress reduction hypothesis posits that spending time in nature triggers a physiological response that lowers stress levels. A third idea, attention restoration theory, holds that nature replenishes one's cognitive resources, restoring the ability to concentrate and pay attention.

Research also shows that people with a greater connection to nature are more likely to behave positively towards the environment, wildlife and habitats. Developing an enduring relationship between people and nature, connecting people, may be critical for future nature conservation.

Tourism development

With a coordinated effort, the KPF's potential for general, cultural, ecotourism and wellness tourism has significant implications for economic growth in the overall region.

The rich Indigenous cultural history, and natural values in the already popular Murray River and surrounds zone, coupled with Agritourism, food trails and on-farm experiences has the potential to create new businesses and jobs; while allowing the expansion and adaptation of existing tourism enterprises.

To date, visitor numbers to the KPF have been lower than in Gunbower. Victorians, for example, can achieve the forest/river experience in Victoria.

However, as the Covid Pandemic impacted all sectors of the tourism industry, changes in consumer preference began to emerge and domestic, shorter-term destinations were being increasingly sought.

Ecotourism has been a significant and growing sector since 2001 and this appears to have undergone an upsurge during Covid as tourists sought experiences that were closer to home, but that balanced factors such as cultural heritage and tangible conservation.

Raising the awareness among visitors of the natural setting and instilling respect for the culture of local communities, can have profound benefits in mitigating any negative environmental effects from tourism activity.

However, although ecotourism is often touted as a win–win model, tourism development and conservation can have conflicting interests, resulting in compromises that lead to some level of environmental impact.

With the body of work already carried out and captured by WMLIG and stakeholders in KPF, a co-designed model for further tourism development and promotion can be devised, carefully geographically targeted and managed.

In some parts of the world, Greece for example, the increased demand for ecotourism, agritourism and 'Responsible Tourism' has made such destinations more popular (Mozaik Hospitality 2021).

The focus points are:

- Protecting cultural heritage – Traditional owners delivering cultural tourism programs, while ensuring tourists and guests are provided with agreed information and guided trips
- Incentives to preserve cultural sites – The reconstruction of cultural heritage sites and sensitive guided access to them is regarded as being well received by visitors
- Business opportunities – the promotion and production of authentic and verified 'souvenirs', bush foods, art works etc, made by locals – including red gum timber products
- Strong cooperation with regulatory authorities – any new tourism incentives would ensure hospitality best practice and high standards are included in all new enterprises

The Federal Government's Australian Trade and Investment Commission, and Tourism Australia (*ecotourism.org.au/assets/Resources-Hub-Ecotourism-Research/Tourism-Investment-In-Regional-Australia-2017*) points to many icons and 'bucket-list' spots being located in regional Australia.

With millennials being seen as the next major wave of travellers, 'their intense global demand for travel experiences that resonate on a deeper emotional level is also driving travel brands to develop product that is more adventurous, more personalised, and more attuned to local culture; inspiring consumers toward a path of self-discovery'.

The KPF already enjoys icon status and is well placed to attract more of this traffic.

The potential to visit regional Australia and key attractors by source market growth in self-drive travel has the potential to increase visitation to Australia's regions even more with international visitors indicating a desire to spend an average of six nights of a 14-night trip in regional Australia and visiting up to four different destinations.

Included among the most sought after experiences are wildlife and natural beauty, and food and wine; with considerably fewer visitors seeking city experiences.

Heritage includes places, values, traditions, events and experiences that capture where a country has come from and where it is headed.

As the world's oldest living culture, Australia's Indigenous people have a continuous history spanning more than 50,000 years. Theirs is the oldest story on Earth, providing an irrevocable understanding of the birth of the Australian continent, its ancient landscapes, spirituality and wonder.

The KPF landscape today is a map of the spirits' journeys and stories created over thousands of years ago describing these journeys.

Indigenous Australians are a living legacy of spiritual knowledge, custodianship of land, culture, people and the connectedness of all things shared through rituals, art, dance, music, secret stories and journeys created in the Dreamtime – the time when ancestral spirits created the landforms and all life.

Indigenous hosts and guides are keen to share their story and give an insight into their culture.

Clean, well maintained environmental attractions; along with Indigenous plants and produce with health properties and an emphasis on distinctive cultural traditions creates a competitive advantage for regional areas to also market into the growing area of 'wellness tourism'.

A Contemporary Vision

(a) best practices in other Australian and international jurisdictions in relation to the sustainability of the timber and forest products industry, including social sustainability, community and Indigenous engagement and multiple uses of the forest estate and,

WMLIG has conducted research into how greater community management inputs could potentially be piloted and implemented.

Over time WMLIG has witnessed opposing expectations during participation between community and government, which has caused conflict and a reluctance for community buy-in to a process.

Any major change that impacts a community is likely to be negatively received, when there is perceived community non-involvement in that change.

This disparity in expectations is due to not establishing a formal process to achieve agreed consensus on what engagement expectations are between different stakeholders.

Community members generally expect their local knowledge will be incorporated into recommendations and actions to the maximum extent possible. Government agencies have predominantly followed an informing and consulting level of engagement to try and achieve acceptance and buy-in, which has not worked.

Communities are also willing to work with government when it comes to any required regulatory changes that bring about a desired outcome.

To ensure expectations between stakeholders are clearly understood between entities, WMLIG seeks to clearly define expectations via encouraging the use of a participation model.

The WMLIG participation model is aligned to three separate models, Arnstein's Ladder of Participation, Callon (1999) and IAP2 Model of Participation. These models provide a powerful tool for public engagement and have been a standard in the practice for 25 years. Built on a foundation of Arnstein's Ladder, it can support understanding, provide focus to a process, build commitment, and clarify expectations.

Historic Models

What can we learn from other Community Forest Management models?

While overseas Community Forest Management (CFM) models and a previous domestic model have provided valuable insights into the scope and management requirements of such proposals, they have also clearly indicated how crucial careful attention to independent, cooperative and transparent best practice governance would be to ensure engaged and ongoing community participation in such a multi-use area.

A previous attempt at co-management of a state forest – the Wombat State Forest in Victoria – is regularly quoted as a reason why co-designed models fail.

Essentially, it resulted in anger and disempowerment, rather than genuine participation and input.

However, research into the failings of a model that is now more than 20 years old provide a valuable set of learnings and a risk assessment approach that takes into account the changes in government policy and direction, community expectation and the convening power that apply in 2022 and beyond.

One of the key studies (*Social accountability and community forest management: the failure of collaborative governance in the Wombat Forest Nathanial Matthews; Bruce Missingham, School of Geography and Environmental Science, Monash University, Vic, Australia Development in Practice, Volume 19, Number 8, November 2009)* points to one of the driving forces behind CFM's advancement having been a movement for decentralised environmental governance that had been gaining strength since the mid-1980s (World Bank 2000).

This framework of decentralisation has developed through a paradigm shift away from state-centred policies, that excluded local communities and stakeholders from resource management and decision making.

CFM is a form of decentralisation and devolution that is now being practised in more than 60 countries (Agrawal 2001).

The Wombat State Forest model was the first such initiative in Australia and covered the 50,000 hectares of mixed dry sclerophyll forest on Australia's Great Dividing Range

Close to Melbourne, and the forest included a number of endemic and endangered flora and fauna, but also adjoined a number of small towns.

It had been a working forest since the 1850s, harvested to support the gold rush, and in 1880 a Royal Commission into its condition declared it a 'ruined forest'.

The much later attempt at CFM – and its failure – point to how the idealisation of communities as 'unified' or attached to a particular place (Agrawal and Gibson 1999: 629) could gloss over significant social conflicts and divisions and create unrealistic expectations.

Conflict over forest management, and polarisation among environmentalists within the state agencies, had confounded the Wombat CFM process.

Timber harvesters reported feeling excluded amid 'blamed' for the historical mismanagement of the forest (interviews; see also Petheram and Race 2005), while others against a continuation of timber harvesting stayed away because of earlier conflicts.

The failure to harness existing social capital was also seen as a crucial oversight. (Pretty and Ward Social Capital and the Environment 2009), argue that for communities to manage natural resources successfully there needs to be investment in social capital.

In some instances, new groups had been set up to deal with issues such as historical values, but had ignored effective existing historical groups.

Future approaches by forest agencies to CFM does not necessarily need initiation or strong direction from government, but it does require a long-term commitment from forest agencies, meaningful devolution of power, and on-going institutional support, including training and financial aid for participants (Matthews and Missingham).

However, since then WMLIG believes that little attention has been paid to contemporising the models that can deliver community desires based on the best consultation and cooperation processes that could continue to deliver the desired economic, environmental, social and cultural outcomes.

The successful and agreed delivery of the projects listed in this document have established valuable groundwork for an expansion of the community input to a management model.

We would welcome further discussions with Members of Parliament, government departments and other stakeholders to advance a management system that integrates the community's stated desire with current and potential future users of the KPF, with a sustainable working forest at the forefront. This model needs to be explored, rather than a default land management decision such as a National Park that is not supported by the community.

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Collaborative forest management in Victoria's Wombat State Forest — will it serve the interests of the wider community?

Mark Poynter[1,2] [1]Consultant forester, Forest and Natural Resource Services, PO Box 2102, East Ivanhoe, Victoria, 3079 [2]m.poynter@fnrs.com.au

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Appendices

Wood Waste and Crop Residue Opportunities to Increase Agricultural Productivity and Reduce Environmental Impacts

Contents

Considerations for the NSW Timber Industry Enquiry

This submission is specifically aligned with the Terms of Reference of the NSW Parliamentary Inquiry into the long-term sustainability and future of the timber and forest products industry relating to the following (in bold text):

(b) the impact of external influences on the timber and forest products industry, including but not limited to **drought, water, fire, regulatory structures, habitat protection and local, State and Federal policies regarding climate change** and plantation establishment,

(e) **opportunities for the timber and forest products industry, including but not limited to drought, water, fire, regulatory structures, habitat protection and local, state and federal policies regarding climate change** and plantation establishment.

(f) the role of the government in addressing key economic, environmental and social challenges to the industry, including funding and support to encourage improvements in forestry practices, training, **innovation** and automation, workplace health and safety, industry and employee support, **land use management and forestry projects**,

(i) best practices in other Australian and international jurisdictions in relation to the sustainability of the timber and forest products industry, including **social sustainability, community and Indigenous engagement and multiple uses of the forest estate**.

(j) **other related matters**

Executive Summary:

Biochar is a form of solid residual black carbon derived from the thermo-chemical decomposition of renewable biomass feedstock such as wood, crop residues, manures or leaves, heated in a closed container at relatively lower temperature (<700 degrees C) under oxygen limited condition and specifically prepared for soil amelioration and Carbon (C) sequestration.

This submission explores the use of using wood waste with crop residue as feedstock for biochar production and associated by-products, which has the potential to realise considerable direct and indirect socio-economic and environmental benefits.

Potential direct economic benefits of $43 to $102M per year have been calculated, pending a range of factors such as biochar prices and Australian and International carbon credit unit prices, with an estimated 35 multidisciplinary jobs created. These jobs range from equipment operation, marketing, communication, logistics, transport and research and development roles including First Nations people working on country.

Infrastructure and technology associated with the pyrolysis process have the potential to produce flow on benefits of $99M to $235M using a regional economic activity multiplier of 2.3 (SEGRA 2019).

There is potential to reduce greenhouse gas emissions by 123,000 tns per year via carbon sequestration, emissions reduction (e.g. livestock feed additives) and emissions avoidance measures (in the case of finding alternatives to crop residue field burning).

Indirect, unmeasured benefits of biochar include improved soil moisture holding capacity and nutrient cycling, plant production and animal health. improved air quality, reduced chemicals inputs and reliance on imported products to Australian Agriculture.

This project would be further scoped with an existing biochar cluster group that is envisaged to be expanded to involve a range of local and state government, business, community and research institutions.

Introduction:

In general, extensive literature is available on biochar formation, characterisation and its potential applications as a soil ameliorant, adsorbent, impact on soil biota, impact on bioremediation of contaminated soil and GHG emission reduction focusing on wood as a feedstock material. Biochar can be added to soil as a soil

conditioner, and as a livestock feed additive improving feed conversion efficiency, production and reducing methane emissions. The nutrient retention capacity of biochar leads to reduction in fertiliser use, so it indirectly results in reduced environmental costs associated with the production of chemical fertilisers and energy for supply and distribution and land application.

Other novel applications of by-products associated with the biochar pyrolysis process have agricultural and industrial applications. These include bio-stimulants, bio-insecticides and bio-fungicides from pyroligneous acid generated in the process. Tar / bio-oil and tannins (used in conjunction with biochar for feed additive methane reduction), bioenergy (from syngas), and carbon / graphene (used for applications such as activated carbon for water filtration and battery manufacture), bioenergy and industrial grade CO2 are other examples of its use.

Several hundred tonnes of wood waste derived from the Red Gum Timber Industry is currently utilised for compost on a local dairy and avocado farm which forms an important agricultural input, reducing the reliance on chemical fertilisers and showcasing an opportunity for novel biological product inputs. A local case study of this process is outlined in Appendix A.

This opportunity, which already has working examples in other locations, provides a clear linkage between the stated community consultation outcomes in the main submission to retain a working forest that benefits the whole community, including the agricultural sector, in order to provide positive economic, social, cultural and environmental outcomes.

This scoping document investigates the opportunity to scale up the use of both wood waste and crop residue as a local feedstock for biochar and other derived products for environmental and economic benefits. Both feedstocks are readily available and are in close proximity to each other in the region, and according to scientific literature review, there are beneficial synergies for using the two feedstocks for biochar production as processing crop residue in isolation without wood waste would likely be unviable; and unattractive from a chemical composition perspective for alternative uses, particularly agriculture.

