Catchment Carbon Offsets Trial

Goulburn Broken Catchment Management Authority

Final Report

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Supporting implementation of the Victorian Government's water plan, Water for Victoria

Catchment Carbon Offsets Trial

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Executive summary

The Catchment Carbon Offsets Trial

The Catchment Carbon Offsets Trial (CCOT) sought to complement Victorian government policies and strategies relating to climate change, water, catchment management and biodiversity by demonstrating how projects may deliver emissions reductions, climate resilience and improve catchment management outcomes. The project was intended to enhance understanding of carbon offset opportunities and help align water sector emissions abatement activities with regional natural resource management (NRM) plans and strategies. The project was strongly collaborative among the Victorian water sector, which comprises Catchment Management Authorities (CMAs), Water Corporations and the Department of Environment, Land, Water and Planning (DELWP).

Catchment carbon offset concepts

The catchment carbon offset (CCO) concept was framed around the idea of projects being designed to retain and increase carbon stocks in the landscape while simultaneously providing environmental and social benefits which are consistent regional NRM planning frameworks, programs and targets.

The first of the CCOT's stakeholder workshops developed the concept to include these additional key features or principles:

- Offset projects result in permanent, real and additional reductions in atmospheric CO_2 which are credibly quantified and independently verified;
- The sequestered carbon is resilient with climate change and "protected" from ownership and policy changes;
- Offset projects provide environmental, social, cultural and/or economic benefits which are consistent with Water Corporation, CMA and State Government policy and program objectives;
- Non-carbon benefits are visible, certain and clearly defined;
- Offset projects build or result from stable, long-term relationships within the water sector and with local communities;
- Offset projects are typically local to CMAs and Water Corporations.

Two alternative "models" of CCO were defined: *certified* and *flexible*. Certified offsets satisfy the key features of CCOs (as above) and are formally certified under the Australian National Carbon Offset Standard (NCOS) or another complementary framework. *Flexible offsets* share the same essential features of CCOs, are credibly measured, but they are not independently verified and credited. They result in emissions reductions which can be measured in state and national greenhouse gas accounts, but are not formally credited.

It was anticipated that CCO projects would generally target the generation of certified offsets and that these would be the most attractive to Water Corporations seeking progress towards their net zero emissions (NZE) targets. However, the CCOT consistently considered the role, if any, of flexible offsets in CCO projects.

Appraisal of catchment carbon offset options

CCO options are the various methods by which carbon offsets – *with the key features of CCOs* - may be generated. These options could potentially generate one or more of three main forms of carbon offset:

- *Green carbon:* carbon sequestered by and/or retained in woody perennial vegetation and soils in forests, woodlands or plantations;
- *Blue carbon:* carbon retained in aquatic or marine soils, vegetation or other structures (e.g. coral reefs);
- *Brown carbon:* carbon stored in agricultural soils.

While brown carbon projects may provide some environmental benefits which are consistent with the CCO concept (e.g. improved soil health, climate resilience), their alignment the full suite of features was not considered to be sufficient for them to qualify as CCOs. While blue carbon projects potentially align strongly with the CCO concept, methods for formal offset crediting are mostly lacking, as is the regulatory basis for owning any credits that might be generated.

Catchment carbon offset case study

Overview

A key feature of the CCOT was a case study to explore the "implementation pathway" for CCO projects. The case study was intended to demonstrate how CCO projects could be designed to deliver emissions reductions, climate resilience in landscapes, improved catchment health and better alignment between regional NRM plans and water sector emissions abatement and how these co-benefits could be evaluated.

The actual case study was selected following a call for expressions of interest from Victorian CMAs and Water Corporations. Six expressions of interest were received from five different applicants. The selected case study was received from a consortium comprising Wannon Water, Corangamite CMA, Glenelg Hopkins CMA and the Centre for eResearch and Digital Innovation (CeRDI).

Gellibrand River catchment carbon offset case study

The case study was designed to improve water quality in the catchment above Wannon Water's Otway South water offtake on the Gellibrand River. Wannon Water's two water offtakes in the Gellibrand catchment are the main sources of drinking water for Warrnambool and surrounding areas. The case study was also designed to improve river health in a key waterway and catchment area for Corangamite CMA, provide certified carbon offsets to at least satisfy Wannon Water's expected annual requirements, build climate resilience in these landscapes and generate other environmental and social benefits.

The case study considered three main vegetation configurations (Figure ES.1):

- *20 m waterway buffer:* 20 m revegetated buffer both sides of all defined waterways within the case study catchment[1]. This represents what is considered to be the minimum width of revegetated buffer to materially improve water quality in the main waterways and catchment.
- *100 m waterway buffer:* 100 m revegetated buffer both sides of all defined waterways within the case study catchment. This represents what is assumed to be the plausible upper limit of revegetation in the catchment.
- *Floodplain + 20 m buffer:* 20 m revegetated buffer both sides of all defined waterways, with further areas of revegetation occupying all of the floodplain for a 1% annual exceedance probability (AEP) flood event (or 100 y average recurrence interval flood).

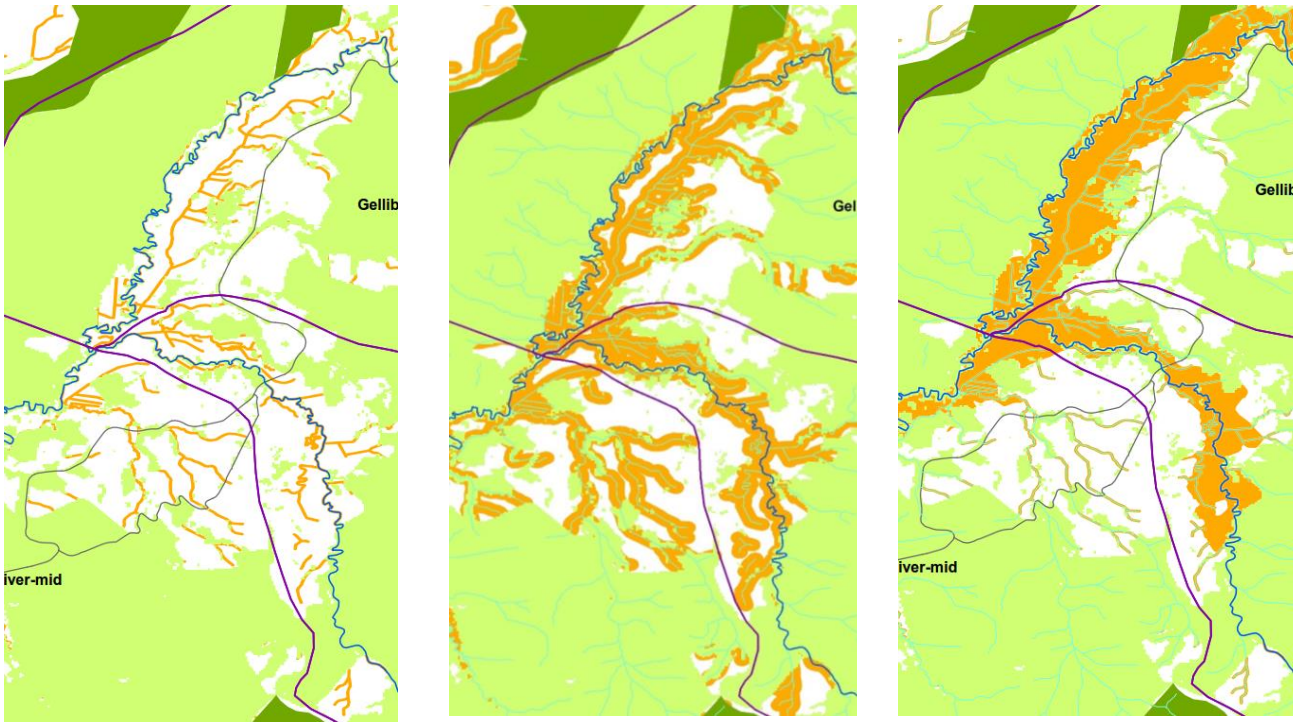
In each configuration, the 20 m buffer either side of the waterway was to be revegetated with locally indigenous species of trees and shrubs. In the 100 m waterway buffer and floodplain+20 m buffer configurations, the plantings outside the 20 m riparian buffer were either EP or farm forestry plantings (FF; assumed to be *Eucalyptus globulus*). According to the design, EP would remain unharvested through their life. The FF plantings were assumed to harvested for pulpwood on a 15 year rotation and then replanted.

In evaluating the potential outcomes of the CCO project, the case study considered two alternatives:

- *Base case:* a "do nothing" option in which no new action would be taken to manage source water quality upstream of the Otway South offtake or to improve river health. Under this option, existing water treatment infrastructure would be used to satisfy health-based water quality targets. While this is a "base case" for evaluation purposes, because of the water quality risks, it is unlikely to be a realistic option for Wannon Water.

[1] The Gellibrand River catchment upstream of the Otway South offtake, near the junction of Kennedy's Creek and the Gellibrand River.

20 m waterway buffer **100 m waterway buffer** **Floodplain + 20 m buffer**



Note: Brown lines and areas mark the extent of revegetation under each of the configurations. The location of the waterway is shown for the 100 m waterway buffer and floodplain+20 m buffer configurations. The illustration shows the Gellibrand River floodplain at the junction between the Gellibrand and Carlisle Rivers and does not differentiate between environmental and farm forestry plantings in the 100 m and floodplain + 20 buffer configurations.

Figure ES.1 : Representations of the case study's main revegetation configurations.

- *Engineered water quality treatment:* in this option, rather than treat the catchment source of water, ultra-violet (UV) treatment would be introduced at each of the five plants treating water from the Gellibrand River. This will allow Wannon Water's drinking water supplies to meet evolving health-based water quality targets and to treat growing levels of *Cryptosporidium* and *Giardia* in the source water – without treating the catchment.

Case study conclusions

The case study results and its conclusions are documented in detail in a separate report to this one. A summary of its main conclusions are provided below.

The case study found that, at least in the Gellibrand catchment, a CCO project could provide a cost-effective option to generate certifiable carbon offsets to help Wannon Water meet its emissions reduction targets. It could do so while improving catchment water quality and providing other complementary environmental and social benefits. The case study demonstrated that the characteristics or design principles for CCOs which were developed by this project's steering committee and a broader stakeholder group were appropriate and workable.

A replicable method for designing and evaluating potential catchment carbon offsets projects was developed. The process and tools used in designing and evaluating the case study project (*described in Appendix E of this report*), could be applied to potential catchment carbon offsets projects in other settings and at different scales.

The case study found that configuration of the catchment carbon offset as a 20 m wide waterway buffer (each side of the stream) was the most cost-effective option to provide the required carbon offsets and achieve the project's other design objectives, including water quality improvement. In other settings, different designs may be more appropriate and a catchment carbon offset project may be more or less cost-effective.

In some settings, the inclusion of FF plantings could significantly improve the financial performance of a large CCO project. If appropriately integrated with EP in CCO design, the overall project could provide certified offsets and a variety of environmental and social benefits.

The case study also found that the concept of flexible offsets – those which are associated with measurable, but uncertified greenhouse gas abatement – has application in CCO projects. With some project designs, it is possible to generate significant non-certifiable abatement that would contribute towards the achieving the State's net zero emissions target. In this case study the flexible offsets would mainly be achieved through avoidance of agricultural emissions rather than a flexible model of CCO planting.

A key feature of the catchment carbon offset concept is collaboration. This was an important feature in the design and execution of this case study and would be in the delivery of any project resulting from it.

Conclusions

The CCOT has developed and piloted (in the case study) an effective framework by which Water Corporations and CMAs can collaborate in generating carbon offsets that also build landscape climate resilience and provide complementary environmental and socio-economic benefits. The case study found that a project which could be practicably implemented was capable of satisfying a Water Corporation's offset requirements and provide catchment-scale environmental benefits. By demonstrating that it is possible and (in some settings) cost-effective to implement CCO projects, the CCOT potentially paves the way for CMAs and Water Corporations to deliver projects which align NRM planning frameworks and emissions reduction requirements under Water Corporations' Statements of Obligations, as well as implement CMA Regional NRM Climate Change Adaptation Plans.

The CCOT has created an important legacy, which is considered to include:

- Establishing that CCO projects can be an appropriate means of generating carbon offsets, while simultaneously providing various environmental and social benefits;
- Creating a vocabulary and conceptual framework for considering multi-benefit carbon offsets;
- Collaborative interactions among water sector organisations through the stakeholder workshops and the case study.
- Development of a replicable process for designing and evaluating CCO projects, as well as supporting information and tools.

Recommendations

The CCOT and its case study has made important progress in defining and developing the CCO concept. While the CCO project representing the case study could move to implementation, it is recommended that further work be done to prove the process and adapt the tools developed for the case study so that they are more generically applicable. This work would include the following:

- Adaptation of the CCO project evaluation tools - particularly the financial analysis tool and project score card – to make them more generically applicable to CCO projects;
- Undertake several additional collaborative water sector case studies to evaluate the CCO concept for appropriateness and cost-effectiveness for other design requirements and landscape settings. These case studies would be undertaken and reported back to the stakeholder group gathered for the CCOT (and other interested parties);
- If the additional case studies provide further evidence of the appropriateness of the CCO concept, further work could be undertaken with CeRDI to develop and deliver web-based tools and information to support the wider implementation of CCO projects.