A local biochar cluster group has been formed in the region supported by Western Murray Land Improvement Group (WMLIG) via funding from the Federal Government's Murray Darling Basin Economic Development Program.

The cluster group is keen to pursue opportunities for the use of biochar in local agro-ecosystems and has started with crop residue biochar trials and analysis. Other opportunities are being scoped that reinforce the valuable cooperative project work currently underway in this region; work that can't be separated from the future of the KP Forest.

Australia has a high potential for low-cost carbon drawdown provided by pyrolysis and gasification technologies. Increasing uptake of biochar and bio-sequestration bioenergy technologies aligns to the Federal Government's 2030 National Bioenergy Roadmap.

These include carbon removal through Pyrogenic Carbon Capture and Storage (PyCCS) and Bioenergy with Carbon Capture Utilisation and Storage (BECCS/BECCU). It is recognised that there is a need to apply this to larger scale demonstrations and provide broader awareness of benefits to help accelerate the industry and provide regional beneficial outcomes (Australian Renewable Energy Agency, 2021).

The biochar industry sector has the potential to contribute significantly to the following:
Socio-economic:

- **Rural and Regional employment**, including substantial multiplier effects in upstream (biomass supply etc) and downstream (markets) industries

- **Mitigation of the 'brain drain' and 'youth drain' from the bush** toward larger cities, through provision of employment in exciting new green technologies and applications, including many still with direct contact (and benefit for) the land.
- Opportunities for **Indigenous employment** as part of fire stick management and land rehabilitation, especially removal of woody weeds and excess course woody debris.
- **Assist PostCovid 19 Recovery** – new jobs and green jobs, potential high growth sectors
- **Assisting food and energy security**
- **"Turbo-boosts" to other sectors** (e.g. agriculture productivity, drought resilience)
- **Circular economy** (wastes to resources of higher value) – today many recoverable organic residues are burned or landfilled, such as plantation wood residues and crop stubble etc.
- **New Carbon Economy** (Carbontech, biobased materials) – US domestic market potential alone estimated at >$200B per annum for solid carbon products (Carbon 180, 2019).
- **Complementary to other forms of bioenergy** (e.g. can improve gas quality and quantity in Anaerobic Digestion for biogas etc).
- **Complementary to other forms of renewables** (e.g. potential for graphite from biochar for Li Ion battery production, bioenergy for dispatchable energy and potential for cogeneration with solar/wind (allowing 24/7 operations, reducing terms for ROI on those technologies).
- **Opportunity to accelerate through further support:** The Australian Renewable Energy Agency (ARENA) has spent over AUD $118M on the bioenergy sector in the last 8 years. Supported projects involving biochar are limited to date (e.g. Logan Biosolids Gasification Project) and as such the sector represents significant potential for further consideration and investment.
- **Cost savings for local government and regional state government services –** Such as a collaboration by the Pyrenees Shire Council in Victoria and the Beaufort and Skipton Health Service network to power the local hospital and aged care facility using straw pellets and local sawmill wood waste.
- **Circular economy** and waste minimisation
- **Land remediation and rehabilitation**

Environmental:

- **Critical action on climate change** – significant carbon dioxide removal (drawdown / sequestration), along with continued emissions reduction in destructive gasses such as nitrous oxide and methane.
- ***Drought resilience*** for farms and also urban vegetated areas (reduced water requirements for soils and sporting fields etc). Biochar absorbs up to several times its weight in water.

The potential benefits of using wood waste with crop residue as a feedstock in a pyrolysis process (as recommended by Singh et al, 2015), has been calculated by WMLIG using a blend ratio of approx. 2:1 crop residue to wood waste (30,00tn crop residue with 17,000 tn wood waste). The annual potential direct and indirect benefits of this use case are compelling and summarised below:

Calculated potential direct benefits to the local region

Socio-economic

- **35 local jobs, comprised of:**
  - 5 Traditional Owner jobs working 'On Country' in the Koondrook Perricoota Forest.
  - 22 people working on processing material to a final value add product ready for sale,
  - 3 transport jobs,
  - 3 market and communications jobs,
  - 2 R&D agricultural trial work jobs.
- **Direct economic benefit of between $43M to $102M per year**. This wide range is dependent upon pyrolysis conversion efficiency and price achieved for carbon offsets and finished products. The potential economic benefits are comprised of:
  - Biochar value $8.4M to $51M/yr (see Appendix C)
  - Wood vinegar value $4M to $6M/yr (see Appendix C)
  - Biochar CO2 offset $1.5M to $6.1M/yr (see Appendix C)
  - Livestock feed additive methane offset $1.85M to $7.8M/yr (see Appendix C)

    - Crop residue CO2 equivalent in field burning avoidance offset value for local farmers $1M to $4.35M.
    - Value add wood waste (Est. $0.8M/yr)
    - Labour $7.3M/yr
    - Feed additive livestock production benefit of $18.67M *(if 20% of biochar was used as a feed supplement @$280/cow/yr x 66,666 cows using rate of 150g/biochar/day). See Appendix B example.*
- Infrastructure and technology required for organic waste conversion to bioenergy, biochar, and related finished products est. $20M+ *(not included in economic benefit calculation).*
- **Indirect economic benefit of $99M to $235M per year** using economic activity multiplier effect of 2.3 (SEGRA 2019).

Environmental

- **Reduce Greenhouse Gas (GHG) emissions by 123,293 tns CO2 equivalent. This is comprised of:**
    - 41,310 tns/CO2 reduction converting wood residues to biochar,
    - 52,983 tns/CO2 equivalent reduction using biochar as a feed additive to reduce methane livestock emissions.
    - 29,000 tns CO2 equivalent reduction from not burning rice stubble in field (avoidance).

Unmeasured indirect potential benefits

There are a range of indirect benefits associated with the production of biochar that have not been economically valued in the benefits analysis. For example, using biochar as a livestock feed additive to improve feed conversion efficiency, reduced fertiliser use and improved animal health (including reduced vet costs). A list of the potential multi-use benefits are outlined below:

- **Improved air quality and amenity** from reduced PM2.5 and PM10 particulates generated from crop residue burning (rice in particular).
- **Improved animal health and production** when biochar and other products such as bio-oil and tannins are included as a feed additive.
- **Improve soil and plant health:**
    - Improved soil organic matter and associated cation exchange and soil moisture holding capacity.
    - Soil ameliorant and carbon sequestration. Improves soil basic properties such as pH (ameliorates soil acidity) along with subdued release of greenhouse gases from agroecosystems.
    - Adsorbtion surface to agrochemicals and therefore can bioremediate contaminated soil improving environmental health and food safety due to reduced uptake by crops and chemical leaching.
    - Provision of important micro and macro nutrients and long-term nutrient retention capacity.
    - Biochar aggregates hold nutrients and soil moisture providing suitable habitat for microbial communities and better symbiosis of crop with bacteria and fungi leading to bioavailablity of nutrients.
    - Suppressed agricultural plant diseases, and increased plant growth. (El-Hadal et. al. 2010, Youssef 2014).
- Create an **agri-innovation demonstration site** / innovation ecosystem transferrable to other regions and leverage regional produce branding opportunities:
    - Establishment of place-based research partnerships and cross-industry networks that collaborate for technological and innovative solutions and create an institutional innovation mindset. This aligns to the One Basin CRC and drought resilience and innovation hub programs.
    - WMLIG has submitted a Quickstart program as part of the One Basin CRC investigating a collaborative project for conversion of waste organic matter to produce novel biological products to increase agricultural production and reduce environmental impacts. This helps build resilience by adaptive measures (which aligns to Murray River Councils Adverse Event Plan), educate community and instil an ‘’Institutional Innovation’’ mindset.

    - Position region as leader in sustainability and innovation.
    - Involvement of businesses in the new carbon economy.
- **Produce niche high value products:**
    - Feed additives,
    - Prescriptive soil ameliorant and decontaminant (different feedstock mixes and pyrolysis temperature can influence soil pH - increased soil cation exchange capacity also provides liming effect to acidic soils which immobilizes heavy metals and persistent organic pollutants),
    - Bio-insecticides, bio-fungicides, and bio-stimulants,
- **Food and energy security:**
    - Reduced supply chain sovereign risk by reducing reliance on imported products.
    - Opportunity for bioenergy production and alignment to the National Bioenergy Roadmap.
- **Reduce financial costs for food and fibre producers**; demonstrate potential for new business opportunities, while addressing climate change/resilience-building initiatives and reducing waste:
    - Increase $/ML water returns (improve soil moisture holding capacity, reduce inputs, income from carbon economy, value add agricultural wastes).
    - Provide additional income to primary producers.
    - Create new industries (diversification), jobs (including Indigenous employment).
    - Reduce waste streams.
    - Direct farm to market value-add opportunities. Positive farmer backstory leverage for produce access to niche high value markets to discerning buyers.

Local resource availability and opportunities for First Nations people

The volume of local red gum wood waste residue generated is greater than 17,000 tonnes per year which has a potential to be converted to 8,500 tonnes per year of biochar, and other useful agricultural products such as wood vinegar (pyroligneous acid).

Traditional Owners have a strong cultural intention (John Kerr, CEO Moama LALC pers. comm. 2021) for reducing coarse woody debris fuel loads in the forest, as they are at a level not seen for thousands of years, putting important cultural heritage sites at risk from out of control bushfires (e.g. birthing and other culturally significant modified trees). Local fire services have noted that there are areas with unacceptable levels of coarse woody debris which would result in crown fires, which have historically been a very rare occurrence in the red gum forest estate to date, and would welcome a reduction in fuel loads.

Log jams change flood water dynamics through flood runners in the forest by increasing deposition in waterholes. This reduces the amount of time water is present to provide wildlife refugia support and subsequent re-seeding of native fauna and flora to repopulate the forest in subsequent flooding events.

In this proposal an estimate of 2,000 tonnes per year of wood residue is proposed to be harvested by Traditional Owners, employing five full time people. (*Note that this proposal would require EPA regulatory support in the case of flood runners, as well as further dialogue with Forestry Corporation and other forest users. However, in saying that, the proposal aligns with the NSW Parliamentary Inquiry into the long-term sustainability of the timber and forest products industry, especially in relation to:*

- *Industry engagement and multiple uses of the forest estate.*
- *Drought, water, fire, regulatory structures, habitat protection and State and federal policies regarding climate change.*

The Value of Crop Residues

In addition to wood residue, the local region has significant quantities of agricultural crop residues that can be converted to biochar, particularly wheat, barley and rice straw.

In a full irrigation water allocation year, several hundred thousand tonnes of crop residues would be available to convert into biochar in the region.

However, it is recommended that crop residue biochar (CRB) be blended with other lignocellulosic material such as wood waste to make the biochar a more useful product for agriculture. (Singh et al., 2015).

Converting crop residue to biochar also improves air quality and reduces greenhouse gas emissions. Rice straw is currently mostly burnt in the field, which releases various air pollutants including non-methane hydrocarbon compounds and particulate matter (PM2.5 and PM10). The retention of barley and wheat crop residue via conservation agriculture (e.g. crop residue retention via no-till) has reduced the incidence of burning and been found to halt the decline of soil organic carbon (Dr Richard Echart Melbourne University pers.comm. 2022), however the degradation of stubble causes significant release of methane (CH4).

International context

Globally about 4,000 MT/yr of crop residue is produced worldwide from 27 food crops. Rice and wheat contribute around 30% of the global lignocellulosic biomass generation. The degradation of crop residue causes significant release of CH4 as a greenhouse gas, as well as the release of other various air pollutants including particulate matter (PM2.5 and PM10) when burnt.

The detrimental effects of crop residue burning calls for an effective crop residue management system for attaining agricultural sustainability and arresting climate change impacts.

Agricultural expansion has decreased the soil organic matter (SAM); reduced microbial and mesofaunal activities associated with biodiversity loss; increased crop residue burning; and enhanced use of persistent agrochemicals causing human and soil health impacts.

In general, wood cannot be considered as a sustainable feedstock for biochar production in Asian countries that produce enormous quantities of crop residue, particularly rice. However, this region has abundant wood resources as well as crop residues to complement each other for conversion to biochar, thus has the potential for creating a significant number of jobs, improving soil health and agricultural productivity, reducing reliance on agrochemicals (many of which are manufactured overseas and create sovereign risk), reducing GHG's and associated anthropogenic climate change, bioremediation of soil (e.g. PFAS), and reduced air pollution (via reduced crop residue burning).

Potential uses of crop residue biochar for sustainable agriculture

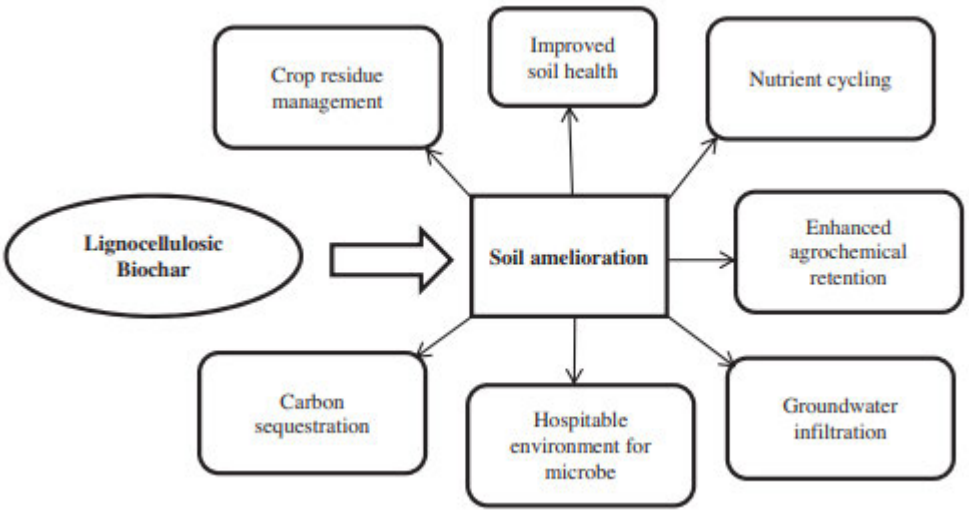
Converting crop residue (CRB) to biochar via pyrolysis has been evaluated as a potential soil ameliorant and carbon sequestration agent. Biochar has been found as a potential soil ameliorant for improving the deteriorating soil quality and has been reported to apply in various ecosystems.

Biochar application to soil has been found to improve soil physical and nutrient profile such as soil C, N and P as like fertiliser, they cause detoxification of soil by adsorbing various contaminants, and provide an hospitable environment to soil biology.

Conversion of biomass carbon (C) to biochar carbon facilitates more C retention in the soil (retains about 50% for a long period of time) of parent C compared to traditional conservation agriculture systems (i.e. burning only retains 3% of the C, with the rest released instantly to atmosphere) and microbial C degradation (10-20% for 5-10 years).

The multifaceted agricultural and environmental benefits of biochar is outlined in Figure 1 below.

Figure 1 – Multifaceted benefits of biochar as soil ameliorant for sustainable agriculture (source Singh et. al. 2015)



Current Trials

There are many unknowns about the conversion of rice straw to biochar via pyrolysis, and concerns have been raised about the composition of rice straw for use in biochar production, in particular its high silica content.

As such Western Murray Land Improvement Group (WMLIG) is sending rice straw to be trialled by a Melbourne company, Earth Systems, using their pyrolysis unit (Charmaker) via funding from the Federal Government's Murray Darling Basin Economic Development Program, and a co-contribution from Murray Local Land Services. The trial will provide:

- Complete basic case study report on conversion efficiency of feedstock to biochar and lessons learned.
- Chemical analysis of biochar emission from stack, feedstock handling, and wood vinegar.
- Basic cost / benefit analysis of producing biochar from rice straw and other by-product options.

This initial trial will be used as a stepping-stone to further explore options for organic waste conversion to biochar in the region, and it is envisioned that a consortia of industry, researchers, government and community group members will join the established biochar cluster group for technical consultation and knowledge sharing and to further scope a range of use options in the future (see Table 1). This can result in a range of benefits and opportunities by:

- Supporting a regionally-based innovation solution to a waste problem that generates products and inputs that can be used for the benefit of agriculture, food and fibre manufacturing, and contribute to regional economic growth and climate change goals. Every regional community generates waste products and needs innovative solutions to improve resource use efficiency and reduce reliance on external farm inputs.
- Delivering the capacity for community, government and industries to respond to emerging climate, water and related changes in business and planning decisions.
- Assist producers here and in other regions (via knowledge sharing) to use waste organics such as biofertilisers to improve soil health and water holding potential, reduce dependence on imported chemicals, and help the community become more self-reliant.
- Provide an opportunity for primary producers to value-add waste organic products (e.g. rice straw and wood waste) via a new value-add income stream providing a buffer against commodity price cycles and climate related issues such as drought.
- Conduct land remediation and rehabilitation, sustainable and profitable regenerative agriculture, rural and regional employment, including substantial multiplier effects in upstream (biomass supply etc) and downstream (markets) industries for businesses in the new carbon economy.
- Opportunities for Indigenous employment as part of land management solutions also present themselves.

Importantly, project outputs can be transferable to any regional community as part of a circular economy.

WMLIG has included the use of wood waste and crop residue conversion to biochar in a One Basin CRC Quickstart Proposal (submitted 9th March 2022) to fund work with a consortia of industry, researchers, government and community groups to scope a range of use options.

Biochar production – the next step

Technologies for biochar production will need engineering, research and infrastructure solutions that provide opportunities for stakeholders/partners to transfer learnings, and intellectual property (IP) to other regions to assist them to respond to emerging climate, water and other emerging issues such as rising input costs.

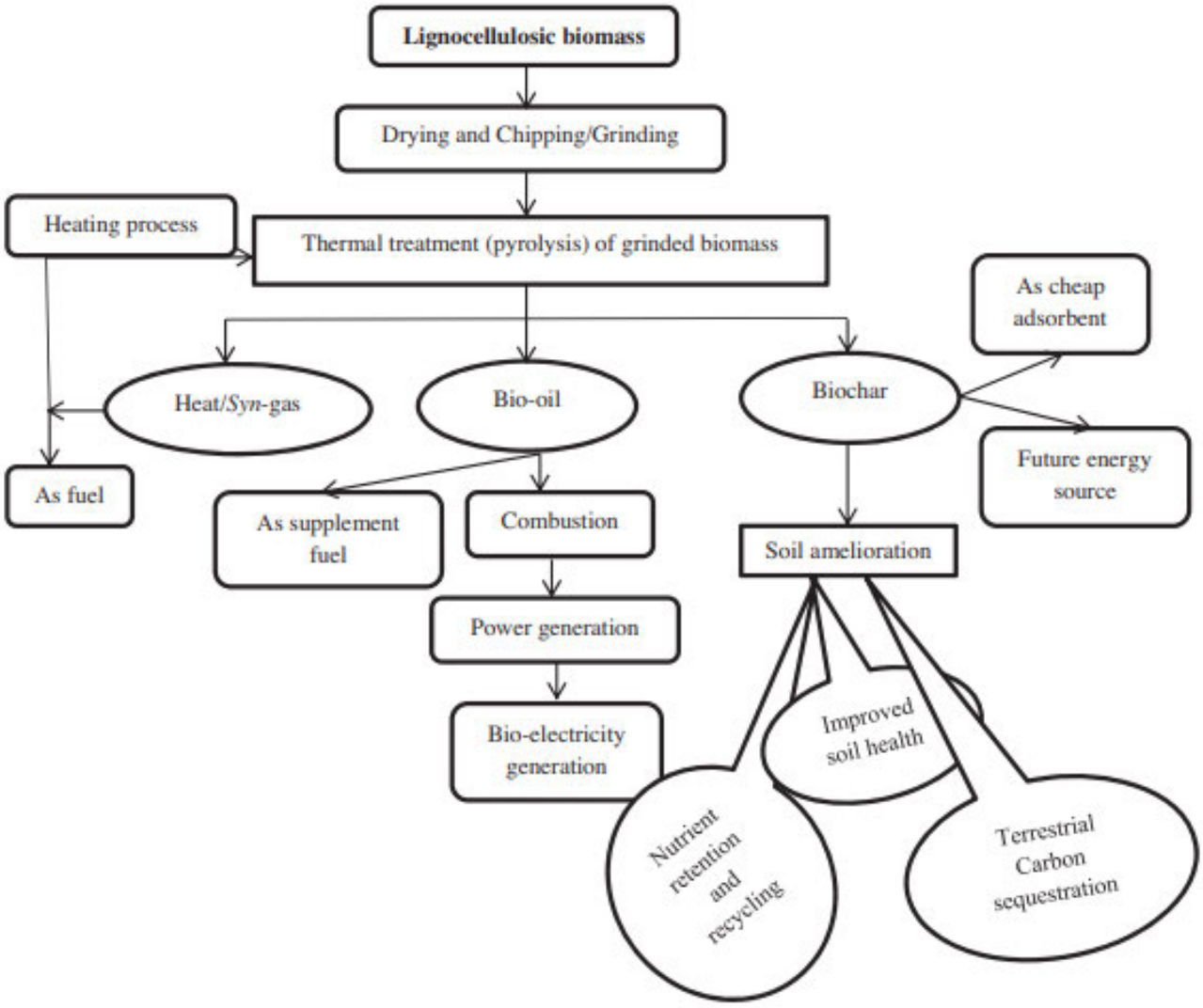
Some off-the-shelf proprietary solutions exist such as pyrolysis units, however the project is seeking to scope a range of other options for novel complimentary projects.

Independent technical advice is needed from researchers and other experienced partners to analyse concepts and provide visibility from salesman and existing IP. The project is looking to integrate technologies and processing ability including biochar production, wood vinegar, biostimulants, biofertiliser, bio-energy / cogeneration. There are opportunities for food and fibre processing (that could utilise waste heat and energy) and hothouse protected habitat plant production for trials or for commercial purposes (this could use waste CO2 in addition to waste heat, wood vinegar for pest and disease control, biochar for growth media addition, biofertiliser and biostimulants as output products from the pyrolysis and biofertiliser production process).

In summary engineering solutions would be required through various concept stages, as well as a blue sky, long term holistic approach infrastructure needs perspective.

Figure 2 below outlines the range of uses of biochar that could create an innovation ecosystem with learnings transferrable to many other regions.

Figure 2 – Sustainable thermochemical conversion process of lignocellulosic biomass to bioenergy and valuable products such as future energy source, cheap adsorbent and soil ameliorating agents (Singh et. Al. 2015)



WMLIG has completed a schematic to illustrate how lignocellulosic biomass from wood waste mixed with crop residue could be used to produce novel biological products in the region (See Figure 3).

Figure 3 – Production of Novel Biological Products

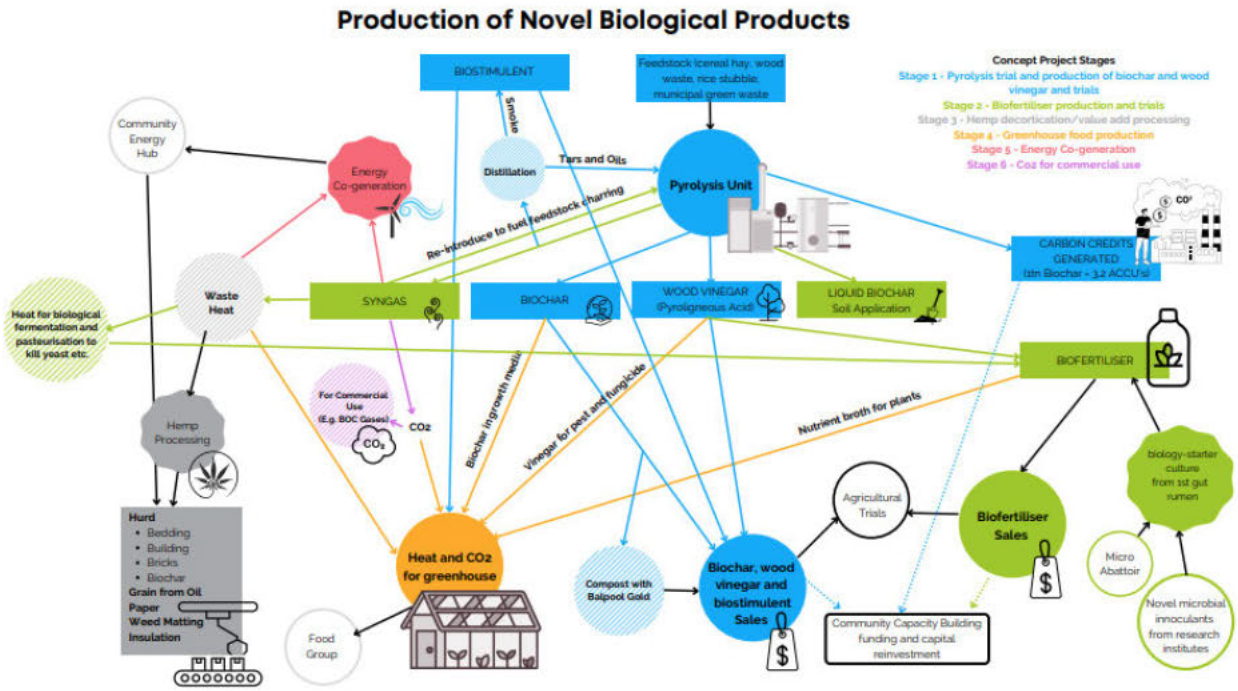


Table 1 below outlines how biochar could benefit a range of stakeholders with outcomes that collectively create a multi-use innovation ecosystem.

Table 1 – Potential multi-use stakeholder association with wood waste / crop residues, secondary novel bi-products and the expected outcomes in a sustainable value chain

User Groups / Organisations	Reason	Expected Outcome
Red Gum Timber Industry	Provision of wood waste as feed stock for pyrolysis process Existing transport and supply chain system Industry knowledge provision	Investment into the project as part of the community investment model. Provision of wood waste for value adding purposes. Conduit for information exchange to the State and Federal Timber Industry Groups.
Industry (e.g. Sunrice / Rice Growers Association, GRDC, MLA, AWI)	To pilot the use of turning industry organic waste products into a valuable resource for agriculture and manufacturing. Value-add current waste organic products, generate additional income, regional jobs and competitiveness. Create new 'green' jobs and secure existing jobs at the community level. Leverage sustainability outcomes for industries in the Basin. There are human health benefits of reducing the level of Particulate	Use the data gathered to apply to future use cases. Commercial partner for product streams arising from the feasibility trials. Establish new sustainable partnerships (practitioners and service providers, placed-based regional partnerships. Linkage to technical experts from isolated research institutions, organisations and agricultural producers).