1. Introduction

1.1 The Catchment Carbon Offsets Trial

The Catchment Carbon Offsets Trial (CCOT) sought to complement Victorian government policies and strategies relating to climate change, water, catchment management and biodiversity by demonstrating how projects may deliver emissions reductions, climate resilience and improve catchment management outcomes. The project was intended to enhance understanding of carbon offset opportunities and help align water sector emissions abatement activities with regional natural resource management (NRM) plans and strategies.

The project involved collaboration among Victorian Catchment Management Authorities (CMAs), Water Corporations and the Department of Environment, Land, Water and Planning (DELWP). Jacobs was engaged to support its development and implementation.

The CCOT project commenced in January 2017 and was completed in March 2018. It was implemented in four main stages, as depicted in Figure 1.1.

- *Stage 1* established the framework for the project, including defining what the key attributes of catchment carbon offsets were.
- *Stage 2* included a major stakeholder workshop (in March 2017), with representation from CMAs, Water Corporations, DEWLP and a group of potential offset providers. The workshop discussed the CCO concept and extended the definition of its key characteristics or principles (see Section 1.2). A discussion paper on the catchment carbon offsets concept was produced and circulated to workshop participants and other interested parties.
- *Stage 3* was a detailed appraisal of the CCO concept. The appraisal was structured around the evaluation framework for the project (developed in Stage 1) and considered the appropriateness, effectiveness and legacy of various types of carbon offset project. A second discussion paper was produced and a set of carbon offsets options that most closely aligned with the CCO concept were selected for consideration in the case study (Stage 4).
- *Stage 4* explored the application of the CCO concept in designing and evaluating a case study in the Gellibrand River catchment of south-western Victoria. The case study was undertaken in conjunction with Wannon Water, Corangamite CMA, Glenelg Hopkins CMA and Federation University.

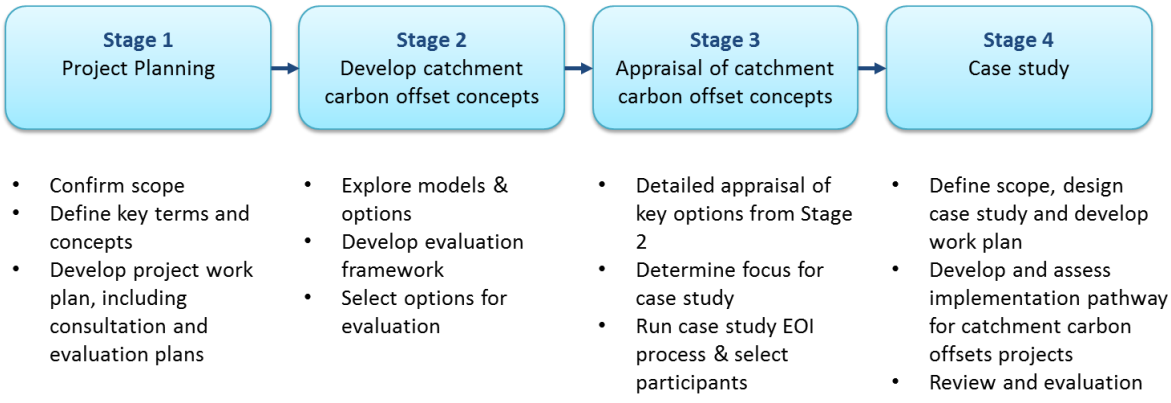


Figure 1.1 : Catchment carbon offsets trial: overview of approach

A second major stakeholder workshop was held during the final stage of the project, in which outcomes of the case study were presented and discussions were held on future opportunities to apply the CCO concept.

1.2 Catchment carbon offset concepts

The catchment carbon offset (CCO) concept was framed around the idea of projects being designed to retain and increase carbon stocks in the landscape while simultaneously providing environmental and social benefits

which are consistent regional NRM planning frameworks, programs and targets. The concept was developed further during the Stage 2 stakeholder workshop to include the features listed in Table 1.1.

Table 1.1 : Key characteristics or principles of catchment carbon offsets.

Extended definition of catchment carbon offset characteristics – following the March 2017 stakeholder workshop
• Offset projects increase landscape carbon stocks, resulting in real and additional reductions in atmospheric CO_2.
• Carbon sequestration is credible, quantified and verified.
• Carbon is "permanently" sequestered.
• Stable and resilient with climate change.
• "Protected" from ownership and policy change.
• Offsets projects provide environmental, social, cultural and/or economic benefits which are consistent with: - Regional NRM planning frameworks, programs and targets; - Water Corporation objectives; - State Government policy.
• Project benefits and outcome can be owned and transferred.
• Non-carbon benefits are visible, certain and clearly defined.
• Build or result from stable, long-term relationships within the water sector: CMA(s)-Water Corporation(s).
• Local to Water Corporations and CMAs.
• Offset projects are scalable up and down.

Two alternative "models" of catchment carbon offset were defined at the outset of the project:

- *Certified offsets:* which are catchment carbon offsets (as per the characteristics described in Table 1.1) which are formally certified under the Australian National Carbon Offset Standard (NCOS) or another complementary framework.
- *Flexible offsets:* which share the same essential features of catchment carbon offsets as the certified offsets (Table 1.1) and are credibly measured, but they are not independently verified and credited. They result in emissions reductions which can be measured in state and national greenhouse gas accounts, but are not formally credited.

Both models were considered through the detailed evaluation of carbon offset options in Stage 3 and the Stage 4 case study.

1.3 Purpose and structure of this report

This is the final report of the CCOT. Its purpose is to provide a record of what the project has considered, outcomes from stakeholder engagement and of the key project outputs. It also includes an evaluation of project against the evaluation framework and criteria defined in its first stage. Some components of the report have been reproduced from working documents developed during earlier stages of the project.

The remainder of this report is structured around the work undertaken in each of the project's four stages. It concludes with an evaluation of the CCOT. Appendices provide additional information on the evaluation of potential CCO options and the methods by which a CCO project might be designed and evaluated.

2. Stage 1: Project planning

2.1 Overview

The project's first stage was concerned with planning for its successful and collaborative delivery. Its main feature was an inception workshop, in which members of the project steering committee (PSC) and key members of Jacobs' team explored:

- *Context for the CCOT:* the range of social-technical-environmental-economic-political-legal (STEEPL) risks and opportunities for multiple benefit catchment carbon offsets.
- *Stakeholders:* CCOT stakeholders were identified and prioritised. The extent and method of engagement in the trial was determined.
- *Features of the CCOT:* key features of the "frameworks" for generating catchment carbon offsets which are to be considered in the project were described.
- *Risk management:* risks to achieving the trial's objectives were identified and key risk controls developed.

The main output from this initial stage was the project plan, which incorporated a stakeholder engagement plan and evaluation framework.

2.2 Stakeholder engagement

The project's inception workshop "mapped" key stakeholders for the project according to their influence and anticipated level of interest (Figure 2.1). This information was used to develop a plan to engage with key stakeholder groups in the course of the project. Four main engagement activities were envisaged (Table 2.1), although the consultation plan was varied as the project was delivered. The main changes were in the choice of the peak body forum to present to and the holding of a second stakeholder workshop during the final stage of the project.

stakeholder interest	Low stakeholder influence	High
High	11. DELWP Biodiversity 12. Carbon offset project developers 13. Cwth ERF working group 14. Indigenous groups (Federation) 15. SA government	1. CMA Chairs & CEOs 2. Water Corporation Chairs & CEOs 3. DELWP Water Plan group 4. DELWP Catchments group 5. Victorian Catchment Management Council 6. Ministers – Environment & Climate Change, Water 7. Victorian NRM Climate Change Forum 8. Water Corporations' sustainability &/or pledge coordinators
Low	16. DEDJTR Agriculture	9. DELWP Climate change group 10. Department of Treasury & Finance

Figure 2.1 : Key stakeholders for the Catchment Carbon Offsets Trial

Table 2.1 : Proposed and actual stakeholder engagement activities

Activity	Description
Stage 2 Stakeholder workshop	**Aims:** • Inform stakeholders about opportunities and constraints associated with catchment carbon offsets models and options. • Test appetite for catchment carbon offsets projects given current policy settings and other constraints and opportunities. • Design key elements of catchment carbon offsets trial • Develop criteria for evaluating catchment carbon offsets models and options. **Target audience:** Primary – CMA NRM CC planning leads; WC representatives involved in catchment health and emissions pledge processes. Secondary – NGO delivery agents for catchment carbon offset type projects, relevant DELWP policy areas. **Approach:** Circulate working version of CCO discussion paper prior to workshop Full day workshop with main sessions on: • Presentation on catchment carbon offsets concept, models and options – drawing on discussion paper. • Sharing of experiences with carbon offset projects • Current and potential appetite for catchment carbon offsets projects – with CMAs, WCs or other investors • Design the catchment carbon offsets trial. • Develop case study concept. **Outcome:** The workshop was held in Melbourne on 24th March 2017, with 22 water sector participants represented. The CCO discussion paper was revised to incorporate discussions during the workshop and circulated to participants and other interested parties.
Peak body forum	**Aims:** • Inform key stakeholders about opportunities and constraints associated with catchment carbon offsets models and options and results of framework appraisal. • Seek feedback on catchment carbon offsets concept. **Target audience:** Initial target: CMA CEO and Chairs, VCMC representative, Water Corporation representatives Actual: Representatives of CMA NRM Climate change forum and DELWP **Approach:** Presentation and discussion within a scheduled forum. **Outcome:** The peak body presentation was deferred until Stage 4 of the project (in December 2017) and focussed on learnings from the appraisal of CCO options and the case study. The presentation was provided to members of the Victorian NRM Climate change forum, with DELWP representatives also in attendance.
Stage 4 Case study workshops	The case study was planned to be run as a series of workshops with a working group drawn from the participating organisations, with the final structure summarised below: 1. Case study design 2. Implementation pathway 3. Review and evaluation Details of the case study process are described in Section 5. The workshops were held between October 2017 and January 2018. **Target audience:** Working group drawn from case study partners and CCOT PSC. **Outcomes:** Three workshops were held with the case study working group, comprising representatives from Wannon Water, Corangamite CMA and Glenelg Hopkins CMA. Notes from each workshop were circulated to participants and results

Activity	Description
	from the case study were documented in a major report from the CCOT.
Briefings and communication about progress	**Aims:** • Inform stakeholders about the catchment carbon offsets concept and the opportunities and limitations associated with it. • Inform stakeholders about progress with the project and, at completion, inform them about the key findings of the project. • Contribute to there being a favourable policy environment for catchment carbon offsets-type projects. **Target audiences:** All target audiences, as per Figure 2.1. **Approach:** Briefings and communication were largely undertaken by Kate Brunt on behalf of the PSC.
Stage 4 Final stakeholder workshop	**Aims:** • Inform stakeholders about case study outcomes and learnings • Discuss interest in developing further case studies and/or implementing CCO projects. **Target audience:** Primary – CMA NRM CC planning leads; WC representatives involved in catchment health and emissions pledge processes. Secondary – NGO delivery agents for catchment carbon offset type projects, relevant DELWP policy areas. **Approach:** Full day workshop with main sessions on: • Overview of CCO concept and the CCOT. • Presentation and discussion of CCO case study in Gellibrand catchment • Learnings from case study • Guide to undertaking a CCO project. • Next steps with catchment carbon offsets. **Outcome:** The workshop was held in Melbourne on 22nd February 2018, with 22 participants from the Victorian water sector. The main case study presentation and workshop notes were circulated to participants/

2.3 Evaluation framework

A set of evaluation criteria were developed to assess the CCOT, based on the performance framework illustrated in Figure 2.2. A set of evaluation questions were developed (Table 2.2) to assist in providing an overall evaluation of the CCOT at its conclusion.

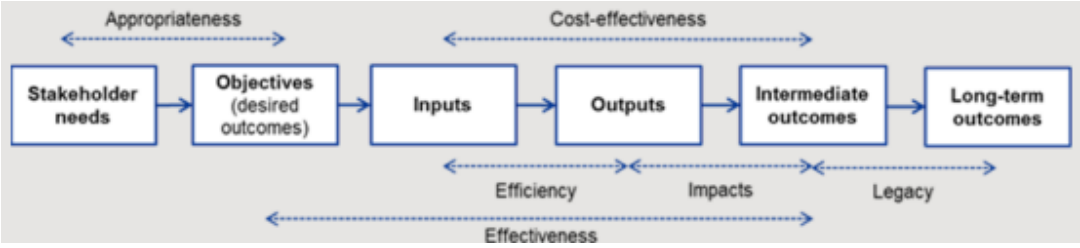


Figure 2.2 : Performance framework for catchment carbon offsets concept, models and options.

Table 2.2 : Evaluation framework for catchment carbon offsets trial

Evaluation criterion	Evaluation questions
Appropriateness	1 Were the catchment carbon offset models and options considered in the trial relevant to the needs of CMAs and WCs? 2 Were the stakeholder engagement processes (stages 2 and 4) appropriate for the objectives of the project and participating stakeholders? 3 Were the key project deliverables (stages 2-4) consistent with the needs of the project and the interests of the target audiences?
Effectiveness	4 Were the stakeholder workshops (stages 2 and 4) designed and facilitated in a way that provided good value to the project and participants? Did they achieve their objectives? 5 Has the project been delivered with the level of collaboration – with the steering committee and key stakeholders – sought? 6 Do they key project deliverables (stages 2-4) provide accessible and useful information to the intended audiences? 7 To what extent did the project accomplish its objectives and intended outcomes?
Efficiency	8 Have the stakeholder workshops (stages 2 and 4) appropriately valued participants' time by (e.g.) providing good information, getting the right people together and working through the process in a time efficient manner. 9 Have steering committee meeting times been used effectively by the consultant and steering committee members.
Cost-effectiveness	10 Has the project provided appropriate value for the resources invested in it?
Impacts	11 How has the project added to knowledge and understanding about the catchment carbon offsets concept with key stakeholders?
Legacy	12 What will form the main legacies of the project?