User Groups / Organisations	Reason	Expected Outcome
	Matter (PM2.5 and PM 10) which are generated through the production of smoke from burning rice straw Improving air quality, and the associated benefits to human health, amenity and activities - forms part of the NSW Clean Air policy, and is a real emphasis of NSW EPA and Dept of Health.	Improved air quality and associated health benefits associated with reduced organic waste residue burning. Investment as part of a potential community investment model Conduit of case study information and alignment to lower carbon footprint products (e.g. rice sustainability platform) seeking higher value added markets from discerning consumers.
Local food and fibre producers and other working group partners	Wood waste utilisation realises opportunities for crop residue waste utilisation. Possibility of farmers employing income-producing add-on processes on-farm, as well as supplying waste material to other manufacturers. Additional income to farmers: • Leverage value chain improvement opportunities, providing additional income to farmers by reducing costs of production and providing value to waste organics, such as rice straw. • Direct farm to market value-add opportunities. Positive farmer backstory leverage for produce access to niche high value markets to discerning buyers.	Improved environmental / sustainability outcomes, opportunity for carbon neutrality, offsetting of GHG emissions (one tonne of biochar sequesters approx. 3.2tns CO2 equivalent) and opportunity to access high value markets from discerning customers. Establish new sustainable partnerships Improved drought resilience for farms: • Improved soil moisture holding capacity - Biochar absorbs up to several times its weight in water. • Reduce input costs associated with chemical fertilisers etc. Improve sustainability outcomes (e.g. soil health, reduce GHG emissions, chemical fertilisers etc.). Reduce environmental impacts and risks associated with chemical/nutrient runoff (biochar is an adsorbent of chemicals) into waterways and agricultural emissions (GHG and air quality). Increase $/ML water returns.
First Nations (e.g. Joint Indigenous Group)	Provide First Nations employment and Connection to Country as an integral element of the co-design. Provide an income-producing outlet for excess timber deemed to be a risk to the ecological and cultural character of the forest. High coarse woody debris loading creates high fuel loads in the forest and associated risk of wild-fire on culturally significant sites (e.g. birthing/scar trees). Log jams in flood runners create unnaturally high deposition of	Use the data gathered to apply to future use cases. Establish new sustainable partnerships Opportunities for upskilling and employment of First Nations people in respect to processing timber from the forest estate (e.g. flood runner log jams), and operation of pyrolysis process and associated products. A pathway for information exchange between First Nations Groups of Barapa

User Groups / Organisations	Reason	Expected Outcome
	sediment in water holes by slowing the flow of water.	Barapa, Yorta Yorta, Wemba Wemba Nations (JIG)
Irrigated Cropping Council	On ground trials of biochar and other novel biological adjunct with research partners across southern NSW and Northern Victoria (pending alignment to strategic plan review by their Board)	Information sharing amongst partners and members. Establish new sustainable partnerships. Uptake of new / novel biological inputs in irrigated agriculture and future R&D to ascertain cost – benefit analysis of using biological products. Potential new customer pathways for circular economy product outputs.
Murray River Council and other municipal councils in the Basin	Align with Murray River Council's aspiration to 'promote local renewable energy products and implementation of best practices for waste management'. Reduce waste and associated cost implications. The co-design model would link to all levels of government policy on resilience-building. Mitigation of the 'Brain drain' and 'youth drain' from the bush toward larger cities through provision of employment in exciting new green technologies and applications, including many with direct contact (and benefit) for the land.	Provision of green waste for addition to pyrolysis supply chain. Reduce waste and associated cost. Establish new sustainable partnerships Reducing financial costs for food and fibre growers in the region and M-D Basin Rural and Regional employment Demonstrate potential for new business opportunities, while addressing climate change and resilience-building initiatives. Conduit of case study information exchange to State Government and Regional Organisations e.g. RAMJO (Riverina and Murray Joint Organisation of Councils). Funding investment assistance.
General community members	Collaborative community investment to benefit the area by reducing economic leakage from the region. Investment opportunity for local people	Community wealth building/reduced economic leakage from the region. Energy and fertiliser security alternative.
WMLIG	Leverage opportunities created from two existing cluster groups supported by WMLIG. Assist First Nations groups (KP Forest Environmental Project Partners) to reduce coarse woody debris loading and manage red gum wetland encroachment in the	Diversify income stream to deliver further NRM, ag productivity and community capacity building outcomes. Opportunities for carbon credits to primary industries using biochar on farms, and or manufacturer investors to offset costs and emissions.

User Groups / Organisations	Reason	Expected Outcome
	local forests. Pyrolysis processes provide an opportunity to utilise wood residue for value-adding and employment. Provide self-supporting income to Western Murray Land Improvement Group (WMLIG), and support WMLIG's mainly farmer member base with improved environmental and agricultural productivity outcomes. The self-supporting income will be generated by managing the governance, logistics, manufacturing, marketing and sale of products (including carbon credits). Educate other Basin communities on cost-benefit analysis of this circular economy model	Educate other Basin communities on cost-benefit analysis of this circular economy model. Uptake of circular waste conversion initiatives in other regional areas of the Basin Sustainable and profitable regenerative agriculture Land remediation and rehabilitation Create a co-designed pilot program to educate other Basin communities re feasibility of being involved in a circular economy model, learnings regarding the regional collaboration model of the 1BCRC, and environmental benefits of products generated from organic waste conversion. Establish new sustainable partnerships (practitioners and service providers, placed-based regional partnerships. Linkage to technical experts from isolated research institutions, organisations). Assist with agricultural trial research and development.
NSW Government	Reducing the impact of burning organic waste materials improves air quality, and the associated benefits to human health, amenity and activities. This forms part of the NSW Clean Air policy, and is a real emphasis of NSW EPA and Dept Health.	Improved air quality and human health outcomes. Biochar reduces nutrient runoff and associated risk to waterways.
Murray Local Land Services (MLLS)	This project works towards achieving the 2021-2026 MLLS Strategic Plan: Vision: Resilient communities in productive healthy landscapes. Aim: Improving the long-term viability of regional farming businesses and the natural assets that underpin them and supporting programs and partnerships that grow primary industries productivity and healthy environments.	Improved ecosystem health, production and profitability, resilience and adaptation, and grower confidence in long-term viability of farm businesses. Establish new sustainable partnerships MLLS are a conduit of information to other LLS regions in NSW. Case study information will be valuable for assessment by other Basin Communities with organic waste issues and for agricultural sustainability considerations

User Groups / Organisations	Reason	Expected Outcome
	Contribution of funding for trial work converting rice straw to biochar by Earthtech. Conduit for information exchange to Landholder and State Government networks	
NSW DPI	Knowledge of project in other regions in NSW. Case study information will be valuable for assessment by other Basin Communities with organic waste issues and for agricultural sustainability considerations.	Provision of valuable skills and knowledge: NSW have conducted agricultural trials and written scientific papers on biochar production. They have several experts and technical information that will be of value. Assistance with on ground trial work Conduit for information exchange
One Basin CRC (1BCRC) consortia	Learnings associated with impact and commercialisation of 1BCRC investments, developing the outputs of using this framework, channelling strategic focus based on the feasibility studies conducted, the establishment of new partnerships for collaboration with CRC's to use in the future. Provide independent visibility to the community on project opportunities (salesman vs technical experts).	Future CRC investment to use as a Best Practice Case Study (demonstrate value). Establish new sustainable partnerships
Murray Darling Basin Authority	This would be a follow up to the MDBA Commissioned Project, Community Adaptability Engagement Research, Sam Houston State University, 2017 that recommended institutional innovation is required for Regional communities hit hard by the water reform process. *This project focused on enhancing the ability of communities to adapt in response to changes in water management practices, as well as other macro-level changes affecting rural communities across the Murray-Darling Basin. Through the process of institutional innovation, this project examines new strategies for addressing local problems through community-based collective action, bringing stakeholders together to create new local processes to proactively mitigate common challenges.*	Use the data gathered to apply to future use cases.
Department of Agriculture, Water	Funded establishment of biochar hemp focus groups and associated field trials, field days	Investment provided by DAWE is improving triple bottom line outcomes for the Wakool irrigation District

User Groups / Organisations	Reason	Expected Outcome
Resources and Environment	and pre-feasibility study as part of the Murray Darling Basin Economic Development Program, for the Wakool Irrigation District.	
Australian Government	Support Basin communities in dealing with the emerging challenge of adapting agriculture to a changing climate. Begin the vital process of change management for wider adoption of climate-linked practices. Support biochar and bio-sequestration bioenergy technologies as part of the National Bioenergy Roadmap by 2030. The 1BCRC will provide a production line of new research outputs that can be translated worldwide, sustaining Australia's reputation as a leader in water and agricultural research. Connect often isolated regional agricultural communities with limited electronic connectivity to research institutions, organisations, private industry, service providers and government agencies.	Use the data gathered to apply to future use cases and scope start-ups for this region. Establish new sustainable partnerships. Reduce sovereign risk of reputation and reliance on imported products. Critical Action on Climate Change – significant carbon dioxide removal (drawdown / sequestration), not just cuts to continued emissions

Information used for the economic and environmental benefits analysis have been used from a range of sources. Specific examples of scientific trials, applications of use on farm and preliminary results to date from research papers and media articles as examples are outlined below:

Methane reduction for the livestock industry using biochar and sequestration of carbon using dung beetles

Methane is a potent greenhouse gas. It is 80-times more effective at heating the earth than carbon dioxide over the first 20 years following release into the atmosphere.

Biochar is one way farmers are working to reduce the hotly debated environmental impact of cattle. As cows digest their food they release methane - a greenhouse gas more than 25 times more potent than carbon dioxide.

The methane leaves their digestive tract at both ends – through “eructation”, better known as burping, and a small amount through flatulence. Once out of their system, their dung continues to release small quantities of methane.

Ruminant animals have diverse microbial populations in their stomachs that employ anaerobic fermentation to digest feed. Methane is belched into the atmosphere as a by-product of the digestive process. This gut, or enteric methane, primarily from cattle, but also sheep and goats, contributes 30% of the methane released into the earth’s atmosphere each day, and is more than any other single methane source.

A major reduction in methane emissions from ruminants is crucial to preserve ecosystems on the planet (Methane Emissions from Ruminants in Australia: Mitigation Potential and Applicability of Mitigation Strategies Black JL, 2021).

There are more than 1.4 billion cattle in the world today, and together they release 65% of all greenhouse gases from livestock. Efforts to reduce the methane emissions from cows have ranged from vaccines to feeding them seaweed. There is now growing interest in whether by adding another substance to a cow's diet methane emissions could be reduced: biochar.

In 2012, a research group in Vietnam found that adding 0.5-1% biochar to cattle's feed could reduce methane emissions by more than 10%, while other studies have found reductions of up to 17%. Studies on beef cows in the Great Plains of the US found that adding biochar to feed reduces cows' methane emissions by between 9.5% and 18.4%. Given that methane makes up 90% of greenhouse gas emissions from cattle farming, this could considerably cut cattle's environmental footprint (Mikki Cusack, 7th February 2020 BBC)

Laboratory adsorption trials conducted in California estimated that using biochar for liquid manure treatment could save 57,000 t NH4 and 4,600 t P2O5 fertilizer per year in California alone. It was further shown that feeding 0.3 to 1% biochar could replace antibiotic treatment in chicken and ducks, respectively.

Feeding biochar could thus have an indirect effect on GHG emissions when it is able to replace regular antibiotic 'feeding' that produces high indirect GHG emissions after soil application of antibiotic contaminated manure.

Moreover, it was demonstrated that feeding biochar to grazing cows had positive secondary effects on soil fertility and fertiliser efficiency reducing mineral N-fertilising requirements that could be another indirect biochar GHG mitigation effect.

Considering an average C-content of fed biochar of 80% and produced at recommended temperatures above 500°C resulting in H/Corg ratios below 0.4, at least 56% of the dry weight of the fed and manure-applied biochar would persist as stable carbon in soil for at least 100 years.

If the global livestock received 1% of their feed in the form of such a biochar, a total of about 400 Mt of CO2eq or 1.2 % of the global CO2 emissions could be compensated. The apparent potential for improving animal health and nutrient efficiency, for reducing enteric methane emissions as well as GHG emissions from manure management and for sequestering carbon with soil fertility improvements makes it compelling to increase the scientific effort to investigate, measure and optimize the GHG reduction potential of biochar use in animal farming systems. (Using biochar in animal farming to recycle nutrients and reduce greenhouse gas emissions (Schmidt et al 2017)

The average specialist beef producer in Queensland has 1158 head of cattle (ABARE 2000) which emitted 103 tons of methane per year. This is equivalent to emitting 2,163 tons of carbon dioxide each year. (ECONOMICS OF REDUCING METHANE EMISSIONS FROM CATTLE PRODUCTION IN CENTRAL QUEENSLAND, Rolfe J. 2001). This equates to 1.87 tonnes CO2 per cow /yr.

Whole-farm biochar system boosts productivity, stores carbon, cuts inputs and emissions.(Lauren Celenza, WANTFA Extension Manager, 2015)

Western Australian example of using biochar and sequestration of carbon by dung beetles

How to feed cows biochar?

Surprisingly, it's not difficult to train a cow to eat something they don't normally eat.

Rewarding them with something sweet is how West Australian farmer, Doug Pow, gets his stock to eat biochar, mixing it with molasses or glycerine and presenting it in a feed trough or bucket. Doug says the cows will eat a few mouthfuls and then move onto pasture, allowing others to ingest the sweet black sludge, regardless of their ranking in the herd. Doug feeds approximately 300g of biochar per cow per day.

This figure was developed from research into intensive dairy operations in Germany to reduce diseases caused by housing, hard floors and ammonia being released from the dung. "Once the dung has the incorporation of

biochar into it, it seems to absorb a lot of the nitrogen and doesn't volatise into ammonia, which is what causes the health problems, but luckily the lack of smell hasn't deterred the dung beetles", Doug said.