3. Stage 2 Develop catchment carbon offset concepts

3.1 Overview

The main activities undertaken in the second stage of the CCOT were a stakeholder workshop and that development of a discussion paper on the CCO concept. A working draft of the discussion paper was circulated to stakeholders prior to the workshop. The document was then revised to reflect feedback received during the workshop and circulated to workshop participants and other interested stakeholders.

Key elements of the discussion paper are reproduced in the following sections.

3.2 Development of the catchment carbon offset concept

3.2.1 Carbon sequestration and carbon stores

Carbon sequestration is the removal of gaseous carbon (as CO_2) from the atmosphere for storage in stable natural systems. Three broad categories of stored carbon are relevant to the catchment carbon offset concept, namely:

- *Green carbon:* carbon stored in vegetation, typically woody vegetation;
- *Brown carbon:* carbon stored in soil, including through the addition of biochar and other sources of “black” carbon; and
- *Blue carbon:* carbon stored in marine and aquatic ecosystems, incorporating marine or aquatic plants, coral, soils and sediments.

Workshop participants generally considered that the focus of the project should be on projects generating green carbon, although there was significant interest in blue carbon opportunities by some participants.

3.2.2 Carbon offsets

Carbon offsets are measured units of sequestered carbon or avoided greenhouse gas emissions[2], created or purchased to compensate for an equivalent carbon emission. To qualify as an offset, the amount of carbon sequestered or emissions avoided must be measurable, “permanent” (for sequestered carbon), transparent, avoid leakage[3], and be additional to what would have otherwise occurred.

The National Carbon Offset Standard (NCOS; Department of the Environment [DoE], 2015) and the framework established by the *Carbon Credits (Carbon Farming Initiative) Act 2011* (CFI Act) set the standards for carbon offsets within voluntary and compliance carbon markets in Australia. They establish definitions and methodologies for offset measurement, permanency, transparency, leakage and additionality. All Australian Carbon Credit Units (ACCUs) issued by the Clean Energy Regulator are eligible for use under the NCOS, as are selected international units.

Sequestration and emissions avoidance projects which operate outside this framework may also function as carbon offsets. However, they are less clearly attributable to an individual entity and may not be credibly[4] included in organisational claims of progress towards carbon neutrality or net zero emissions (NZE). Nonetheless, such projects have potential to enhance carbon stocks within state and national emissions accounts and could contribute to the achievement national and state emissions reduction targets.

[2] Note that only avoided emissions of green (vegetation), brown (soil) or blue (marine or aquatic) carbon are applicable to the catchment carbon offsets concept.
[3] Leakage is where actions to sequester carbon or avoid emissions in one project or area lead directly or indirectly to activities which increase emissions in another area.
[4] Such claims may also not be consistent with consumer law in Australia.

Discussions in the stakeholder workshop differentiated between offsets which resulted from projects undertaken or directly commissioned by a water sector entity[5] and those that might be sourced from a third party provider and projects with which they have no direct connection.

3.2.3 Catchment carbon offset models

As defined with the steering committee for the CCOT, the catchment carbon offsets concept embodies two fundamental characteristics:

- They result in the retention of carbon stocks in the landscape and further carbon sequestration;
- They also provide environmental benefits, consistent with regional NRM planning frameworks, programs and targets.

At least in the development stage for the concept, the steering committee considered that it was also important that catchment carbon offset projects lead to or result from stable, long-term relationships between individual or groups of CMAs and Water Corporations. Projects may be undertaken on private land or public land for which Water Corporations and/or CMAs have management responsibility.

While the initial focus of the concept is on partnerships between CMAs and Water Corporations, the steering committee also considered that the concept could ultimately develop to include other partners and different land tenures. The initial partnerships may also be expanded to include other providers of multi-benefit vegetation management projects such as Trust for Nature and Greening Australia.

Discussions during the stakeholder workshop extended the potential characteristics of catchment carbon offset projects to include those listed in Table 1.1.

Consistent with this characterisation, there are considered to be two main “models” for carbon offset projects, as illustrated in Table 3.1[6]. The “flexible” model is characterised by projects in which the carbon sequestered (or emissions avoided) is estimated using credible methodologies, but there is no formal or certified offset generated (e.g. under the NCOS) and greater flexibility in project governance and implementation. This model represents an incremental adjustment to business-as-usual CMA projects. Under the “certified” model, carbon sequestration or emissions avoidance resulting from catchment management projects is measured and verified in compliance with the NCOS or another applicable standard and the offsets are certified.

Water Corporations require certainty in their emissions reporting, as well as the ability to take on the obligations inherent in any particular model of offset. However, although certified offsets aligned with the ERF and other crediting frameworks provide surety of the amount of carbon offset over a defined timeframe, the requirements for complying with these schemes can be onerous. Policy changes over time may mean that elements of the flexible model become compliant with an accreditation framework, and current requirements for the certified frameworks may become more relaxed. Regardless of the framework, the projects will need to provide benefits in addition to carbon offsets, such as to biodiversity, water quality and/or social amenity. There will also need to be a story or narrative about the offset and its benefits to enable public engagement with, and support for, the project.

[5] Wannon Water defines such projects as sequestration projects. In their terminology, “offsets” are sequestration credits purchased from third party providers and generated by projects with which they have no connection.

[6] The names for the models were modified following discussion in the CCOT workshop. The “formal” model of offsets has been renamed as “certified”. “Informal” offsets are now called “flexible” offsets.

Table 3.1 : Characteristics of catchment carbon offset "models" – as understood during Stage 2 of the project - with reference to business-as-usual projects undertaken by CMAs.

	CMA business-as-usual projects	Catchment carbon offset project types	
		Flexible model	Certified model
Carbon sequestration potential	**Low-high**, depending on location and type of project.		
Environmental service provision	**Primary objective** of project. Moderate-high, depending on project.		**Potentially a secondary objective**. Low-high, depending on project.
Measurement of carbon sequestration	**Not typical** practice.	**Required**. Use accepted models or calculation tools.	**Required**. Use method applicable to project type.
Measurement of other environmental services	Inputs routinely measured & reported.	Inputs measured & reported. Environmental service outcomes potentially measured & reported, but measurement not necessarily required.	
Type of carbon offset provided	Sequestered carbon contributes to the **state greenhouse gas account** and progress towards ZNE at that level. May contribute to a narrative about an entity's progress with emissions reductions.		**Produces ACCUs** and can formally offset an entity's emissions.
Revenue generation potential from carbon or environmental services	**Not typically**. May be eligible for cost-sharing with CMA.	**Unlikely**. May be eligible for cost-sharing with CMA	**Revenue from carbon**. Projects may also be eligible for cost share with CMA.
Regulatory compliance burden	**Low**. Verification of project completion and assurance of security of sequestered carbon.		**Significant:** carbon maintenance obligation; verification & reporting.
Costs	Establishment and maintenance. **Opportunity cost** of foregone agricultural or other production.		
	Potential land price implications (favourable/unfavourable) associated with some mechanisms to provide assurance of security of carbon.		Offset registration, verification & reporting. Potential land price implications of carbon maintenance obligation.
External investor drivers	Environmental service provision – NRM and social benefits.		**Ownership** of carbon offset. Potential interest in environmental service provision.
Landholder risks and obligations	**Low** and typically limited to maintenance requirements.		**Significant:** due to carbon maintenance obligation.

Note: References to "carbon sequestration" in the table also incorporate emissions avoidance.

3.2.4 Certifying and crediting multi-benefits from catchment carbon offset projects

A recent discussion paper issued by the Climate Change Authority (2017) reviewed opportunities for project proponents to realise value from the carbon and non-carbon benefits accruing from catchment carbon offset-type projects. They noted that the Emissions Reduction Fund (ERF) specifically excludes non-climate benefits from its scope - to ensure the Commonwealth had access to carbon credits at the lowest possible cost.

Notwithstanding this, various possibilities exist by which carbon offset projects can generate non-carbon benefits which align with the catchment carbon offset concept (). These exist for both certified and flexible catchment carbon offset models.

The Climate Change Authority (2017) identified three options for enabling carbon offset providers to capture value from non-carbon benefits:

- *Separate crediting:* under this concept, offset providers receive separate "credits" (e.g. biodiversity credits) for non-carbon benefits accruing from a project. Where there is a market, these credits could be sold

separately to the carbon credits. While it is conceptually workable, it faces challenges from the additionality requirements of carbon offsets methods. ACCUs cannot be credited to projects which are required under Commonwealth or State law. This means that biodiversity credits (for example) from carbon offset projects could not be sold to parties with legal biodiversity offset requirements.

The Queensland Department of Environment and Heritage Protection (DEHP) have instituted a voluntary market for nutrients, through which nutrient offsets may be formally recognised and traded (DEHP, 2014). To date, only a small number of projects have been implemented. While not currently available in Victoria, were a similar scheme developed, it could provide another crediting stream for catchment carbon offsets projects. However, as with biodiversity credits, the additionality test for the carbon sequestration activities providing nutrient benefits would need to be satisfied.

- *Multiple benefits accreditation:* non-carbon benefits would be captured with carbon benefits in a single tradeable instrument. Various voluntary carbon market standards have been developed to accredit non-carbon benefits of carbon offset projects. Of these, only emissions credited under the Voluntary Emissions Reductions (VERs) issued by the Gold Standard Foundation are compliant with NCOS. VERs include a principle of co-benefits, by requiring that projects enhance sustainable development and comply with the UN Millennium Development Goals for social and environmental conditions.
- *Direct grants programs:* non-carbon benefits of projects could be captured through direct "grant" payments to offset providers (whether through grants, via an auction or some other delivery mechanism). This concept could potentially apply to both certified and flexible catchment carbon offset projects.

3.2.5 About blue carbon

Several CMAs have expressed interest in the concept of blue carbon as a means of supporting the protection of coastal ecosystems and inland wetlands. Of the certifications allowed under the NCOS, blue carbon projects are currently only included in Verified Carbon Units (issued by the Verified Carbon Standard, VCS). There is currently no ERF method for generating ACCUs from blue carbon projects.

Methods for calculating emissions abatement by protecting or enhancing mangroves and salt marshes are currently being considered by Commonwealth Government (Dr P. Carnell[7] pers. comm.). Methods for generating carbon credits from management of freshwater wetlands remain in the early stages of development. For ACCUs to be generated from blue carbon projects, issues associated with additionality, permanence (for sequestration), ownership and attribution of project actions to abatement outcomes would need to be clarified. These barriers are not inconsiderable and are currently being considered by the Commonwealth.

Current blue carbon research aims to characterise the carbon budget for these ecosystems, with future work to set up and maintain a demonstration site (Dr P. Carnell, pers. comm.). The data gathered through these studies is required to provide assurance of the robustness of measurements methods, which is required for those methods to be accepted under the ERF.

Macreadie *et al*. (2017) identified three main types of outcome from NRM projects which could help to enhance blue carbon stocks in mangroves and seagrass beds, namely:

- Reduced nutrient load of waterways draining to mangroves and sea grass beds;
- Reduced bioturbation (disturbance of the marine sediment) in coastal environments;
- Improvement in the flow regime of waterways draining to coastal ecosystems.

At least the first of these align with both CMA and Water Corporation objectives and are consistent with the catchment carbon offset concept.

[7] Dr Paul Carnell: Blue Carbon Lab, Deakin University.

3.3 Experiences with carbon sequestration and catchment carbon offset projects

3.3.1 Emissions Reduction Fund projects

As of February 2017, 670 sequestration and emissions avoidance projects had been registered with the ERF, with a total of 32.7 million ACCUs[8] issued. Participants in the ERF include: companies from a variety of industry sectors; specialist carbon project developers; local government; state government agencies; Aboriginal corporations; and private individuals.

About 6.5% of all registered ERF projects are located in Victoria, with these accounting for 9.5% of the total ACCUs issued (Table 3.2). Vegetation, landfill and waste and energy efficiency projects are the most common project types in Victoria, however almost all of the ACCUs issued to Victorian projects have been to landfill and waste projects.

Vegetation projects are the largest group nationally, in terms of both the number of projects and ACCUs issued. Many of these are for native forest protection or avoided deforestation projects in savannah woodland regions of jurisdictions (mostly New South Wales and Queensland) where landholders have established legal permission to clear or re-clear land (Climate Change Authority, 2017). Clearing regulations, farming systems and vegetation types in Victoria mean that such projects are generally inapplicable in this state.

Table 3.2 : Numbers and types of projects registered under the Commonwealth Emissions Reduction Fund and the quantity of ACCUs or carbon offsets certified.