Biochar and Animal Husbandry

(by Cyclic Carbon November 05, 2020)

The use of biochar in animal husbandry continues to be a key source of interest among researchers and its application is signalling an effective, non-invasive and low-cost strategy that could markedly improve the sustainability and outcomes of animal husbandry and farming more generally.

Expanding research continues to shed light on the various intricate mechanisms by which biochar interacts with gastrointestinal and broader metabolic processes in livestock and their products, and the real-world environmental and economic implications of biochar used in animal husbandry more broadly.

Schmidt et al. (2019) published an extensive review covering the current state of published research on the topic:

- **The use of biochar in animal husbandry is a common practice**
  The use of biochar in animal husbandry is in common use and there is evidence that the application of biochar as an animal feed additive and curative has occurred for millennia.

  In the case of modern management techniques, biochar is increasingly being adopted in animal husbandry as it gains recognition for a range of on and off-farm benefits, particularly in Europe and Australia. Currently in Europe, the largest end-user of industrially produced biochar is as an additive in feed, bedding and manure treatment (Schmidt et al., 2019).

- **Biochar as a feed additive**
  As a feed additive, biochar is shown to increase nutrient uptake and improve the overall feed efficiency and the feed to weight ratio for livestock. Further, biochar helps control gastrointestinal pathogens and reduces methane emissions from livestock.

  Schmidt et al. (2019) provides and overview of the results of 27 individual peer-reviewed studies investigating biochar as an animal feed additive ranging from feed for cattle, poultry, goat, sheep, pig and aquaculture with feed rates ranging from 0.2-4% (weight) of livestock basal diet.

- **Biochar as a feed supplement for cattle**
  In cattle, biochar in feed was reported—by surveyed farmers using the practice—to improve the overall health and vitality of animals. Harmful bacteria measured in the milk (as the somatic cell count) of biochar fed cattle was indicated to decrease significantly. Farmers also reported a decrease in hoof problems, greater postpartum health, reduced symptoms of diarrhoea, an overall decline in mortality rates and a decrease in associated veterinary costs (Schmidt et al., 2019; study from *Gerlach and Schmidt, 2012).*

  Biochar was shown to increase live weight and feed efficiency in cattle fed at a rate of 1% by weight of basal diet, with one trial indicating a 31% increase in feed conversion rate using biochar as a feed additive alone, and a 60% increase in feed conversion rate when biochar was enriched with a rice wine distillery (fermented) byproduct. This compares to an 18% increase in feed conversion rate when animals were fed the fermented wine byproduct alone (Schmidt et al., 2019, study from *Phongphanith and Preston, 2018*).

The above findings indicate that even relatively small supplementation of biochar can result in disproportionately enhanced growth benefits. Additionally, by combining biochar into diets with other beneficial feed additives enhances the outcomes of both amendments.

Disclaimer: More detailed research needs to be undertaken to evaluate a range of soil types, using different biochar types, biochar/molasses ratios, and dosage rates and dung beetles species. There is a need to analyse accurately costs and benefits to the farmer and also the feasibility of this method for long-term sequestration of C into soils. Further tests need to be carried out to determine if there are any residual toxins, such as polycyclic aromatic hydrocarbons or dioxins, which have accumulated in the meat of the cattle (Joseph et al. 2015).

Appendix A

Case Study 1 – Utilisation of wood waste and dairy manure for compost.

Dairy and Avocado Orchard

Dairy: 500 cows

Orchard size: 30Ha, 8,500 avocado trees

Waste red gum timber residue is valued as a primary feedstock in a novel approach to producing compost for avocado trees. Avocado Farm Manager, says locally sourced red gum waste residue is mixed with cow manure from the farm dairy operation, with biological cultures added to mineralise source material and make it more plant available.

The manure is not officially composted but has been turned several times and is approximately one year old or more before application. Previously this was applied as a mulch mix of @1 part manure/2 parts redgum mulch. This mix is now @ 1 part manure / 6 parts redgum mulch.

In spring a proprietary biological product known as Metagen Digestor NP is applied via fertigation and driplines to the mulch. Digestor NP is microbially formulated to improve crop and soil health, yield and production quality by improving nutrient availability, nitrogen cycling and phosphorus release. Other benefits include improving soil structure, rooting depth, water infiltration and water holding capacity. It brings whole system gains.

In Autumn, another proprietary biological product called CataPult SuperFine is applied onto the mulch. CataPult SuperFine contains Mycorrhizae (VAM) and Bacillus. The product improves P nutrition in crops collects N, Zn, Ca and several other nutrients very efficiently and transports them back to the crop plant via the mycorrhizal hyphae. This improves feeder root mass, nutrient uptake and reduces root-based disease, particularly Phytophthora.

Soil health contributes to fruit quality, size, and fruit robustness. Avocados have a great pack out rate, which reduces waste and provides access to premium markets.

If wood waste was no longer available, said he would have to use some type of straw. The straw requires specific machinery to break it down and apply and does not have the service life of wood waste or the same micro and macro nutrient composition.

Mushrooms have been observed to voluntarily grow on the mulch in the avocado orchard, and there maybe an opportunity to grow specific commercially significant species as a business diversification option in the future.

Appendix B

Biochar boosts Fleurieu dairy production (Stock Journal 7th Jun 2020)

INCLUDING biochar in dairy feed mixes has led to a marked increase in milk yield during trial work on the Fleurieu Peninsula, and its effects are set to be investigated in beef herds.

In research conducted by Climate and Agricultural Support Group's Melissa Rebbeck and funded by the Dairy Industry Fund, a hardwood-based biochar was added to a dairy herd's feed mix at a rate of 150 grams a head per day.

Across a year, one dairy trial showed an improved milk yield of 1.4 litres/head/day on average.

Ms Rebbeck said biochar was sourced from NSW for the trials at $800 a tonne, with a total cost of $11,000 for the year.

"The increase in profit from increased milk yield worked out to about $70,000 for the year, taking into account the cost of the biochar," she said.

"We're looking to get biochar produced locally and hoping to keep the cost under $300/t."

Ms Rebbeck said despite the increased milk yield, the trial's dairyfarmer noticed his cows required less fodder.

"He was feeding two round bales less a week for 250 cows, which equates to about $12,000 of savings a year just in fodder," she said.

The astounding trial results were credited to improved feed conversion, stemming from a redox reactive process in the rumen.

"I buy my cattle from markets to fatten and sell," she said. "I get them onto biochar straight away and have noticed a marked improvement in behaviour, manure smell, coat shine and they fill out reasonably quickly."

While the increased milk yield and fodder savings shown during the dairy trials were impressive, a co-existing dung beetle breeding program has amplified the trial's success by helping to positively impact soil and plant health.

Creation Care's Greg Dalton, owner of a Strathalbyn dung beetle breeding facility, has worked with Fleurieu Beef Group and Dung Beetles Solutions' Bernard Doube to breed and release winter and summer active beetles over the past decade.

FBG has seen multiple soil health and production benefits as the beetles have populated the Fleurieu.

BEETLES AMPLIFY FEEDING RESULTS

CREATION Care's Greg Dalton has now imported, bred and released three species of spring active dung beetles on 40 properties across the Fleurieu.

Climate and Agricultural Support's Melissa Rebbeck said the beetles had quickly multiplied and would soon be released to infiltrate other Fleurieu farms.

"Dung buried from cows on the biochar feed is carbon and mineral-laden and we have anecdotal evidence that it builds soil microbes, carbon and soil health," she said.

"We're conducting additional replicated trials to further measure and publish this work.

"When talking manure content, 250 cows produce 2000 tonnes of dung in a year. If that's buried by dung beetles - an average property on the Fleurieu might be 200 hectares - it equals 10t/ha of cow manure full of beneficial minerals and carbon.

"It is a rate far higher than what can be afforded spreading other fertilisers, which are often spread at a maximum of 200kg/ha.

"Spreading 10t/ha of cow manure that's been activated with biochar could have big benefits to soil, profitability and production."

At a dairy hosting a biochar feed trial with active populations of dung beetles, Ms Rebbeck said there had been one unit of pH increase in its acid soils in just nine months.

They also found an increase in cation exchange capacity - better nutrient and mineral take-up by plants - and more potassium and calcium in plant tissue.

Appendix C

Conceptual Pyrolysis Opportunity

Converting wood waste and crop residue to biochar / wood vinegar with carbon credit potential/yr for 23 pyrolysis units			
Summary Costing wood waste only			
Item	$ Return (conservative) /yr	$ Return (Average) /yr	$ Return (High End) /yr
Output			
Biochar	$ 8,500,000.00	$ 29,750,000.00	$ 51,000,000.00
Wood vinegar	$ 3,966,666.67	$ 4,958,333.33	$ 5,950,000.00
Total	$ 12,466,666.67	$ 34,708,333.33	$ 56,950,000.00
Carbon Credits CO2 from biochar	$ 1,530,000.00	$ 3,825,000.00	$ 6,120,000.00
CO2 equivalent methane reduction (CC above x 1.28)	$ 1,958,400.00	$ 4,896,000.00	$ 7,833,600.00
Total	$ 3,488,400.00	$ 8,721,000.00	$ 13,953,600.00
Subtotal	$ 15,955,066.67	$ 43,429,333.33	$ 70,903,600.00
Net Return (after labour, feedstock cost etc.)	$ 8,683,386.67	$ 36,157,653.33	$ 63,631,920.00
Note that livestock productivity benefits, job creation and infrastructure flow on benefit economics have not been included in the benefits analysis			

Production based on a pyrolysis unit operating 6 hours day, 5 days a week = 3 tonnes per day or 15 T /wk.

Calculation assumptions:

Biochar and bio vinegar sales:

- Biochar sales of $500 - $3,000 per tonne
- Wood Vinegar as above operation times = 350 Litres per day or 1,750 litres per week @ $2000-$3000 per 1000 Litres
- Potential income on sales = $7,500 – $45,000 Biochar and $3,500 – $5,250 Wood Vinegar - Total $12,000 – $50,500 per week

Carbon credits:

- Australian carbon credit units (ACCU's) are currently attracting between $30-50 per tonne of CO2 equivalent on govt and voluntary carbon markets. A high end value of $150 / ACCU was used as the high end figure.
- 1 tonne of biochar is equivalent to offsetting 3.37 tns CO2 equivalent. A figure of 2.5 was used as a conservative estimate taking into account mix with crop residue biochar which has a lower CO2 equivalence value.
- A livestock feed additive methane reduction factor of 1.28 x biochar CO2 carbon credit was used based on 20% of biochar availability being used for feed additive.

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1. KP Visioning document

BACKGROUND

With a purpose to develop a cohesive community vision for the Koondrook-Perricoota (K-P) Forest, a series of community engagement events were facilitated by Western Murray Land Improvement Group (WMLIG) between December 2020 and April 2021.

One introductory seminar, two field days, and a follow-up visioning workshop were held to invite the attention and perspectives of local community members. The field days provided attendees with an opportunity to visit the Pollack Wetland and the currently dry Smokehouse Lagoon in the KP. As environmental contrast sparked discussion, these events provided community members with a platform to provide input regardless of their position and interests in the KP.

Over 160 participants attended this event series, as the engagement footprint spanned across Barham, Caldwell, Moulamein, Mallan, Deniliquin, Moama, Koondrook, Leitchville, Gunbower, Cohuna, Kerang, Swan Hill, Budgerum East, Melbourne, and Canberra. This event series was held with funding support from the Forestry Corporation of NSW and Murray Local Land Services.

Prior to follow-up community visioning workshop on 26th February 2021, a survey was conducted to provide an additional and anonymous avenue for community members to state their visions for the KP. This survey received 42 responses, which have been utilised in combination with the workshop visioning to produce the present outcome summary.

Consolidated feedback was used to establish:

- Three vision pillars to encompass shared objectives of the K-P Forest,
- A series of key themes and interests that community members deemed important in the future of K-P Forest,
- A series of draft community vision statements.
- A finalised community vision for the K-P Forest

KEY VISION PILLARS

A HEALTHY FOREST

A FOREST WITH PERMANENT WATER HOLES TO SUPPORT RICH, DIVERSE FLORA AND FAUNA.

A FOREST WITHOUT DOMINANT PEST SPECIES.

A FOREST TO SUSTAIN BREEDING EVENTS FOR WATER BIRDS, WITH SUPPORTING POPULATIONS OF NATIVE FISH.

A FOREST WITH SELF-REGULATING NATURAL CYCLES.

A PEOPLE'S FOREST

AN ENGAGED AND EVOLVING COMMUNITY WITH A UNIFIED VOICE.

A FOREST WITH RECOGNISED CULTURAL HERITAGE, BOTH INDIGENOUS AND NON-INDIGENOUS.

A FOREST FOR LIFE-LONG ENVIRONMENTAL EDUCATION.

CO-DESIGNED, CO-MANAGED OBJECTIVES WITH TRANSPARENCY IN COMMUNICATION.

CO-DESIGNED, CO-MANAGED OBJECTIVES WITH TRANSPARENCY IN COMMUNICATION.

BROAD COMMUNITY AWARENESS AND NATIONAL, MAINSTREAM MEDIA ATTENTION.

A WORKING FOREST

A RECREATIONAL AND ACCESSIBLE FOREST WITH SUPPORTED INFRASTRUCTURE.

A FOREST FOR POSITIVE ECONOMIC OUTCOMES, INCLUDING TOURISM AND LOCAL EMPLOYMENT.

A FOREST WHERE FIREWOOD CAN BE GATHERED AND TIMBER CAN BE HARVESTED.