Source: Clean Energy Regulator; http://www.cleanenergyregulator.gov.au/ERF/project-and-contracts-registers/project-register

	Projects registered (# and % in the jurisdiction)		ACCUs issued (# and % in the jurisdiction)	
Project type	**Australia**	**Victoria**	**Australia**	**Victoria**
Vegetation	359 (54%)	14 (32%)	17,751,881 (54%)	16,282 (1%)
Landfill and waste	132 (20%)	13 (30%)	12,617,095 (39%)	3,074,805 (98%)
Agriculture	36 (5%)	5 (11%)	296,787 (1%)	45,111 (8%)
Savanna burning	76 (11%)	-	2,775,170 (8%)	-
Energy efficiency	46 (7%)	11 (25%)	0	0
Transport	7 (1%)	1 (2%)	0	0
Industrial fugitive emissions	13 (2%)	-	0	-
Facilities	0	-	0	-
Total	**713**	**44**	**36.58 million**	**3.14 million**

3.3.2 Victorian Catchment Management Authorities

Resources provided by the Commonwealth government under the *Planning for Climate Change in Natural Resource Management Fund* have been used by all Victorian CMAs to complete regional climate change and NRM plans to guide actions on climate change adaptation and mitigation. These plans operate under the planning framework provided by the *Regional Catchment Strategies*.

Specific approaches and favoured options for carbon offsets vary between CMAs, several common themes run through the regional climate change and NRM plans:

- *Multi-benefit carbon offset projects are favoured:* CMAs generally favour projects which the catchment carbon offset concept characterises, that is projects which yield multiple environmental benefit streams, including: climate resilience; enhanced green, brown and/or blue carbon stocks; enhanced biodiversity; and improved water quality, soil and/or river health.

[8] Each ACCU corresponds to 1 t CO_2 equivalent (CO_2e).

- *Economic feasibility of carbon offset projects:* CMAs recognise that the price for carbon is currently too low to solely fund (at any significant scale) environmental planting-type carbon offset projects. Additional financial or perceived value from environmental co-benefits may be required to justify investment.
- *Landholders may undertake projects which sequester carbon independently of carbon pricing:* where co-benefits directly contribute to the productivity and/or long-term viability of their land, landholders may not require additional payments. This indicates implicit support for the flexible catchment carbon offsets project model.
- *Risks associated with carbon offset projects:* most CMAs recognise that carbon offset projects also carry landscape risks, with these associated with (e.g.): water interception; loss of biodiversity; fire; and loss of control over future land use.

Discussion during the workshop highlighted that the CMAs have "investment ready" catchment carbon offset projects.

3.3.3 Victorian Water Corporations

Victorian Water Corporations are responsible, collectively, for emissions of approximately 1 million t CO_2-e/y, the majority of which are from energy use in waste and potable water treatment and fugitive emissions during waste water treatment. This constitutes about one quarter of the emissions attributable to State Government activities.

The State Government has committed the Victorian water sector to pursuing ZNE by 2050 (DELWP, 2016a). Their 2050 ZNE pathways are to be incorporated into their Statements of Obligations in 2017 will comprise their TAKE2 pledges. Compliance with the government's ZNE target and policies will be shifted into the compliance and mandatory action element of the Water Corporations' pricing submissions (to the Essential Services Commission).

High energy costs have meant that Water Corporations with responsibilities for potable and waste water treatment have invested significantly in energy efficiency and energy generation measures. Some Water Corporations have also developed or participated in carbon sequestration offset projects to lower their net emissions, for example:

- *Goulburn Valley Water (GVW):* plantations were established on 139 ha of its property in 2008-09. This was estimated to sequester 690 t CO_2-e (overall) during that year, approximately 1.2% of GVW's operating emissions (EPA, 2010).
- *Wannon Water:* signed a 50 year agreement with CO2 Australia in 2009 to establish and maintain a mallee planting to offset their operational emissions (CO2 Australia, 2009). Wannon Water also registered a reforestation project under the ERF in 2014 (myCarbonFarming, 2017).

Several of the Water Corporations have historically purchased carbon offsets (not necessarily from carbon sequestration projects), although this practice appears to scaled back in recent years (Jacobs, 2016). Some Water Corporations have tested customer response, and found strong support for emissions abatement.

While the Water Corporations are focussing on reducing their own emissions, it is expected that offsets will be needed by several Water Corporations to reach ZNE by 2050. Water Corporation representatives at the CCOT workshop indicated strong interest in collaborating with CMAs in multi-benefit catchment carbon offset-type projects to assist in reaching ZNE.

3.3.4 NRM and water sector experience in other Australian jurisdictions

South Australia's approach to regional NRM-climate change planning has focussed on integrated vulnerability assessments and climate change adaptation planning (e.g. Siebentritt *et al*., 2014a; Siebentritt *et al*., 2014b; Limestone Coast, 2015). Carbon sequestration address through State Government's Greenhouse Strategy (DEWNR, 2015).

Similarly, in New South Wales, regional NRM-climate change planning has focused on climate change adaptation and where carbon offsets are considered, this is typically framed around carbon farming contributing to climate resilience.

The Western Australian Department of Agriculture and Food partnered with the NRM regions to deliver the *Awareness Raising of Carbon Farming Issues* project (NRM WA, 2016). The project showcased a number of carbon farming techniques across a range of landscapes. Techniques used included additional compost use, biochar, biological farming, perennial grazing systems, and revegetation in saline areas. The program engaged landholders through addressing important local problems (e.g. salinity, compost use).

The project found that land managers would adopt more sustainable land management practices, with carbon sequestration considered to be a (financial) bonus. Landholders hosted trials they considered were likely to improve profitability. Once proven to be successful, landholders were more open to exploring other alternatives. The project also facilitated sharing of learnings between regions.

Hunter Water in NSW initiated a tree planting project to offset 80% of its emissions over 20 years with a project registered under the ERF (Hunter Water, 2011). The project established 300,000 native trees and shrubs over 160 ha: in two areas adjacent to water supply dams and a third area where wetland was rehabilitated. Icon Water (ACT) has a reforestation project registered under the ERF. The project has generated almost 18,000 ACCUs (CER, 2017).

A partnership between the WA Department of Water and the WA Water Corporation planted a 90 ha forest to offset some of the Water Corporation's greenhouse gas emissions. The project was located to protect water quality of an important groundwater resource, thereby providing cost-neutral water source protection (DoW, 2011).

The review shows that NRM groups and water utilities are at an early stage in engaging with the catchment carbon offsets concept. While there is interest in and some experience the concept, most Australian carbon offsets are driven either by financial (i.e. carbon price or revenue) or carbon accounting (i.e. emissions offsetting) imperatives.

3.3.5 Indigenous participation in carbon offsets projects

The *Water Plan* explicitly considers Indigenous values in water and includes Aboriginal Victorians in water management. It suggests that CMAs consider partnerships with Traditional Owners as they develop catchment carbon offset projects.

The 2011 Commonwealth Clean Energy Future policy package included $45 million to fund projects with Indigenous leadership or participation. This program was closed in 2014 (Aboriginal Carbon Fund, 2013), however the Department of the Environment and Energy maintains an Indigenous Carbon Farming Fund to support the involvement of Indigenous Australians in the carbon market. The Fund has allocated $4.4 million to research and development, and $17.1 million to capacity building and business support (DoEE, 2017).

The most common method for Indigenous carbon abatement has been through changed savanna burning practices; which is not relevant to Victoria. Other projects have been based on environmental plantings, native forest protection, use of cattle feed supplements and destocking (Aboriginal Carbon Fund, 2013). Two Indigenous reforestation projects (both in South Australia) are registered under the ERF (Aboriginal Carbon Fund, 2015).

"Carbon farming" has the potential to align with cultural obligations to care for the land, and use traditional knowledge to improve land management. A recent study engaged with Indigenous communities to characterise the spectrum of motivations for Indigenous people to be involved in carbon offset projects (Robinson *et al*., 2016). The major themes seem to parallel those which could emerge from consultation with non-Indigenous primary producers, as follows:

- *Protect local landscapes and livelihoods:* carbon offset activities provide an opportunity to build capacity within communities through training and employment. They may also strengthen cultural resilience through involvement in decision-making and management of activities on Indigenous land. The projects may also

provide financial support for generating ecosystem services which also restore connections to country, preserve and develop Indigenous knowledge, and improve landscape health.

- *Meaningful community engagement:* communities wish to be engaged meaningfully so that they can provide informed consent, maintain authority and build knowledge and capacity*:*
- *Sustainable development*: carbon offset projects can potentially restore habitats or species which are important for Indigenous social-cultural-ecological systems and improve climate resilience.

The study found that it has been difficult to design effective programs due to a lack of understanding about how the benefits may be realised for Indigenous communities.

The Aboriginal Carbon Fund (2013) noted that finding financial support for such projects outside of government funding is difficult. When conducted on Indigenous land, such projects may provide environmental and social benefits which may not be available for those on non-Indigenous land or without Indigenous involvement. Depending on the perspective of an investor, these attributes may result in a more valuable offer relative to other offsets projects and potentially attract a premium price.

3.3.6 International applications of the catchment carbon offsets concept

Wylie *et al*. (2016) compared blue carbon projects in Kenya, Vietnam and India and found that in all cases, successful projects incorporated the livelihoods of the local communities into the design. They found that considering local requirements and needs during development prevented leakage (shifting the impact to a different site). High transaction costs precluded participation in formal or compliance carbon markets: carbon offsets were instead sold as voluntary credits.

The US Fish and Wildlife Service (US FWS) has recorded an increase in protected land for conservation due to carbon offsetting. Projects have typically involved partnerships between conservation organisations, the Trust for Public Land, and energy companies (US FWS, 2017). Energy companies purchase high value lands, restore them according to conservation priorities, and donate the lands to the US FWS and/or land trusts along with funding for their ongoing maintenance. These efforts provide the energy companies with carbon offsets.

The highly fragmented and widely distributed nature of agricultural and forestry sectors (in USA) mean that aggregation of offset projects may be necessary to achieve large-scale emissions reductions (EPRI, 2012). EPRI examined several US case studies of aggregated offset projects (including energy efficiency, improved farm management, soil carbon storage, protection of native ecosystems from clearing). Aggregation helped to accommodate spatially dispersed projects and could increase profitability of the carbon offsets. Major benefits were found to include:

- *Reduced measurement costs*: modelling approaches to quantification are statistically more accurate with the larger sample size offered through aggregation. Aggregation allows use of statistical sampling to verify emission reductions and offsets, where smaller-scale projects do not affordably achieve the required levels of statistical rigour and risk reduction.
- *Standardised protocols*: standardised protocols across a program support large-scale participation through lower transaction costs.
- *Reduced risk:* with a large number of participants and projects, the diversification can contain risk resulting from an individual offset project failing. Reduced risk was also found to increase participation.
- *Greater opportunity:* aggregators may seek loans and equity investment at scale, where stand-alone participants are not large enough to merit the attention of large-scale investors.

EPRI found that successful aggregation models build upon existing relationships, such as client bases or local unions. These US experiences are not dissimilar to those operating in the Australian carbon market, with exception of Australian Government playing a much stronger role in setting the regulatory environment for carbon markets and developing and approving accounting methodologies.

The Verified Carbon Standard has a framework for aggregated, “grouped projects”. All members of the group must share a baseline scenario and crediting period, which can reduce the flexibility of the aggregate. This is in

contrast to the Climate Action Reserve and the Clean Development Mechanism, which allow greater granularity as a “program of projects”, rather than operating as a single large project (EPRI, 2012).

3.4 SWOT analysis of the catchment carbon offsets concept

The findings of the review undertaken in preparing the Stage 2 discussion paper and discussions from the stakeholder workshop have been synthesised into a SWOT analysis of the catchment carbon offsets concept (Table 3.3), structured around the two catchment carbon offset models. It suggests that both models may have a place in the development of catchment carbon offset projects, although only the certified model can provide unambiguous offsets for a water sector entity’s emissions.

This analysis was taken further in a detailed appraisal of CCO models and options in Stage 3 of the CCOT (Section 4).

Table 3.3 : SWOT analysis for catchment carbon offsets models.

Strengths	Weaknesses	Opportunities	Threats
Certified catchment carbon offsets			
• Entities "own" the carbon offset and can credibly claim progress towards carbon neutrality or ZNE. • Frameworks to support the generation and certification of this model of carbon offset are well established in Australia and well understood by experienced market participants. • Methodologies are set, credible, clear and meet the (carbon market) regulator's requirements. • The carbon market framework provides reasonable certainty to owners and purchasers of offset credits. Investment risk is reduced relative to the flexible model. • Carbon sequestered is tradeable and may have financial or market advantages. • Model provides for generation of a tangible asset. • Calculation process allows contingency for losses due to natural factors (e.g. fire, climate change). • Market participation provides motivation for development of new or alternative methodologies for generating or accounting for carbon sequestration.	• Transaction costs, regulatory obligations and methodological requirements for participation in the formal carbon market are relatively high. Bureaucracy, language, rules and regulations may be imposing for new entrants. • Permanency requirements impose long-term commitments to land use. • Getting landholder involvement (at scale) may be problematic, particularly if carbon price is low relative to the value of land and costs of participation. • Carbon price offered in compliance markets (e.g. ERF) is relatively low, which influences other markets. Carbon price is currently too low for projects which establish new vegetation to be driven by carbon funding alone. • Most certified carbon offset model options do not require environmental co-benefits. • Projects are typically driven by carbon and financial considerations and are not necessarily consistent with the key characteristics of catchment carbon offsets.	• Where environmental co-benefits are generated, offset projects may not need to be fully commercial in their own right. • Some certified offset options explicitly require the generation and measurement of environmental and social co-benefits. • Fluid state of policy provides an opportunity to develop a co-investment framework for implementing/sharing benefits of multi-benefit projects. • Frameworks for aggregation exist, which may reduce transaction costs to individual project participants. • Engagement with Traditional Owners in offset projects to provide multiple environmental and cultural benefits. • Non-carbon benefits potentially include: education, custodianship, employment, income, land value improvement, lower price to customers for cost of Water Corporation emissions reductions. • Water Corporations are likely to require some offsets to achieve ZNE. Concept (of certified multi-benefit offset projects) may also attract attention across other sectors required to contribute to government's ZNE target. • CMAs can build on their links with landholders to design projects which address their needs and concerns. • Low carbon price may drive interest in projects which are able to provide other environmental or social benefits. It may also help to prevent leakage or movement of projects to locations which are unable to provide the same benefits. • Develop long-term partnerships with investors to enable them to "own" or value the full range of benefits generated. • Learnings transferrable from existing ERF/CFI project participation	• Climate change impacts could pose challenges to the permanency of some green, brown and blue carbon options. • Delay between investment and realisation of carbon offset benefit for some offset options may diminish attractiveness. • Unless environmental, economic, social &/or cultural benefits of offset projects are clear, they are unlikely to attract widespread participation. • Landholders may feel a loss of control/ownership of their land. • Changes in policy/regulations for carbon offsets. • Lower cost of alternative offsets. • Water Corporation investment may be 'restricted' to water corporation land. • Project certainty reduced if there is low confidence in science on emissions estimation. • Multi benefit verification is not a trivial or cost-free activity.