RECOGNITION OF THE FOREST AS A RAMSAR-LISTED SITE, CARED FOR AND MANAGED APPROPRIATELY.

KEY THEMES AND INTERESTS

The table below summarises community-identified interests, both short and long term, as present in event discussion and the visioning survey. Key themes and interests are here divided into four major categories, though many are cross-cutting.

Sociocultural	
CULTURAL HERITAGE	Both Indigenous and non-Indigenous
EDUCATION	Primary, Secondary, Lifelong, and Recreational.
RECREATION	Tourism, camping, birdwatching, fishing, and other activities.
Ecological	
HABITAT	Establishing habitat for refugia and breeding for native species.
FISH	Managing pest carp populations and re-establishing native fish species and yabbies.
BIRDS	Establishing food resource and breeding refugia for migratory and permanent bird populations.
VEGETATION	Improving biodiversity, managing weeds, controlling over-abundant species
Economic	
FIREWOOD COLLECTION	Continued.
TIMBER HARVESTING	Continued.
EMPLOYMENT	Creating employment opportunities via infrastructural, ecological enhancement, environmental monitoring, tourism, and other projects.
TOURISM	Attracting visitors to the KP, establishing 'something to see', developing infrastructure to support this.
Management	
WATER DELIVERY	Establishing a watering regime for optimal environmental outcomes and minimising third-party impacts.
THIRD-PARTY IMPACTS	Resolving third party impacts of water delivery, including levy bank repair and removing barriers where appropriate (e.g. log jams).
ACCESS	Establishing emergency and non-4WD vehicle access into the KP.

INFRASTRUCTURE	Roads, campsites, toilets, interpretive information, bridges, and fish screens.
FIRE RISK	Managing fuel load in the KP, including leaf litter.
RECOGNITION	Facilitating broader local engagement and attracting mainstream media attention toward the condition of and visions for the KP.

DRAFT COMMUNITY VISION STATEMENTS

The following statements were written to summarise the common themes, focuses, and values identified in the preliminary K-P engagement series.

WITH A UNIFIED VOICE, THE COMMUNITY CALLS FOR THE KOONDROOK-PERRICOOTA FOREST TO BE:

A HEALTHY WORKING FOREST WHERE NATIVE SPECIES CAN FLOURISH, AND WHERE LOCAL COMMUNITIES CAN CONNECT AND CO-MANAGE THE FOREST FOR FUTURE GENERATIONS.

A HEALTHY WORKING FOREST WHICH SUPPORTS AND IS SUPPORTED BY A VIBRANT, THRIVING RURAL COMMUNITY.

A HEALTHY, MULTI-USE FOREST WITHIN WHICH LOCAL COMMUNITIES ARE CONNECTED, EDUCATED, AND ACTIVELY INVOLVED.

OUR FOREST: STRENGTHENING PEOPLE, STRENGTHENING NATURE.

A HEALTHY AND PRODUCTIVE FOREST OVERSEEN BY A REVIEWABLE MANAGEMENT PLAN CREATED BY QUALIFIED PROFESSIONALS WITH INPUT BY FOREST USERS AND FOREST APPRECIATORS.

COMMUNITY KOONDROOK-PERRICOOTA FOREST VISION STATEMENT

A community vision statement was finalised by online vote with the option to submit a hard copy vote on the 1st April.

From a list of the five draft statements, the below was selected by a 70% majority.

'A healthy working forest where native species can flourish, and where local communities can connect and co-manage the forest for future generations'.

Western Murray Land Improvement Group is working on how to bring this vision statement and pillars to life.

2. Participation rates

Table 2 - Member group participation level expectations

Task	Member group participation level						
	Koondrook Perricoota Alliance (KPA)	Joint Indigenous Group (JIG)	Wakool River Association (WRA)	Red Gum Timber Industry	Murray River Council (MRC)		Western Murray Land Improvement Group (WMLIG)
TLM[1] Environmental water delivery – Intervention Monitoring	Collaborate	Collaborate	Collaborate	Collaborate	Collaborate		Collaborate
TLM Environmental water delivery – Traditional Flows	Collaborate	Collaborate	Collaborate	Collaborate	Collaborate		Collaborate
CEWH[2] Environmental water delivery – Pollack Swamp etc.	Collaborate	Collaborate	Collaborate	Collaborate	Collaborate		Collaborate
KP Third Party Impact Mitigation Infrastructure - Design and Construct[3]	Collaborate	Collaborate	Collaborate	Collaborate	Collaborate		Collaborate
KP Community engagement and communication	Empower	Empower	Empower	Empower	Collaborate		Collaborate
KP Community Visioning projects	Collaborate	Collaborate	Collaborate	Collaborate	Collaborate		Collaborate

1TLM (The Living Murray) water is via MDBA.

[2]CEWH (Commonwealth Environmental Water Holder) via CEWO (Commonwealth Environmental Water Office). Pollack and future water for Little Forest is CEWH water.

[3]KP Third Party Impact Mitigation Infrastructure via NSW DPIE.

3. Red Gum Timber Industry Overview

KP Group of Forests Today

- Highly modified landscape, managed for multiple uses inc. timber harvesting and recreation
- Largely regrowth forest, resulting from past silvicultural practices and river regulation
- Require active, interventionist management for forest regeneration, good health and longevity
- A Working Forest
- Ramsar Listed- “wise use”
- Culturally significant
- Recreationally significant
- Local domestic firewood collection

Redgum Timber industry Today

- Since 2010 NSW National Park Estate Act created more than 100,000HA of national parks and reserves, timber harvesting occurs now in 36K HA of KPCI
- Operating under IFOA between FCNSW and EPA NSW
- Seriously legislated and regulated
- Highly resilient and adaptive industry, wanting to be a driver in best practices
- Current Industry investment > $30M
- Provides employment opportunities for local communities (in excess of 100 FT employees)
- Significant flow on effect to other local businesses (in excess of $20M annually)
- Very important economic driver in local communities
- Source of invaluable knowledge and experience of the KPCI landscape
- Passionate stewards of the forest
- Thinning programs- removal of low-grade timber- promoting a healthy, vigorously growing bush. Vital key to drought proofing the bush
- Keeping the bush accessible -road access – grader/water trucks/ gravel (approx. 800T annually)
- Contributing to fire risk management -Provision of trained firefighters and equipment suitable to fight fires (skidders/graders/water trucks etc) (approx. 800 hours annually)

Current Structure of Redgum Industry/FCNSW :

- Fully integrated operations
- Producing high quality sawlogs: Arbuthnot PL (in operation > 130years)
- Low quality sawlog/Residue: Mathoura Sawmills PL
- Residue/Early Thinnings- Gelletly Redgum Firewood, O’Briens Redgum
- Wood Supply Agreements- mostly 5 year agreements. Expiring- 2024/2025/2030

Mitigating Third Party impacts

- Industry supports the concepts of E-water/Cultural water into the bush in principle
- Ready to work with Government authorities and other community organisations to co design scope and specifications of works to maximise outcomes and minimise impacts
- Must take into account the extent and duration of flooding impacts on timber industry viability
- As water inflows become more frequent, greater need for industry to access allocated volumes over a shorter period of time
- Increased harvest/haul capacity will be necessary
- Will require further investment from industry in equipment and appropriately staffed by FCNSW
- Access into compartments -bridges/crossings - will be vital
- Otherwise reduced access=significant impact on timber businesses, local employment and local economies

4. Wakool Region Statistics

The community has been impacted by major challenges such as the Millennium Drought, the Murray Darling Basin Plan and associated water reform process, the creation of Red Gum National Parks (and associated loss of timber industry jobs) and farm consolidation. These changes have resulted in a reduction of employment opportunities, and community and government services in the area. The socio-economic wealth decile for this region has diminished considerably reducing financial capacity for businesses to adapt to change.

Evidence of the need for adaptation is outlined in the range of reports and community engagement activities in the last few years. Many of the services and expertise necessary for adaptation and innovation are not accessible locally. Community facilities are rapidly declining, with numerous local sporting clubs and schools closing due to lack of participants.

Socio-economic evaluation statistics:

A 2014 report on the Economic Impact Assessment of the Murray Darling Basin Plan on the Wakool Shire (now the Murray River LGA), Michael Connell and Associates found that agriculture was the largest sector in the regional economy with an output of $68 million in 2005-06 and $95.8 million in 2010-11. The population decline seen in the last 10-15 years was suggested to reflect changes within the farming sector, with less income generation and employment available in the region. The report clearly stated that the local economy is highly reliant on irrigated agriculture and associated linked businesses.

The MDBA has completed Community profile evaluations for 40 basin communities. MDBA Community Profile evaluations completed for Wakool, Deniboota and Denimein are compelling (see Appendix A1).

The Wakool Region has lost a considerable quantity of water entitlements compared to the original quantity of water entitlements. As summarised in Appendix A, Table A1, between 2001 and 2016, the Wakool community had a reduction in water entitlements of 98 GL, which is reduction of 38%. When taking into account the surrounding communities of Denimein and Deniboota, all west of Deniliquin NSW, there is a combined total reduction in water entitlements of 164 GL. According to the 2012 MDBA report, NSW Central Murray Community Profile (Appendix A2), a reduction in the long-term water availability of greater than 20% will result in many farm businesses becoming unviable with direct flow on impacts occurring at a community level.

Key findings in the Wakool Community Profile analysis of the period between 2001-2016 was that the;

- Area population decreased by 45.6% (715 people)
- Total area workforce decreased by 53.7% (288 Full Time Equivalent jobs)
- Agricultural workforce decreased by 61.5% (158 FTE)
- Agricultural manufacturing workforce decreased by 44% (8 FTE)
- Non-agricultural private workforce decreased by 57.3% (96 FTE)
- Government service workforce decreased by 35.1% (34 FTE)
- Socio-economic wealth decile ranking for town went from a wealth rating of 5 in 2001 to a wealth ranking of 2, which leads to diminished capacity for adaption or change in response to circumstances.

When taking into account Wakool and neighbour affected communities of the Western Murray Valley (Deniboota and Denimein) between 2001-2016, the:

- Area population declined by 29.1% (1254 people)
- Total area workforce decreased by 40% (1518 Full Time Equivalent jobs)
- Agricultural workforce decreased by 57.8% (339 FTE)

- Non-agricultural private workforce decreased by 42.2% (232 FTE)
- Government service workforce decreased by 14% (27 FTE)

References:

Experimental ecosystem accounting project in the Gunbower-Koondrook-Perricoota Forest Icon Site
Director, Environmental-Economic Accounts Section, Department of Agriculture, Water and the Environment

Dr Neville Crossman, Murray-Darling Basin Authority

Dr Becky Schmidt, CSIRO Land and Water

5. KPA Members and Membership Organisations

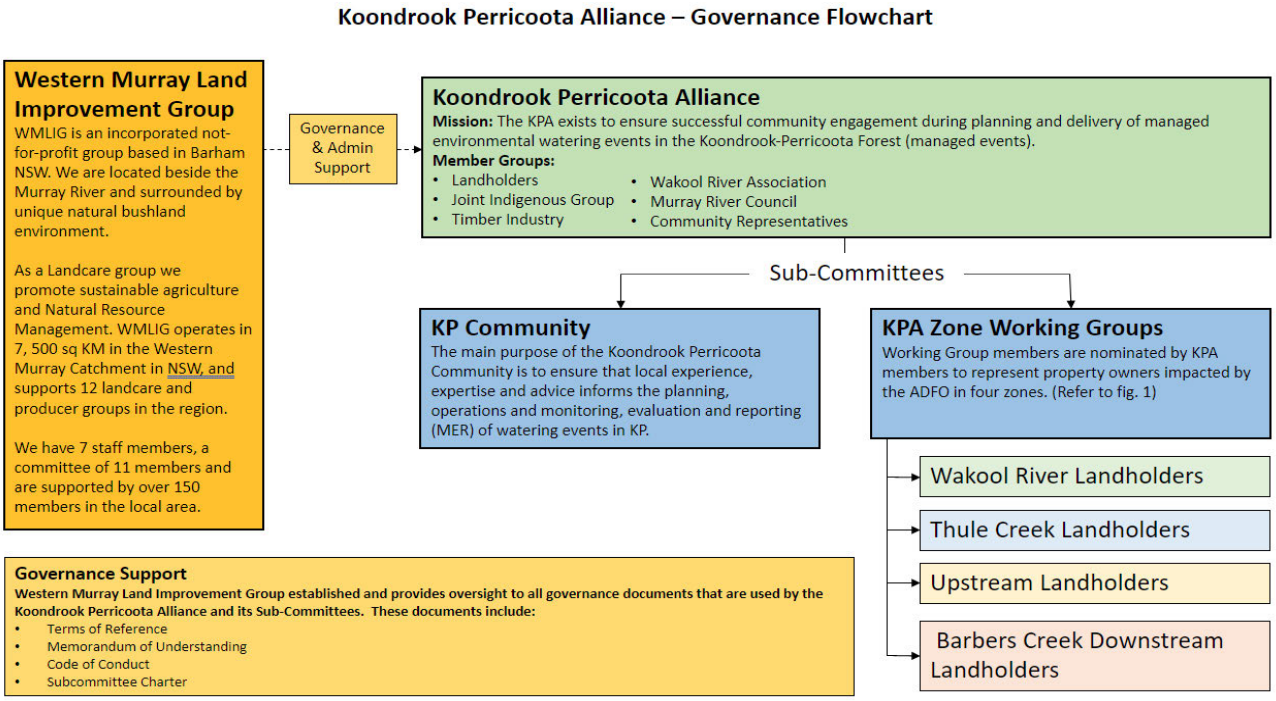
Name	Organisation	Position
	Barham/Wakool Zone Landholder	Chair
	Eagle Creek Trust, Barham Landcare	Deputy Chair
	Barbers Ck Downstream Landholder	Member
	Barbers CK Zone Working Group member (Lead). Barbers Ck Downstream Landholder	Member
	Barbers Ck Downstream Landholder.	Member
	Barbers Ck Downstream Landholder	Member
	Barbers Ck Downstream Landholder	Member
	Barbers Ck Downstream Landholder	Member
	Barbers Ck Downstream Landholder	Member
	Barbers Ck Downstream Landholder	Member
	Barbers Ck Downstream Landholder	Member
	Barham Consolidated – An umbrella organisation to other groups including Barham Koondrook Tourism Group, retail traders, Barham Women's Group	Member
	Barham/Wakool Zone Landholder	Member
	Barham/Lower Thule Road Landholder	Member
	Barham/Wakool Zone Landholder	Member
	Bringan Trust, Barbers Ck Downstream Landholder	Member
	JIG/ Dan Hutton Consulting	Member
	Deniboota Landholder.	Member
	Thule Zone Working Group member (Lead), Deniboota Landholder	Member
	Deniboota Landholder.	Member
	East Barham Landholder	Member
	Inlet end Landholder	Member
	Inlet end Landholder. Deniboota Landholders	Member
	Joint Indigenous Group (JIG), Moama Local Aboriginal Land Council (Moama LALC)	Member
	JIG / Yorta Yorta Nation	Member
	JIG / Barapa Barapa Nation	Member
	JIG / Deniliquin LALC / Barapa Barapa Nation	Member