Strengths	Weaknesses	Opportunities	Threats
Flexible catchment carbon offset model			
• Complements business-as-usual projects in which CMAs engage. • Would generally be based on similar/same measurement standards to formal projects, but entry barriers are lower due to the lower transaction costs and regulatory burden. • Entities can own carbon under carbon rights provisions in *Climate Change Act* without a formal certification process • Project design and implementation has greater flexibility. • Likely to achieve more on-ground work for the same amount of money. Costs expected to 50% of certified offset model. • Carbon sequestered contributes to State's progress towards ZNE via the national greenhouse gas accounts. • Projects are designed to provide multiple environmental benefits. • Low entry barriers more likely to attract interest from landholders. Can still be monitored and reported upon to meet permanency requirements. • May be less locked in to particular policy stream.	• Non-certified emissions mean that offsets likely to have reduced credibility with investors and/or public, meaning fewer buyers, smaller market and less attractiveness to commercial project developers. • No guaranteed permanency – although this may be possibly through carbon rights provisions. • Lack of ownership of the offset (as opposed to carbon) likely to limit attractiveness to external investors and commercial project developers. • Model does not assure on-going management of carbon. • Projects do not necessarily align with NGERS – although carbon sequestration should be measureable with NGERs compliant methods.	• Measurement or estimation of carbon adds to understanding of the value of multi-benefit projects. • Projects able to leverage learnings from certified model, without being tied to its cost and regulatory structures. • Low carbon price may drive interest in projects which are able to provide other environmental or social benefits. • Develop long-term relationship with project investors, based on the multiple benefit stream rather than carbon or carbon offset "ownership". • Multi-benefit project enables the breaking of organisational and academic siloes between carbon and biodiversity. • Plays to CMA strengths, who may lack organisational capacity for formal projects. • Can apply recognised methodologies to measurement of carbon, independently of engaging in a formal certification process. • Essential Services Commission may allow for this kind of offset providing reporting and verification is adequate. • Social and cultural benefits may be included with ecosystem services analysis. • Use catchments data sets to inform state accounting for carbon (and non-carbon benefits). • Develop governance and assurance processes for flexible offsets project to integrate with State's ZNE pathways.	• Offset not formally recognised – although carbon ownership can be. • No regulatory framework to provide assurance of carbon offset. Limited recourse in case of project failure. • Project failures would undermine credibility of flexible offset concept. • Climate change impacts could pose challenges to the permanency of some green, brown and blue carbon options. • Changing legislative / regulation landscape. • Multi benefit verification is not a trivial or cost-free activity.

4. Stage 3: Appraisal of catchment carbon offset concepts

4.1 Overview

Stage 3 of the CCOT included a detailed appraisal of the catchment carbon offsets (CCO) concept. The appraisal was structured around the evaluation framework for the project (Figure 2.2) and explored:

- *Appropriateness:* of various types of carbon offset project, in terms of consistency with the characteristics of the catchment carbon offset (CCO) concept (as defined in the Stage 2 *Discussion Paper)* and the needs, objectives, policies and strategies of key stakeholder organisations. The appraisal also considered how well various types of project could satisfy National Carbon Offset Standard (NCOS) integrity requirements (Department of the Environment, 2015).

  This initial assessment of appropriateness was used to shortlist a set of offset project types which were most closely aligned with the agreed characteristics of the CCO concept. It considered flexible and certified carbon offset models[9], and project types or options which could provide green (vegetation) or blue (marine) carbon offsets.

- *Effectiveness:* which was assessed in terms of the input types required to plan and implement various kinds of carbon offset projects and the direct outputs of those activities. This assessment highlighted what would be required to implement short-listed CCO project types, including cost. It also assessed whether there were major differences in the efficiency with which project inputs were converted into outputs on the basis of offset model (certified or flexible) or project type.

- *Legacy:* which evaluated the potential carbon offset project legacies, in terms of the long-term carbon and non-carbon benefits which may accrue and the risks which may be posed over a project's life. Again, the assessment considered whether the offset model or short-listed option affected the potential project legacy.

The appraisal was used to inform the Stage 4 case study. A summary of the appraisal is provided in the following sections. Further details are provided in Appendix B.

4.2 Appropriateness of catchment carbon offset models and options

The Stage 2 CCOT *Discussion Paper* defined two main "models" for CCO projects: flexible and certified. It also described the characteristics of CCO projects (see Table 1.1) which were agreed with the CCOT steering committee and the broader group of project stakeholders.

The appropriateness appraisal (summarised in Table 4.1) largely comprised an evaluation of the alignment between potential carbon offset projects – under both certified and flexible models – to the key characteristics of the CCO.

The appraisal identified that only three main carbon offset options align closely with the CCO concept: new environmental plantings (EP), managed natural regeneration (NR) and marine blue carbon options involving tidal wetlands (TW). Uncertainty about legal frameworks for owning and generating marine blue carbon offsets would need to be resolved before they could be seriously considered as potential CCO projects.

Non-environmental plantings (NE) have limited alignment with the CCO concept and should not be considered *on their own* for use in a CCO project. However, as was identified in the case study, there are circumstances in which inclusion of non-environmental farm forestry plantings *with environmental plantings* can enhance the financial performance of a CCO project without unduly diminishing environmental and social co-benefits (see Section 5).

[9] The "flexible" model is characterised by projects in which the carbon sequestered (or emissions avoided) is estimated using credible methodologies, but there is no formal or certified offset generated and consequently potential for greater flexibility in project governance and implementation. Under the "certified" model, carbon sequestration or emissions avoidance resulting from catchment management projects is measured and verified in compliance with the NCOS or another applicable standard and the offsets are certified.

Table 4.1 : Catchment carbon offset appraisal: appropriateness of carbon offset options

Evaluation criteria	Certified carbon offsets			Flexible carbon offsets	
	New plantings & regeneration	Vegetation protection	Blue carbon – tidal wetlands	New plantings & regeneration	Vegetation protection
Project description	New plantings of woody vegetation on previously cleared land, managed natural regeneration of cleared land in close proximity to remnant vegetation. *Project types:* **EP** – new environmental plantings using locally indigenous native species. **NR** – managed natural regeneration. **NE** – non-environmental plantings using non-local natives or exotics.	Avoidance of clearing and permanent removal of native vegetation where there is valid pre-2010 permission to do so. *Project type:* **CA** – avoidance of clearing and permanent removal of native vegetation.	Creation, restoration and/or management of tidal wetlands (including mangroves), leading to sequestration of carbon. *N.B. there are currently no valid methodologies for generating certified freshwater/inland blue carbon offsets and hence these forms of blue carbon have not been considered.* *Project type:* **TW** – creation, restoration or management of tidal wetlands.	As per certified carbon offsets for new plantings and regeneration. *Project types:* **EP** – new environmental plantings. **NR** – managed natural regeneration. **NE** – non-environmental plantings.	Avoidance of clearing or harvesting of native vegetation where there is valid permission to do so. *Project types:* **CA** – avoidance of clearing and permanent removal of native vegetation. **HA** – avoidance of planned harvesting of native forests.
Appropriateness of type of carbon offset. This considers alignment with: • Key stakeholder needs (CMAs, WCs, DELWP). • CCO concept (as described in Table 1.1). • Relevant Victorian Government and CMA policies and strategies. • Offset integrity requirements. • Requirement for clear property rights.	**EP, NR:** clear alignment with CCO concept and all other appropriateness criteria. Offsets have high integrity and clear ownership. *Appropriate for inclusion in the CCOT case study and further appraisal.* **NE:** use of non-indigenous species weakens alignment with CCO concept and some other key appropriateness criteria. High integrity offsets with clear ownership. *Used alone, these options would not be appropriate for the CCOT case study or CCO projects.*	**CA:** aligns with key appropriateness criteria. However, the requirement for valid permission to clear greatly restricts the applicability of this type of offset in Victoria and hence its appropriateness for consideration in the CCOT case study. *Not appropriate for further consideration.*	**TW:** aligns well with stakeholder needs, policies and strategies, where they relate to coastal management. Marine blue carbon has some alignment with landholdings and interests of WCs in coastal areas. Legal frameworks for generating and owning carbon offsets are currently unclear and as a result, this option *is currently not considered to be appropriate for inclusion in the CCOT case study or other aspects of this appraisal.*	**EP, NR, NE:** largely as per certified new plantings and natural regeneration.	**CA:** as per certified vegetation protection assessment. **HA:** aligns with most key appropriateness criteria. However, avoidance of harvesting would only apply at scale in State forests. This option is inconsistent with State Government forest policy and (potentially) in conflict with obligations relating to harvesting in State forests. *Not appropriate for CCOT case study.*
				The use of flexible or uncertified offsets will be predicated on a design which satisfies some integrity requirements, particularly permanence, measurability and transparency.	

Both certified and flexible offset models were found to be appropriate for further consideration as catchment carbon offsets.

4.3 Effectiveness of catchment carbon offsets

The appraisal framework considered the effectiveness of carbon offset options in terms of their potential inputs and the outputs which they produce (Table 4.2). Effectiveness was only considered for the short-listed carbon offset options which align well with the CCO concept: environmental planting (EP) and managed natural regeneration (NR) projects operating under the certified and flexible models. The criteria and issues considered in the effectiveness appraisal will be subject to further analysis and discussion during the CCOT case study.

Table 4.2 : Appraisal criteria for assessing the effectiveness of carbon offset options.

Project inputs	Project outputs
Land: amount and key characteristics of land on which offsets project must be undertaken. *Cost:* the types of cost which may be incurred in establishing and operating the project. *Skills:* the types of skills which may be required to undertake the project through its life cycle. *Benefit measurement methods:* the methods and requirements for measuring carbon and non-carbon benefits of the project. *Investment/funding sources:* the types of investor this style of project may appeal to and who may co-invest for the non-carbon benefits which may accrue from it. *Stakeholder engagement:* the types of stakeholders who may need to be engaged in the project. *Governance:* the types of governance requirements to be considered for a collaborative and multi-benefit project of this nature.	*Project narrative:* the storyline about the project, particularly its benefits. If funding limits opportunities to measure non-carbon benefits, the storyline about the project may be how non-carbon legacies of the project are recorded. *On-ground works:* characteristics of the delivered offset project *Partnerships:* the types and intention of partnerships developed for the project, including the possibility of partnerships with Traditional Owner groups.

Table 4.4 notes the proposed minimum and maximum land requirements for EP and NR project types. These areas could be distributed across multiple landholdings and the carbon sequestration and other project legacies aggregated. Practical constraints (and cost) mean that projects at the lower end of the size spectrum should only be distributed across a small number of landholdings.

The effectiveness appraisal considered the areas in which cost may be incurred in designing and implementing a CCO project (Table 4.3). Most costs are inherent in the project or its requirement to align with the CCO concept. The appraisal found that inclusion of multiple environmental benefits and partnerships between CMAs and Water Corporations in the CCO concept appears to add to cost and complexity. Certification only adds incrementally to these.

While the additional inputs required of CCO projects may not materially alter the direct outputs, they should be more effective in providing a legacy of environmental benefit than projects solely concerned with maximising the efficiency of carbon offset generation. Environmental planting projects are likely to provide a richer storyline than natural regeneration projects, because they are likely to be larger and involve more obvious activity than managed natural regeneration.

Table 4.3 : Potential areas in which costs may be incurred in designing and implementing a catchment carbon offset project.

Potential areas of cost	Application to project type				Indicative cost range
	Certified		Flexible		
	EP	NR	EP	NR	
Land: depending on location and the nature of project partners' landholdings, land may be an in-kind contribution or need to be purchased or leased.	✓	✓	✓	✓	May range from $1,000 - $20,000/ha.
Project management – governance	✓	✓	✓	✓	Significant cost during project initiation, diminishing thereafter.
Establishment of carbon ownership rights	✓	✓	✓	✓	$1,000-$5,000 per project, depending on # landholdings.
Site establishment: fencing, ripping, sowing, weed and pest control, planting or seeding etc.	✓	✓	✓	✓	$1,000-$5,000/ha, with NR significantly lower than EP.
On-going site management and maintenance	✓	✓	✓	✓	$10-$20/ha/y.
Carbon sequestration measurement or modelling	✓	✓	✓	✓	$2,000-$10,000. Required each time offset is claimed.
Assessment of non-carbon benefits, capture of project storyline	✓	✓	✓	✓	$2,000-$10,000+, depending on benefit type and method.
Audit and verification, registration with and reporting to certification body	✓	✓			$2,000-$10,000, depending on project size and method.
Reporting of project benefits/legacy to partners and stakeholders	✓	✓	✓	✓	Small additional cost.
Payments to third party landholders (if land not purchased)	✓	✓	✓	✓	$10-20 /t CO_2e sequestered – potentially varying over time. Alternatively, the payment may be based on the foregone value of the previous (agricultural) land use.

4.4 Legacy of catchment carbon offsets

CCO projects have potential to create both favourable and unfavourable legacies. The third component of the evaluation considers the potential benefits and risks associated with EP and NR projects under both certified and flexible models (Table 4.5).

Project benefits result from the sequestration of carbon by the new vegetation established as part of the CCO project and any environmental, cultural, social and/or economic outcomes which result. The benefits achieved will reflect the design of the project, its location, the way in which it is implemented, as well as climate and other "environmental" influences through its life. While certification processes may influence how the carbon legacy is measured and reported, the actual amount of carbon sequestered by an EP or NR project is largely independent of whether it operates under a certified or flexible model.

Annual rates of carbon sequestration are likely to vary in Victoria between <5 t CO_2-e/ha in parts of the Mallee to as much as 25 t CO_2-e/ha or more in some higher rainfall regions. Sequestration from NR projects is projected to be 50-60% of that from EP projects (England *et al.*, 2006). Sequestration by some forms of NE planting may be much greater than is modelled for EP projects, particularly in higher rainfall areas.

Both EP and NR projects are capable of providing additional non-carbon benefits. While EP projects may provide greater benefit overall because of their likely greater size, NR projects in some settings may provide better biodiversity outcomes (Table 4.5).

Table 4.4 : Catchment carbon offset appraisal: effectiveness of carbon offset options

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offsets	Flexible offsets	Certified offsets	Flexible offsets
Project description	New woody vegetation from plantings on land which has previously been cleared, using locally indigenous native species		Managed natural regeneration of cleared land adjacent to or which includes (low density) remnant vegetation.	
Project inputs The appraisal considers these types of project input: • Land requirements • Costs likely to be incurred in project design and implementation • Skills required to design and implement the project • Benefit measurement methods • Investment or funding sources • Stakeholder engagement and participation • Governance requirements.	The types of project input are largely independent of whether the carbon offsets are certified or uncertified. With the exception of a few key types of cost and skill (mainly relating to offset audit, verification and reporting to the certifying authority), offset project inputs are characterised by the requirements of the CCO concept. Minimum (100 ha) and maximum (5000 ha depending on location) project sizes are proposed for EP (and other kinds of) CCO projects. These have been defined on the basis of scale efficiency and environmental impact (minimum size) and risks associated with water interception and perception of social impact (maximum size). Areas in which cost may be incurred, skill requirements and methods for assessing carbon and non-carbon benefits are discussed in the detailed appraisal. Estimated costs to establish CCO projects are provided for reference in Table 4.3. Certification adds complexity and cost to a carbon offset project. However, satisfying core attributes of CCO projects and measuring or demonstrating non-carbon environmental benefits also does this, independently of certification.		Most inputs to NR projects will be similar to those for EP projects. However, as they rely on natural regeneration rather than planting or direct seeding, the site establishment inputs and associated costs are likely to be lower. Opportunities for external participation (e.g. WC staff, Landcare or other volunteers) in the establishment of the project are also likely to less than for EP projects. As NR projects rely on proximity to existing native vegetation, it is likely that the area of land suited to this style of project will be less than for EP projects. As a result, the minimum land area requirement has been reduced to 25 ha for NR offset projects.	
Project outputs The main project outputs comprise: • Project narrative or storyline about the benefits • On-ground works • Partnerships.	Each form of output largely reflects the objectives and design of the EP project, rather than its certification status. Certification adds value in that it provides greater assurance of the carbon offset achieved and so strengthens the project narrative. The project narrative is likely to be stronger for EP than for NR projects, as the former are more deliberate and visible in their actions and the benefits are likely to accrue more rapidly. These types of offset projects will not be as reliant on proximity to existing vegetation as natural regeneration projects and therefore may be larger and achieve greater overall environmental benefit. The actual financial, environmental and social effects of the project are considered as part of the legacy.		As with EP projects, the outputs will largely reflect the objectives and design of the project. The project narrative is likely to be weaker for NR projects than EP projects as the works may be perceived as being somewhat passive and the results may take longer to emerge.	

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offsets	Flexible offsets	Certified offsets	Flexible offsets
Overall effectiveness of carbon offset option	The inclusion of multiple environmental benefits and partnerships between CMAs and WCs in the CCO concept adds to cost and complexity. While this may not materially alter the carbon benefit, the focus of CCO projects on non-carbon benefits should ensure a wider set of benefits, a richer storyline about the project and a greater level of effectiveness. EP projects are likely to be larger and achieve a greater level of benefit than NR projects.		The overall assessments for NR and EP projects are similar. NR projects may seem passive (relative to EP) in that they facilitate natural regeneration rather than create a new vegetation system. While this reduces input costs, storylines about such projects may be weaker and hence this style of project is likely to be less attractive to project partners and less effective.	

Table 4.5 : Catchment carbon offset appraisal: legacy of carbon offset options

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offsets	Flexible offsets	Certified offsets	Flexible offsets
Project description	New woody vegetation from plantings on land which has previously been cleared, using locally indigenous native species		Managed natural regeneration of cleared land adjacent to or which includes (low density) remnant vegetation.	
Project benefits The legacy benefits resulting from offset projects potentially include: • Carbon sequestration and emissions abatement • Non-carbon environmental, social and/or economic benefits.	Project legacies – both benefit and risk – are largely a function of the design and implementation of the project and are only marginally influenced by the certification process. CCO projects are designed and implemented to provide carbon and non-carbon environmental, social and/or economic benefits. Carbon sequestration is unlikely to be adversely affected by design for multiple benefits, although sequestration is likely to be less than for NE projects targeting only carbon sequestration. EP projects would be expected to provide a greater carbon offset legacy than NR projects, which reflects their more rapid growth and, potentially, larger size.		As with EP projects, the benefit legacies of NR projects will reflect their design and implementation and should also be broadly similar to those of EP projects. Overall benefits achieved by NR projects may be affected by their likely smaller size (relative to EP), slower development and reduced opportunities for volunteer or community input. NR projects may provide greater biodiversity value because of the presence of mature trees and if the land on which they are established retains key native understorey elements. River health, soil protection, climate resilience and other environmental legacies should be similar to similarly-sized EP projects, once the naturally regenerated stands are fully developed. Carbon sequestration from NR projects may be about 50-60% of those for EP projects.	

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offsets	Flexible offsets	Certified offsets	Flexible offsets
Project risks Offset projects may create legacy of risk for the environment, community and project partners. Types of risk may include: • Fire • Land use change inflexibility • Organisational risk for project partners • Pests • Population and demographics • Water interception.	As noted above, the legacy of risk which may be created by an EP project is largely inherent in the type of project and reflects the scale and location of implementation rather than the certification process. However, certification influences risk in several ways: • *Loss of carbon due to fire, drought and/or pests:* Commonwealth Emissions Reduction Fund offset calculation methods include a "risks of reversal" buffer in sequestration calculations and processes to manage offsets following loss events. Such measures may need to be designed in to flexible offsets to provide assurance if the level of offset available. • *Organisational risk:* which may be greater for certified than flexible offsets in some respects and less in other respects. Risks associated with changes in the regulatory framework are greater for certified than flexible offsets. However, risks arising from lack of assurance of the quantity of offsets available are reduced through the certification process. Management interventions can mitigate most of the risks. Designing the project to provide both carbon and other benefits may also help to mitigate some risks.		The legacy of risk for an NR project also reflects its design and implementation and will largely follow those described for EP projects. The likely smaller size of projects may mean that some risks (e.g. fire, land use inflexibility, water interception) are diminished. The effects of certification on project risk will also apply to NR projects. Most of the risks can be at least partly mitigated by good project design and execution.	
Overall legacy of carbon offset option	With good design and project execution, most risks associated with EP projects can be effectively mitigated. These projects have potential to provide a rich legacy of environmental benefit and carbon sequestration.		Benefits and risks associated with NR projects will likely be similar to EP projects. If they are well designed, NR projects should provide significant carbon and non-carbon benefits.	

The risk legacies which may be created by EP and NR projects are largely inherent in the type of project and its location. They will reflect project scale and the risk controls which have been incorporated into project design and delivery. Key areas of risk are listed in Table 4.5.

Some aspects of the certification process may help to mitigate project risks. Certification and the processes which sit behind it potentially provide greater assurance about the amount and permanence of the carbon offset and provide ways in which unforeseen carbon losses, such as through fire, may be managed or accounted for.

5. Stage 4: Catchment carbon offsets case study

5.1 Case study selection

Stage 4 of the CCOT took the form of a case study, which explored the "implementation pathway" for catchment carbon offset projects. The case study was intended to demonstrate how CCO projects could simultaneously deliver emissions reductions, climate resilience in landscapes, improved catchment health and better alignment between regional NRM plans and water sector emissions abatement.

The case study was intended to design a potential CCO project and assess various options for achieving the intended outcomes. The case study was also intended to develop a replicable process for other parties interested in designing, evaluating and potentially implementing a CCO project to follow.

Since there appeared to be significant interest among CMAs and Water Corporations in participating in the case study, an expression of interest (EOI) process was run to allow organisations to offer to participate and for those offers to be evaluated in a fair and transparent manner. Expressions of interest were submitted using the form included in Appendix C and evaluated against the criteria in Table 5.1.

Table 5.1 : Case study EOI evaluation criteria.

Evaluation criteria	
• Alignment of case study with CCOT objectives and CCO concepts (Table 1.1). • Applicability of case study to other regions and partnerships. • Breadth of stakeholder engagement and participation in the case study. • Ideas and innovation in case study concept.	• Level of engagement of the respective CMA and Water Corporation in the case study. • Pathway to implementation beyond the CCOT case study. • In-kind resources available to support case study1. • Anticipated benefits of participation in the case study.

Six expressions of interest were received from five different applicants. The selected case study was received from a consortium comprising Wannon Water, Corangamite CMA, Glenelg Hopkins CMA and Federation University.

5.2 Case study overview

The case study designed and evaluated several options for a potential catchment carbon offset project in the Gellibrand River catchment in south-west Victoria (Figure 5.1; Figure 5.2). The case study was designed to:

- Improve water quality in an important Wannon Water drinking water catchment (for Warrnambool and surrounding areas);
- Enhance river health in a key waterway and catchment area;
- Provide certified carbon offsets to at least satisfy Wannon Water's expected requirements;
- Build climate resilience within the catchment;
- Provide biodiversity and other environmental and social benefits relevant to Wannon Water and Corangamite CMA's objectives and strategies.

Figure 5.1 : Wannon Water's Otway South water offtake on the Gellibrand River. Livestock have unimpeded access to the river at this point.

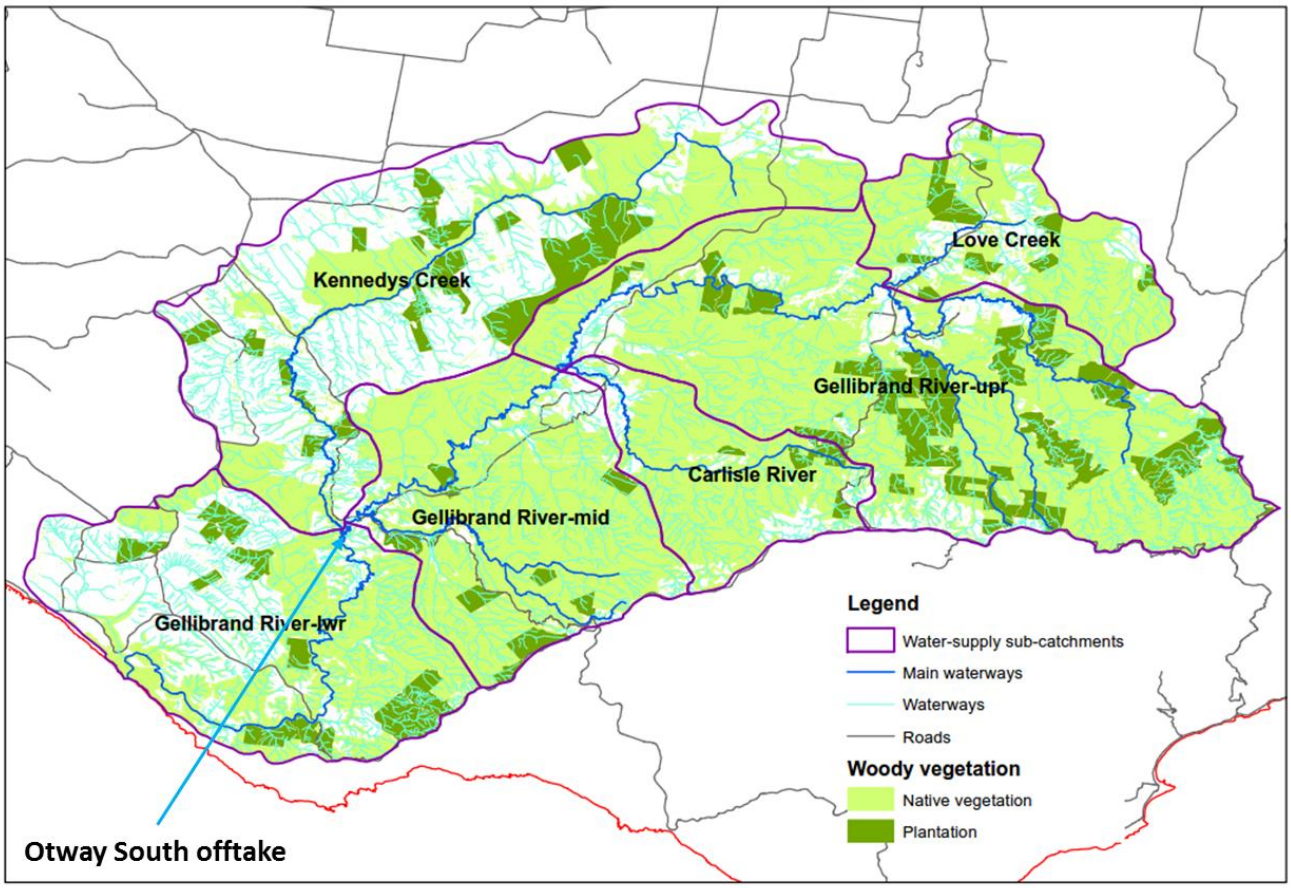


Figure 5.2 : The Gellibrand catchment. The case study considered the catchment upstream of the Otway South water offtake, which includes the mid and upper Gellibrand River, Carlisle River and Love Creek sub-catchments.