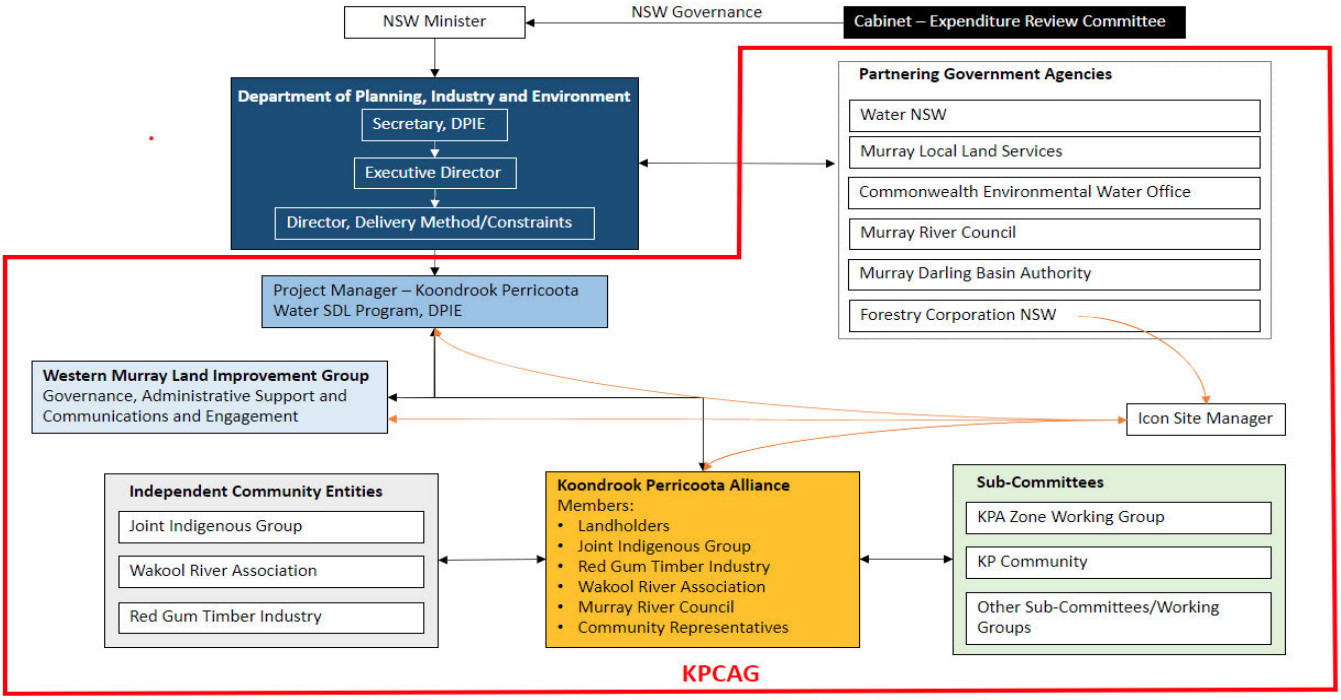
Name	Organisation	Position
	Red Gum Timber Industry	Member

- Note that many landholders are also actively members in their prospective Rural Fire Brigade groups, and therefore have an interest in the KP Forest from a fire management perspective.
- The Red Gum Timber Industry representation provides active fire management support for the KP Group of Forests.

6. KPA Governance Structures

KPA governance flow charts are outlined below:





7. Koondrook Perricoota Little Forest Traditional Flow Environmental Water Planning Case Study

Project Planning

Bringing together a diverse range of stakeholders for project development and achieving a valuable and community-wide, wealth-building outcome is core business for the Western Murray Land Improvement Group (WMLIG).

A recent demonstration of our ability to facilitate this invaluable cooperation – from the ground up – has been delivered by the Koondrook-Perricoota Little Forest traditional flow environmental watering project.

Involving 10 months of project planning time, we brought the community together with other stakeholders, including government agencies and industry groups, for information sharing and project development.

This has allowed the determination of where common interests converge and joint, agreed actions can expedite a process.

One of WMLIG's values is to empower our community through knowledge exchange, education, and local decision-making. This co-design approach provides a meaningful engagement model, that is inclusive and participatory.

This 'bottom-up' approach requires more upfront resources but results in a higher level of project 'buy in', 'ownership', trust, and appreciation of the benefits for the community.

WMLIG's case study and 'lessons learned' from project planning for the traditional flow environmental water event provides not only valuable insights for the WMLIG Board for due diligence purposes; but also, for government agency consideration to understand both the level of resources needed for effective co-design; and other valuable cross-community outcomes that are delivered via a co-design process.

Over the 10 months of community engagement activities and in-kind support, the following was carried out:

- Seven community reference group meetings
- One open community KP Forest forum titled 'Toward a New Water Balance'
- 22 individuals attended planning meetings
- 8 organisations and government agencies actively involved
- 135 hours of neighbouring landholder volunteer time
- 97 hours of Traditional Owner consultation and working group time
- 84 hours of WMLIG planning support time
- 70 hours of subject matter expert engagement
- 5,780 km ($4,161) travelled to attend meetings and site visits
- $33,000 in kind and WMLIG general ledger fund labour

In addition, there have been considerable resources allocated to this project by the Forestry Corporation of NSW.

Other government agencies that have provided a valuable contribution to the project include CEWO, NSW DPIE, MDBA and Murray LLS. The resources from these departments are already covered by existing programs and the labour has not been determined for use in this case study.

Project Co-benefits

For WMLIG, the project provides an important community learning process that creates the social licence to deliver an environmental water project and a socio-ecological outcome.

The project provided a valuable opportunity for an Indigenous representative to chair community meetings - an important leadership experience and professional development outcome and at the same time, neighbouring landholders, WMLIG staff and Traditional Owners shared local knowledge, cross-cultural learnings and aspirations.

Five Traditional Owners were employed for cultural heritage assessments over two culturally-rich locations. The first location selected was dismissed due to not receiving unanimous support from all neighbouring landholders.

Apart from the direct economic benefits, the project provided customary, cultural, and future business development opportunities for Traditional Owners; and fostered and built on the trust and relationships that have started an ongoing conversation for future collaborative projects at other sites.

It is anticipated the project will provide a valuable showcase to the broader community of what can be achieved from a community-led environmental water project and a higher level of understanding of what can be achieved with targeted environmental water in the much more expansive Koondrook-Perricoota Forest in the long term.

Lessons Learned

WMLIG's case study provides compelling evidence to support upfront investment in co-design.

We recognise that diversity builds strength. Once people are joined in a common goal, they are committed to that joint outcome and a solid working relationship is actively developed.

WMLIG is concerned that government agencies in particular do not comprehend the importance and volume of work required for effective co-design.

WMLIG regards the facilitation and execution of such co-design as 'cheap insurance' to ensure a successful project outcome. Too often we see project plans developed without the contribution of those who are ultimately affected by the decisions from the outset.

Co-design in a holistic community sense is not on the radar.

Given the volume of planning for the Little Forest Traditional Flow, funding for many shovel-ready projects only provides for a 10% administration component for the entire project; with pre planning costs expected to be absorbed by the project proponent. This is inadequate for not- for-profit and/or registered charity organisations to be expected to deliver upon this proven working model.

The process requires the ability to successfully recognise and facilitate all participants, including subject matter experts with a specialised skillset who can help execute a project using best practice and in the most cost-effective way.

There are valuable opportunities to use this model for other sites right across the Murray Darling Basin.

If governments are serious about engaging communities to deliver successful agreed outcomes, they need to resource upfront planning effectively.

These outcomes create a major flow-on effect resulting in a seismic shift in community consciousness, and a cohesive solutions-based, 'can-do' mindset for the benefit of all sectors.

8. KPA NSW Timber Industry Inquiry Submission regarding Koondrook Perricoota Forest Water Issues and Proposed Solutions

David McConnell
Chairperson

NSW Timber Industry Inquiry Submission regarding Koondrook Perricoota Forest Watering Issues and Proposed Solutions

As a result of questions raised during the NSW Parliamentary Inquiry Committee Tour of the Koondrook Perricoota Forest on the 7th February, 2022, the Koondrook Perricoota Alliance are providing additional information for the Inquiry Committee for consideration. This document provides additional context to the Committee lines of enquiry specifically relating to the repeated failure of environmental water delivery to the Koondrook Perricoota Forest.

This submission is specifically aligned with the Terms of Reference of the NSW Parliamentary **Inquiry into the long-term sustainability and future of the timber and forest products industry** relating to the following (in bold text insert):

> (b) **the impact of external influences** on the timber and forest products industry, including but not limited to drought, **water**, fire, **regulatory structures**, habitat protection and local, State and Federal policies regarding climate change and plantation establishment,
>
> (f) **the role of the government in addressing key** economic, **environmental and social challenges** to the industry, including funding and support to encourage improvements in forestry practices, training, innovation and automation, workplace health and safety, industry and employee support, land use management and forestry projects,
>
> (i) best practices in other Australian and international jurisdictions in relation to the sustainability of the timber and forest products industry, including **social sustainability, community and Indigenous engagement and multiple uses of the forest estate**.

Forward

To enable effective environmental water delivery to occur that would lead to improved environmental outcomes for the KP Forest, there are several high priority issues that the KPA deem need addressing. These are as follows:

1. **Liability exposure is shared among too many 'partners'.**

   There is a need to clarify operational liability and decision making accountability. Liability for operation of the scheme needs to be resolved. Acceptance of liability continues to be an issue between the States and the Federal Government.

   1.1 Solution: Reduce liability exposure to a single NSW entity:

   - icare NSW monetise exposure

- NSW reduce basin contribution
- Provide direction to liability owner

A Koondrook Perricoota Forest Operating Committee (KPOC) exists however there are blurred lines relating to decision making and accountabilities which need addressing.

1.2 Solution: KPOC Terms of Reference clarity in accountability is required.

2. Third party impacts have never been mitigated.

Mitigation of third party impacts are still to be addressed to enable environmental water delivery into the forest using existing structures constructed as part of the $100M + Koondrook Perricoota Flood Enhancement Project, commissioned in 2013.

2.1 Solution: Mitigate third party impacts ASAP:

- KP accelerated works
- Reconnecting River Country
- Temporary 'Shear Paddock' levee works to mitigate third party impacts. *This was an important consideration in the 2021 failed watering event. The proposal is now part of the KP Forest Third Party Impact Mitigation Accelerated Works Package.*

3. Mismatch between co-design policy and practice.

There is a need to embed Co-design into KP Environmental watering events. In 2021, Water Infrastructure NSW resisted community representation on KPOC until Government Agency and Ministerial pressure was applied by community groups that had an aim of improving accountability, transparency and inclusiveness. Community lobbying to try and achieve local representation started in Dec 2020. Permission was granted eight months later on the 23rd July 2021. The 2020-2021 environmental water planning and watering event timeline of activities is outlined in Table 1 below.

It must be recognised that the 2012 Guide to the Basin Plan stated that ''localism' was hard wired into the Basin Plan', however the biggest failure of the water reform process has been a failure for this process to occur.

Ministers have stated that they want co-design hard wired into the water reform process. See Appendix 1. There appears to be a broken link between Minster expectations and actions of agencies. It is clear that agency staff need to understand what co-sign means and to build this into their operating systems.

3.1 Solution: Best-practice co-design:

- invest in relationships
- best for project
- stakeholder centric

Where people are affected by decisions, they need to be part of the decision-making process. This will build social Build license.

3.2 Solution: Involve local stakeholders in all phases of a project:

- concept development
- design
- operations
- monitoring and reporting

4 Provide long term, multi-year (5-10 year), no regrets funding.

This will ensure there is time to effectively plan projects such as Traditional Flows with stakeholders. This bottom-up, inclusive approach will achieve the social license to operate the scheme and would achieve timely environmental outcomes that suits the environment and First Nations people. Currently water event planning and budget commitments occur on an annual basis (for submission to MINCO by

mid-June seeking budgetary approval). This a which is a protracted process that doesn't suit the community or provide commitment to achieve long term environmental outcomes. Generally, the provision of additional information and budget negotiations occur between State and Federal Government entities which takes considerable time. Ideally funding and then contracts would be completed in late winter / early spring to enable environmental water delivery and mitigate risk of black water hypoxia associated with warm weather water delivery.

4.1 Solution: Multi-year, long term contracts

5 Community empowerment:

Notwithstanding legal liability acceptance associated with a managed watering event that requires resolution, the Federal and State government could address all of the issues outlined above by **focusing on outcomes and not processes**. Due to the risk averse and non-inclusive nature government agencies have shown has resulted in repeated failure. A solution would be to devolve the actual delivery arrangements associated with a watering event to the local community. The government could provide the broad parameters to be adhered to, and the desired outcome and then transfer power to the local community for decision making purposes.

5.1 Solution: Devolution of decision making powers of environmental water delivery to the local community / First Nations people

Turning around a decade of engagement failure: what will it take?

Imagine the public outcry if a new 100-bed hospital opened in Western Sydney but administrative failures meant that care could be provided to only five patients at a time?

This is what engagement failure looks like near Barham in southern New South Wales (NSW).

The Koondrook-Perricoota State forests (the Forest) form the NSW component of the second largest River Red Gum forest in Australia. Situated on the Murray River floodplain between Moama and Barham, the Forest is also part of a Ramsar Wetland and an Icon Site under The Living Murray (TLM), one of only six in the Murray-Darling Basin.

Because of its environmental and cultural significance, and after more than thirty years of deliberation, infrastructure to deliver environmental water into the Forest was completed in 2013, comprising nine large-capacity regulators, a 3.8 kilometre (km) inlet channel and a 45km levee.

With a reported cost of $80 million, the scheme was heralded as the largest investment under TLM and a testament to cooperative federalism. No longer a forgotten backwater or poor cousin, more than 17,000ha of the Forest could be inundated seemingly with the flick of a switch.

The scheme was designed to deliver large volumes of environmental water into the Forest every three years on average—645 gigalitres (GL) over 115 days with inflows reaching up to 6,000 megalitres per day (ML/day). Unfortunately, reality has fallen much shorter than design:

- the commissioning event in 2014 comprised a delivered volume of around 30GL and a peak inflow of 1,000 ML/day;
- the first managed event in 2019 comprised a delivered volume of around 30GL and a peak inflow of 500 ML/day; and
- the cancelled 2021 Traditional Flow was to comprise a delivered volume of 30GL and a peak inflow of 250 ML/day.

Despite the distinguished labels and multi-million dollar-investment, the Forest currently languishes on the bottom of environmental scorecards: the imposed water balance has stripped the Forest of its leaves as much as its celebrity. In fact, the scheme is widely considered a White Elephant.

The schemes' significant construction footprint has also not been offset as the expected environmental benefits have not been realised. 148 Aboriginal sites were discovered and recorded, of which 96 were impacted during construction: traditional owners have sacrificed much and benefited nothing.

The scheme is unable to operate above 5% of design capacity owing to three interrelated factors:

- the scheme does not have a social license to operate;
- third-party impacts have not been mitigated; and
- legal liability is distributed among many jurisdictions and government agencies, and none accept significant (any) exposure.

Community engagement failure is the common thread, despite local people being oriented toward the public good and having the willingness and capabilities to engage with government.

The question “Where does responsibility rest for engagement failure?” requires consideration of government policy and government agency practice.

When it comes to constraints relaxation in the Murray-Darling Basin, the policy intent is clear: there will be no flooding without landowners’ consent; there will be no compulsory land acquisitions, flood easements or works, and there will be co-design of third-party impact mitigation.

In simple terms, government policy gives affected people the power to say “no” and for their consent to be conditional. Policy fails in practice because government structures and public servants are incapable of facilitating this new relationship.

At best, agencies are proficient in using compulsory powers. At worst, they are dependent on those powers as they lack enabling, negotiating and collaborating skills that are vital when relationships must be built from mutual trust and respect, and decision-making power is shared.

Co-design is widely accepted as the golden key for the scheme to operate closer to capacity. Research and lived experience reach the same unequivocal conclusion: co-design requires devolution of decision-making power and resources to frontline public servants and to the local people with whom they engage. This represents a major shift in the culture and operations of government agencies.

Ministers must make agency heads accountable if they fail to deliver the changes required to effectively implement government co-design policy.

This document has been created in partnership with:

Table 1 – 2020-2021 environmental water planning and watering event timeline of activities

Date	Description	Notes
31-Jul-2020	DPIE Water KP Governance and Liability Working Groups	
4-Sep-2020	DPIE Water KP Liability Working Group	
10-Sep-2020	DPIE Water KP Governance Working Group	24 community participants
23-Oct-2020	KP Forest Community Field Trip	
29-Oct-2020	DPIE Water KP Liability Working Group	
9-Nov-2020	KPA submits KP TPIM business case to DPIE Water	
19-Nov-2020	DPIE Water KP Liability Working Group	
18-Dec-2020	DPIE Water acknowledges receipt of KPA business case	
6-Dec-2020	KPA submits early works package to NSW Government	
10-Dec-2020	FCNSW proposes community representation on KPOC	
11-Dec-2020	WMILG hosts 'Toward a new water balance' community seminar	42 community participants
14-Dec-2020	FCNSW hosts teleconference with EES and KPA on Traditional Flow proposal	
17-Dec-2020	DPIE Water hosts KP Governance Working Group	16 community participants
18-Dec-2020	WMLIG hosts first community tour	45 community participants
31-Dec-2020	FCNSW requests modelling of Traditional Flow from MDBA	1 August start, 120 days @ 250 ML/day
7-Jan-2021	MDBA provides a high resolution model run to FCNSW	Inundated area of 1414 ha (4.4%), with minor incursions onto private property at two locations

18-Jan-2021	FCNSW requests additional run of 150-day duration	End date extended to 31 December
20-Jan-2021	MDBA provides a second model run to FCNSW	Inundated area retracts due to December evapotranspiration exceeding inflows
31-Jan-2021	WMLIG hosts second community tour	49 community participants
1-Feb-2021	FCNSW holds planning day with community stakeholders	Strong community support shown for a managed event in 2021
8-Feb-2021	Internal (FCNSW) Approval Request submitted	
9-Feb-2021	FCNSW circulates draft KPOC Terms of Reference to Governance Working Group	ToR includes community representation and planning role
9-Feb-2021	Malcolm Starritt provides conditional support for Tradition Flow	Conditions include engagement of local contractors where possible
18-Feb-2021	Familiarisation tour with DPIE Water staff	
26-Feb-2021	Community visioning workshop hosted by WMLIG	26 community participants
3-Mar-2021	National Party, MDBA and DAWE tour with KPA, JIG and WRA	16 attendees
10-Mar-2021	Joint Indigenous Group (JIG) release definition and proposal for Traditional Flows. Proposal endorsed by whole local community.	
10-Mar-2021	FCNSW circulates revised draft KPOC Terms of Reference to Governance Working Group	
15-Mar-2021	FCNSW advises Governance Working that a Community Advisory Group will be formed	Significant agency opposition to a joint agency-community committee
23-Mar-2021	JIG assisted FCNSW in hosting the second familiarisation tour with DPIE Water staff	
29-Mar-2021	FCNSW hosts inspection of early works sites with DPIE Water	
29-Mar-2021	DPIE Water hosts KP Governance Working Group	Paper to be considered by the River Murray Operations Committee (RMOC) on 13 May
1-Apr-2021	FCNSW circulates draft Strategic Risk Register to stakeholders for review	

1-Apr-2021	FCNSW submits draft SCBEWC proposal to EES	
21-Apr-2021	DPIE Water announces Early Works Package	To secure landholder consent and enable the Traditional Flow
6-Apr-2021	EES submits draft SCBEWC proposal to MDBA	
28-Apr-2021	FCNSW hosts familiarisation tour with DPIE Water - Water Infrastructure NSW (WIN)	
4-May-2021	FCNSW submits draft Event Design Report to KPF Governance Working Group members	
11-May-2021	EES submits final SCBEWC proposal to MDBA	
24/06/2021	KPOC Meeting 1	
8-Jul-2021	KPOC Meeting 2	
15-Jul-2021	KPOC Meeting 3	
22-Jul-2021	KPOC Meeting 4	
29-Jul-2021	KPOC Meeting 5	
23-Jul-2021	Consent given to enable community participation in KPOC	
5-Aug-2021	KPOC Meeting 6	
12-Aug-2021	KPOC Meeting 7	
19-Aug-2021	KPOC Meeting 8	
25-Aug-2021	Letter from WIN to KPA on approach to local contractor involvement	Proposal not acceptable to KPA
26-Aug-2021	KPOC Meeting 9	

27-Aug-2021	JIG suggest extending planning period for Traditional Flow by two weeks to allow more time for agencies to consider proposal	
9-Sep-2021	KPOC Meeting 10	
15-Sep-2021	JIG withdraw their support for a Traditional Flow	Government agency approval to use local contractors on private property not forthcoming and JIG remove their support for a traditional flow
16-Sep-2021	Draft letter from WIN to KPA on revised approach to local contractor involvement	

Appendix 1

An extract from Minister Pitts media release early in 2021:

"We have heard loud and clear from locals that they have felt they have been sidelined in previous attempts to get these projects off the ground.

"I have made it clear to both our NSW agencies and the Commonwealth that if these projects are to become a reality, communities will need to drive these projects with local knowledge the key to success.

"Community is at the heart of the success of these projects and locals have repeatedly said they have projects which can deliver good environmental, social and economic outcomes. Now is the time to make those ideas a reality."

Appendix 2

The Koondrook Perricoota Alliance (KPA) was established on 16 July 2013 in partnership between the Joint Indigenous Group (JIG) and the Community Operational and Planning Assessment Committee which was established after construction of the Koondrook Perricoota Forest Flood Enhancement Project.

The KPA was formed as a sub-committee of WMLIG which is an Incorporated Association and provides the governance systems for the KPA. WMLIG is an intermediary between the community, partners, and other entities to engage and deliver programs. This is to achieve mutually respectful and beneficial outcomes based on community aspirations and deliverables for partner entities.

WMLIG supports community empowerment for a co-design methodology that promotes inclusive and local decision-making, so that community members are not negatively impacted by external decision-makers now and in the future. The level of participation is dependent on the consensus of the community and is generally aligned to decisions that affect the wider social-ecological system.

Western Murray Land Improvement Group

9. Co-Design Definition

Co-design is a design-led process that uses participatory methods to actively involve and empower all stakeholders in the design process of projects to help ensure the result meets their needs and is usable.

Underlying the principles of co-design is the idea that a collaborative, cooperative and community-centred approach leads to more efficient and effective outcomes.

Localism is a key aspect of co-design where strengthening the capacity for joint action requires power and resources to delegated and devolved to the lowest capable level.

These four principles help to shape how people can see themselves and others differently and to make co-design a reality:

Principle 1 Prioritising Relationships - *Co-design is founded on relationships, social connection, respect and trust*

Principle 2. Sharing Power - *Co-design requires power and resources to be redistributed to local on-ground sources*

Principle 3. Localism - *Co-design promotes local history, culture, identity, capacity, and jobs*

Principle 4. Participatory Action - *Co-design requires local people to be accepted as partners in everything*

Engagement Levels and Co-design

Appropriate engagement levels within a co-design process are essential. The IAP2 Public Participation model is a universally accepted and published engagement power level model (Figure 1). Co-design moves directly beyond low levels of engagement such Inform, Consult and Involve levels, to Collaborate and Empower Levels.

	Inform	Consult	Involve	Collaborate (Co-design)	Empower (Co-design)
Goal	To provide the public with balanced and objective information to assist them in understanding the problems, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
Promise	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and provide feedback on how public input influenced the decision.	We will work with you to ensure your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for direct advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.
Techniques	Fact sheets, Web sites Open houses	Public comment Focus groups Surveys Public meetings	Workshops Deliberate polling	Citizen Advisory Committees Consensus building Participatory decision-making	Citizen juries Ballots Delegated decisions

Conditions for Co-design

A number of conditions are needed for Co-design to occur. They include:

1. **Support and Sponsorship**

   We need people to endorse and reinforce the approach we're taking and the outcomes we want to achieve. Funders and supporters help to build commitment, remove obstacles and overcome resistance as and when it arises.

2. **Time and Money**

   To do co-design we need time and money for:

   - Facilitation and convening (co-design is not free)
   - Paying people with lived experience for their time and for any expenses
   - Investing in approaches (after they have been co-designed)
   - Supporting lived experience capability and leadership
   - Prototyping, testing and learning (prior to implementation)
   - Communicating the work throughout to build commitment

3. **Culture and Climate**

   Supportive culture and climate includes:

   - Authorising environments from formal and informal leaders
   - A focus on learning not control
   - Connective tissue to share learning, failure, success
   - Support to adopt the mindsets, especially when we regress to old ways of being
   - Support to develop the skillsets for co-design
   - Accountability to the people we engage through
   - Co-design (they can call us out)

4. **Commitments**

   Commitment to co-design looks like:

   - Focusing on outcomes (value) over outputs (busyness)
   - Following through into implementation
   - Staying committed to elevating the voice and contribution of lived experience
   - Practising cultural intelligence and widening inclusion
   - Partnering, not parenting
   - Sharing decision making, power and attribution
   - Value and reciprocity with co-designers

Co-design Project Process

Co-design follows a series of defined steps for partners to follow which involve:

1. Defining the **Problem**
2. Understanding the **Context**
3. Expressing the **Needs**
4. Proposing the **Options**
5. Agreeing on the **Solution-s**

These are the standards by which we will judge value and reciprocity.