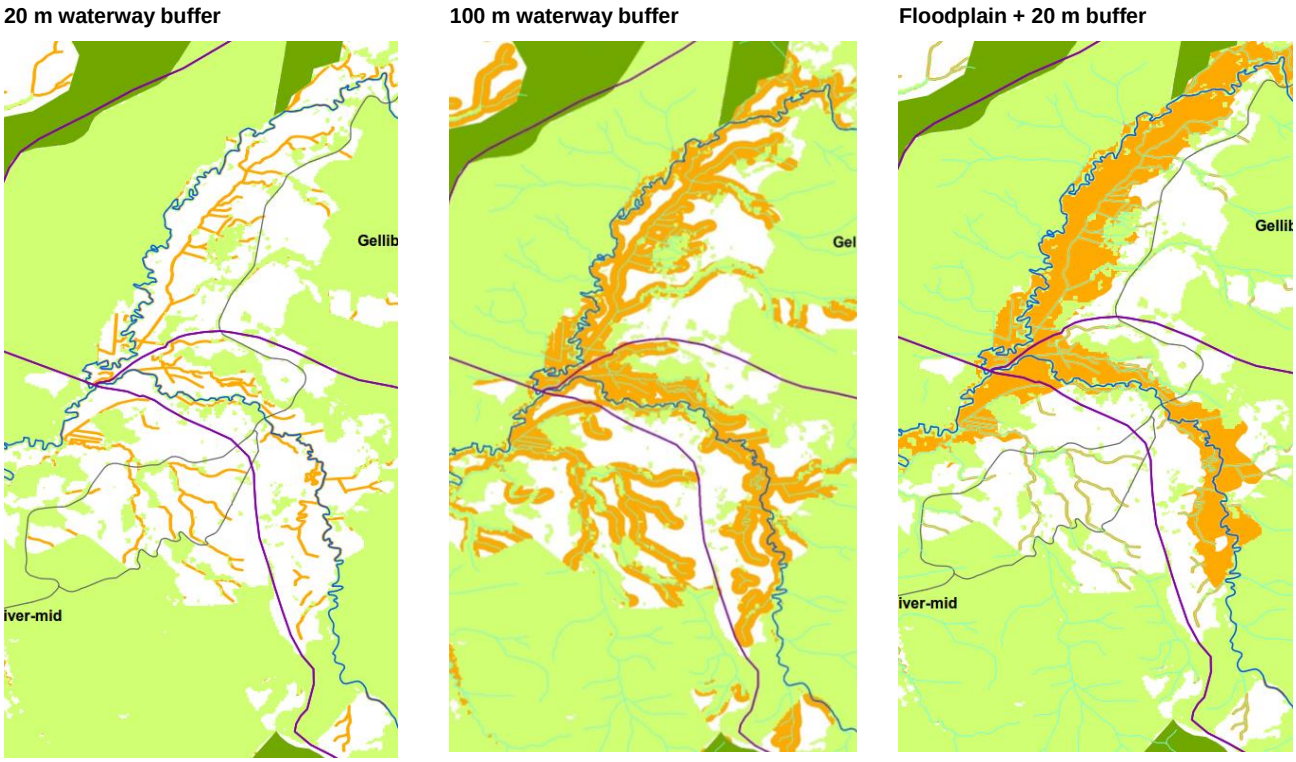
5.2.1 Catchment carbon offset options

The case study considered three main configurations for revegetation:

- *20 m waterway buffer:* 20 m revegetated buffer both sides of all defined waterways within the case study catchment[10]. This represents what is considered to be the minimum width of revegetated buffer to materially improve water quality in the main waterways and catchment.
- *100 m waterway buffer:* 100 m revegetated buffer both sides of all defined waterways within the case study catchment. This represents what is assumed to be the plausible upper limit of revegetation in the catchment.
- *Floodplain + 20 m buffer:* 20 m revegetated buffer both sides of all defined waterways, with further areas of revegetation occupying all of the floodplain for a 1% annual exceedance probability (AEP) flood event (or 100 y average recurrence interval flood).

In each configuration, the 20 m buffer either side of the waterway was assumed to be revegetated with locally indigenous species of trees and shrubs (*environmental plantings*; EP). In the 100 m waterway buffer and floodplain+20 m buffer configurations, the plantings outside the 20 m riparian buffer were either environmental plantings or farm forestry plantings (FF; assumed to be *Eucalyptus globulus*).

[10] The Gellibrand River catchment upstream of the Otway South offtake, near the junction of Kennedy's Creek and the Gellibrand River.



Note: Brown lines and areas mark the extent of revegetation under each of the configurations. The location of the waterway is shown for the 100 m waterway buffer and floodplain+20 m buffer configurations. The illustration shows the Gellibrand River floodplain at the junction between the Gellibrand and Carlisle Rivers and does not differentiate between environmental and farm forestry plantings in the 100 m and floodplain + 20 buffer configurations.

Figure 5.3 : Representations of the case study's main revegetation configurations.

Environmental plantings would remain unharvested through their life. The farm forestry plantings were assumed to harvested for pulpwood on a 15 year rotation and then replanted (within 18 months of harvest).

Managed natural regeneration was initially considered as an option for achieving the three main CCO configurations. This could be used as a means to establish riparian or floodplain buffers within about 50 m of existing native vegetation (with fencing, livestock exclusion and development of off-stream watering), with the latter providing the seed source. However, natural regeneration was not considered in the final CCO configurations due to several limitations on its practicability, including:

- *Competition from dairy pastures:* this would limit the likely success of natural regeneration or require that high levels of grass control would be maintained for several years to achieve adequate levels of recruitment;
- *Limited extent:* the limited extent of remnant vegetation patches in the target areas for the three main CCO configurations would mean that most of the plantings would need to be in the form of environmental or farm forest planting;
- *Carbon accounting:* areas of managed natural regeneration would need to be accounted separately to the environmental and farm forestry plantings under the methodologies for generating carbon offsets. This would increase transaction costs associated with claiming the carbon offsets (i.e. costs associated with monitoring, carbon stock modelling and measurement, reporting and verification)[11].

[11] Note that the managed natural regeneration methodology (under the Commonwealth Emissions Reduction Fund) has also been criticised for overstating the amount of carbon sequestered (Climate Change Authority 2017. *Review of the Emissions Reduction Fund*, http://climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/files/CFI%202017%20December/ERF%20Review%20Report.pdf, Section 3.4.1.

In evaluating the potential legacies of the CCO project, the case study considered two alternatives to the revegetation designs described in the previous section. These included:

- *Base case:* a "do nothing" option in which no new action would be taken to manage source water quality upstream of the Otway South offtake or to improve river health. Under this option, existing water treatment infrastructure would be used to satisfy health-based water quality targets. While this is a "base case" for evaluation purposes, because of the water quality risks, it is unlikely to be a realistic option for Wannon Water.
- *Engineered water quality treatment:* in this option, rather than treat the catchment source of water, ultra-violet (UV) treatment would be introduced at each of the five plants treating water from the Gellibrand River. This will allow Wannon Water's drinking water supplies to meet evolving health-based water quality targets and to treat growing levels of *Cryptosporidium* and *Giardia* in the source water – without treating the catchment.

5.2.2 Working group consultation

The case study included three full day workshops with a working groups representing Wannon Water and the two CMAs. Workshops were supported by out-of-session work by the consulting team from Jacobs. Content covered during each workshop and a description of supporting work is summarised in Table 5.2.

Table 5.2 : Case study format and program of activity

Workshop	Focus of agenda	Follow on work by consultant
1. Case study design – October 2017	• Building shared language and understanding about catchment carbon offsets concept • Case study scope and objectives • Case study context – issues, (conceptual) project area • Case study design • Work planning, including communications and stakeholder engagement • Governance and management arrangements • Tour of case study area	• Case study work plan • Project planning documentation – for certified and flexible options • Develop case study evaluation framework • Characterisation of the catchment carbon offset project (based on the catchment carbon offset appraisal).
2. Implementation pathway – December 2017	• Review of catchment carbon offsets concept • Conceptual design for the Gellibrand catchment carbon offsets project • Analysis of potential project legacies • Analysis of potential project costs • Governance options • Community and landholder engagement • Environmental Impact Bonds: a potential funding model for environmental works	• Further analysis to support documentation of implementation pathway • Case study reporting • First pass case study evaluation
3. Review and evaluation – February 2018	• Presentation and review of case study: ▪ Evaluation of the Gellibrand CCO project: financial, environmental, socio-economic and governance costs and benefits ▪ Lessons learned and key messages • Next steps for region and partners	• Finalisation of case study report • Incorporation of case study report into final project report

5.3 Case study findings

The design of the case study, the methods used to evaluate its effects and the results of those assessments are documented in a separate report (Jacobs, 2018). A summary of the case study findings is given below.

5.3.1 Assessment against the catchment carbon offset evaluation framework

The CCO options considered in the case study were assessed against the CCOT's evaluation framework (Figure 2.2; Table 4.1-Table 4.5). Key findings are as follows.

Appropriateness:

Appropriateness criteria included in the evaluation framework (Appendix B) consider alignment of a CCO option or project with:

- Key stakeholder needs;
- CCO concept principles (as per Table 1.1);
- Relevant Victorian Government and Corangamite CMA policies, strategies and objectives;
- NCOS offset integrity requirements;
- Requirement for clear property rights.

Each of the CCO options considered in the case study were found to be broadly appropriate, in terms of alignment with the CCO key characteristics (Table 1.1) and the environmental and social outcome requirements of the key project and case study stakeholders (Wannon Water, Corangamite CMA). The larger scale environmental plantings options (100 m waterway buffer, floodplain plantings) align better with environmental and some social objectives of these stakeholders than the 20 m waterway buffer option. However, as they are likely to displace farming operations, they may generate community resistance and be less consistent with stakeholders' objectives for building community partnerships.

All of the options would be implemented, evaluated and verified in accordance with Commonwealth Emissions Reduction Fund methodologies and would satisfy NCOS offset integrity requirements. Whether the revegetation was carried out on Crown water frontage or private land, property rights could be clearly established for the trees and the carbon they sequestered under the *Climate Change Act 2017*.

As highlighted in the case study, inclusion of farm forestry as an option in CCO projects adds a potential source of revenue and contributes to some aspects of a project's environmental legacy. This is particularly the case if (as in this case study) they were to be combined with environmental plantings along waterways. However, as discussed in the appraisal of CCO options (Section 4, Appendix B), farm forestry is generally less well-aligned with CCO principles (Table 1.1) or key stakeholder objectives or strategies, relative to environmental plantings.

Effectiveness:

Effectiveness criteria included in the evaluation framework (Appendix B) consider the relative inputs and outputs of a CCO option or project. A brief narrative in relation to each of the main effectiveness criteria is given below:

- *Inputs to a CCO project*
    - *Land:* the CCO concept (Appendix B) does not specify the types of land on which CCO projects would be undertaken. This will depend on the design objectives of each project. Based on the case study, the suggested minimum and maximum sizes of CCO projects was increased to provide greater confidence that projects could achieve material improvements in environmental condition and sufficient carbon credits over the project life.
    - *Cost:* costs for establishing and maintaining each of the CCO options were estimated in present value terms (Table 5.3).
    - *Skills:* the financial evaluation of the CCO options considered each of the main input skill requirements specified in Table B.4.
    - *Investment-funding sources:* it was anticipated that environmental plantings (and associated fencing and off-stream watering provision) would be funded by Wannon Water (if it was to proceed). Farm forestry plantings would likely be funded by landholders.
    - *Stakeholder engagement:* the case study did not engage beyond the key stakeholder group (of Wannon Water, Corangamite and Glenelg Hopkins CMAs). If the project was to go to detailed design

and then implementation, it would be essential to engage with other stakeholders, including landholders, Traditional Owners and DELWP.

- *Governance:* the project would be implemented under a memorandum of understanding between Wannon Water and Corangamite CMA, with Wannon Water owning sufficient carbon credits to satisfy their offset requirements.

- *Outputs:*
  - *Project narrative:* a narrative for the case study has been developed which reflects on its design objectives and outcomes (Box 1). The case study developed approaches to characterise and evaluate key aspects of the project narrative.
  - *On-ground works:* under the options considered in the case study, between 720 and almost 3,500 ha of new environmental and/or farm forestry planting would be established.
  - *Partnerships:* the case study helped to develop relationships between Wannon Water and Corangamite CMA. If the case study was to proceed to implementation, further relationships would need to be developed, for example with DELWP, Traditional Owners and catchment landholders.

The 20 m waterway buffer option – employing only environmental plantings – was assessed to be the most cost-effective of the CCO options considered in this case study. It is the least cost method of achieving or advancing the full suite of case study design objectives. It requires the least area of land, is likely to be the most attractive option for landholders and generally has similar or better environmental, socio-economic and governance legacies that other options. While it most likely provides reduced source water quality benefit compared with other options, it greater adoptability means that it is more certain of achieving the projected benefits than other CCO options.

Box 1: Gellibrand River Catchment Carbon Offset project narrative

Wannon Water and Corangamite CMA could collaborate to deliver a catchment carbon offsets project in the Gellibrand River catchment that would satisfy Wannon Water's carbon offset requirements, while improving water quality, building resilience in farming landscapes and improve river health and terrestrial and aquatic biodiversity.

The project partners would work with landholders and Traditional Owners to fence and revegetate a 20 m buffer along waterways in the Gellibrand catchment upstream of Wannon Water's Otway South offtake. The 20 m waterway buffer would be planted with locally indigenous native trees and shrubs. The plantings would occupy approximately 720 ha of land (depending on landholder uptake), which is less than 10% of the cleared farming land in the target area. Livestock would be excluded from the plantings and all waterways in the target area.

The plantings would sequester carbon and provide certified carbon offsets using a methodology which has been approved for use under the National Carbon Offset Standard. They would remain in place permanently.

Small tributaries of Gellibrand River. These would be revegetated with 20 m environmental plantings under the preferred CCO option from the case study.

As well as sequestering carbon, the plantings would provide habitat and migration corridors for the native fauna, help to connect fragmented patches of native vegetation, improve vegetation connectivity along waterways and provide better habitat for aquatic species. River health and biodiversity would be improved. Vegetation restoration and livestock removal would address several major drivers of deteriorating water quality in the catchment. This would help to improve the health of downstream reaches and the estuary of the Gellibrand River and may remove the need for Wannon Water to add to its engineered water quality treatment facilities.

The catchment carbon offset project would improve cultural and social values associated with waterways in the target area. Water yields may decline slightly with the establishment of the plantings. Bushfire risk may marginally increase. Overall dairy production should remain largely unaffected by the project, with stock accessing water via off-stream watering.

Inclusion of farm forestry with environmental plantings in waterway buffers increases the cost-effectiveness of the larger scale CCO options (100 m buffer, floodplain + 20 m buffer). The potential financial advantage offered by farm forestry was diminished in this case study because of the relatively high value of the land use it displaced.

Corangamite CMA is currently implementing a project with landholders in the Gellibrand River catchment which seeks similar water quality benefits to the case study (e.g. through improved management of dairy effluent ponds). Such work would complement a CCO project based on the designs developed for the case study.

Legacy:

Legacy criteria included in the evaluation framework (Appendix B) consider the relative benefits and costs or risks of a CCO option or project. A summary of the most legacy elements is given in the case study scorecard (Table 5.3). A brief narrative in relation to each of the main legacy criteria is given below:

- *CCO project benefits:*
  - *Carbon sequestration:* each of the CCO options was able, on average, to at least satisfy Wannon Water's expected carbon offset requirements. Sequestration would range between 7,800 and 40,000 t CO_2-e/y over the 50 year project life. All but the 20 m waterway buffer options were anticipated to result in up to 20,000 t CO_2-e/y in uncertified greenhouse emissions reduction.
  - *Non-carbon environmental, social and/or environmental benefits:* these are described in the CCO case study score card (Table 5.3) and include changes in river health, biodiversity, cultural and social value of the Gellibrand River, as well as the development of community and agency partnerships.
- *CCO project risks:*
  - *Bushfire:* bushfire risk in the Gellibrand River catchment was not considered likely to be materially affected by the CCO case study project, if it was implemented – due to the high level of existing native vegetation and plantation forestry cover.
  - *Land use change inflexibility and population and demographics:* these criteria were not considered in detail in the case study. It is clear that these potential legacies of a CCO project would be much greater for the 100 m waterway buffer and floodplain + 20 m buffer options than the preferred 20 m buffer option. The former would occupy up to 40% of agricultural land within the catchments, compared with less than 10% for the 20 m buffer option.
  - *Organisational risk:* this was assessed to be lower for the 20 m waterway buffer option, due to its smaller footprint on the landscape and much lower impact on agricultural production. Since the option was assessed to be more readily implemented than other CCO options it was considered to offer the lowest organisational risk.
  - *Pests:* the effect of the CCO options on weeds and pest animals was not considered in the case study.
  - *Water interception:* each of the CCO options would see new perennial vegetation established upstream of Wannon Water's Otway South offtake. This would be expected to reduce mean annual flows by between 0.4 and 2.7%. Flow reductions would be lowest for the 20 m waterway buffer option.

Inclusion of farm forestry plantings as part of the larger-scale CCO options reduced most aspects of their legacy, although this effect is diminished by the inclusion of 20 m waterway buffers.

Some aspects of the options' environmental and socio-economic legacies were constrained by the existing high level of vegetation cover within the case study area. Had the case study been conducted in an area with less intact waterways and native vegetation, the opportunity for improvement in river health and biodiversity may have been greater.

5.3.2 Case study scorecard

Results of the evaluation of case study options against financial, environmental, socio-economic and governance criteria are reproduced in a case study score card in Table 5.3. The score card lists certified carbon

offset potential of each CCO option (as per Section 5.2.1, Figure 5.3) as well as the performance against financial, environmental, socio-economic and governance criteria and metrics[12].

Table 5.3 : Case study option overall scorecard

Effect	Base case	Engineered WQ treatment	Riparian buffer			Floodplain + 20 m	
			20 m EP	100 EP	20 m EP + 80 m FF	EP	20 m EP + FP FF
Certified carbon							
Average yearly sequestration (tCO_2-e)	0	0	7,800	40,000	35,000	17,000	16,000
Financial							
Net present value	0	-$8.3M	-$4.4M	-$72M	-$43M	-$32M	-$25M
Environmental							
Non-certified GHG emissions abatement (t CO_2-e/y on average)	0	-460	0	20,000	21,000	8,900	9,100
Treatment of causes of water quality impairment	-ve	-ve	56%	90%	85%	80%	80%
Change in length of waterway with connected vegetation	-ve	-ve	13%	13%	13%	13%	13%
Additional area of connected terrestrial vegetation (ha)	0	0	356	391	391	356	356
Change in river flow regime (% mean annual flow)	0	0	-0.4%	-1.7%	-2.7%	-0.8%	-1.1%
Socio-economic[1]							
Waterway cultural values[2]	-1	-1	1	1	1	1	1
Waterway social values	-1	-1	3	2	1	2	1
Bushfire risk	0	0	0	0	-1	0	-1
Governance[1]							
Confidence in level of implementation	0	4	3	1	2	1	2
Development of community partnerships	0	0	3	3	2	3	2

Note:

1. Socio-economic and governance criteria were assessed on a scale ranging from -4 (very much worse than current base case) – 0 (current base case conditions) -+4 (very much better than current base case).
2. The cultural values assessment is preliminary only and based on the kinds of features which characteristically have higher cultural value. A full assessment would be undertaken with Traditional Owner representatives.

The overall assessment suggests that the 20 m waterway buffer option is the most cost-effective approach to achieving the case study design objectives. It could be implemented at lower cost than the engineered water treatment plant, provide significant water quality improvement with relatively high implementation confidence and provide a range of other complementary environmental and socio-economic benefits. It could also satisfy Wannon Water's certified offset requirements.

[12] Further details on the case study metrics are given in the case study report (Jacobs, 2018).

While the environmental benefit provided by the 20 m waterway buffer option is assessed to be lower than is the case for other CCO options, this is largely due to reduced effect on the causes of water quality impairment (relative to other options; Table 5.3). However, this option poses the lowest implementation risk of any of the CCO options and so it is more likely to achieve the estimated water quality effect than the other options. Its smaller footprint means that this option has lower costs – in terms of establishment, management and foregone value of agricultural production – and better socio-economic and governance legacies.

5.4 Case study conclusions

The case study designed and evaluated several options for a catchment carbon offset project in the Gellibrand catchment in south-west Victoria. The case study found that, at least in this catchment, a catchment carbon offset project provides a cost-effective option to generate certifiable carbon offsets to help a Water Corporation meet its Take2Pledge emissions reduction targets, while improving catchment water quality and providing other complementary environmental and social benefits. The case study demonstrated that the characteristics or design principles for catchment carbon offsets which were developed by this project's steering committee and a broader stakeholder group were appropriate and workable.

A replicable method for designing and evaluating potential catchment carbon offsets projects was developed (Appendix D). The process and tools – examples of which are described in Appendix E - could be applied to potential catchment carbon offsets projects in other settings and at different scales.

The case study found that configuration of the catchment carbon offset as a 40 m wide waterway buffer (20 m each side of the stream) was the most cost-effective option to provide the required carbon offsets and achieve the project's other design objectives, including water quality improvement. In other settings, different designs may be more appropriate and a catchment carbon offset project may be more or less cost-effective.

The case study also found that the concept of flexible offsets – those which are associated with measurable, but uncertified greenhouse gas abatement – has application in catchment carbon offset projects. With some project designs, it is possible to generate significant non-certifiable abatement that would contribute towards the achieving the State's net zero emissions target.

The flexible offset concept was applied in a different sense in the case study to how it was considered in the Stage 2 option appraisal. In the case study, flexible offsets were conceived as an additional rather than an alternative source of abatement to that available from certified offsets. Since Water Corporations' Statements of Obligations require any offsets to be certified, flexible offsets for environmental and farm forestry plantings were not considered. They were only considered for agricultural emissions abatement, reduced energy usage in water treatment and in circumstances where natural regeneration may be used to complement environmental plantings. Within the case study score card (Table 5.3), only avoided agricultural emissions were cited as flexible offsets.

A key feature of the catchment carbon offset concept is collaboration. This was an important feature in the design and execution of this case study and would be in the delivery of any project resulting from it.

5.5 Evaluation by case study working group

Members of the case study working group were invited to contribute to an evaluation of the case study. A summary of key learnings and their thoughts on the effectiveness of the approach to undertaking the case study are given in the case study report (Jacobs, 2018) and parts of Table 6.1.

6. Evaluation of the Catchment Carbon Offsets Trial

A series of key evaluation questions were developed for the CCOT during Stage 1 of the project (Table 2.2). Responses to these from the Jacobs consulting team, with applicable evidence is provided in Table 6.1.

Table 6.1 : Jacobs responses to key evaluation questions for the Catchment Carbon Offsets Trial.

Evaluation questions	Jacobs' preliminary response
Appropriateness	
1 Were the catchment carbon offset models and options considered in the trial relevant to the needs of CMAs and Water Corporations?	**Models:** Two offset models were developed: certified and flexible. The latter was characterised to explore offset opportunities outside the formal certification process. The case study highlighted opportunities for flexible offsets to be considered, namely: • Reduction in agricultural emissions resulting from the displacement of agricultural land uses; • Emissions reductions from reduced energy use in water treatment; • Sequestration associated with managed natural regeneration in instances where environmental plantings are not practicable. The evaluation framework devised for the case study considered both types of offset, with certified offsets included in the financial analysis (based on the current or assumed value of carbon) and flexible offsets included as environmental performance measure, which adds to the narrative about the project. The appropriateness of the flexible model (and likely interest by WCs) is diminished by the requirement in the Water Corporation Statements of Obligation to require any offsets to be certifiable to NCOS standards. Given this, flexible offsets may form part of a project's narrative, but no more. **Options:** These are the various methodologies by which carbon sequestration may calculated in compliance with the NCOS and by projects that are consistent with CCO key characteristics. Only green and blue carbon offsets are considered to conform with the CCO characteristics and blue carbon options are not yet developed to the point of use in Australia. Several green carbon options are potentially applicable to CCO-type projects in Victoria, those involving: • Environmental plantings – established by seedlings, direct seeding or natural regeneration • Unharvested non-environmental plantings – potentially of fast-growing non-native eucalypt species • Harvested non-environmental plantings -farm forestry options, such as Blue Gum plantations These have been explored in the case study and are all potentially applicable, at least as part of a CCO project. Non-environmental plantings *on their own* would not sufficiently conform to CCO principles to be considered as a valid project. However, as indicated by the case study evaluation, they may be a useful complement to environmental plantings.
2 Were the stakeholder engagement processes (Stage 2 stakeholder workshop and Stage 4 Case study workshops and broader stakeholder workshop) appropriate for the objectives of the project and participating stakeholders?	**Stage 2** The stakeholder workshop identified strong support for the CCO concept among participants representing the Water Corporations and CMAs. Given uncertainty about the role of carbon offsets, this was encouraging and highlighted the potential value of the project. The workshop developed criteria defining the CCO concept; these have proven to be highly appropriate. Interest from participants in the project has been maintained since the workshop, suggesting that is was effective in building awareness of the idea, developing the concept and progressing something Water Corporations and CMAs were interested in. Five water sector partnerships were formed to express interest in undertaking a case study, which also indicates the level of interest in the CCOT and CCO concept. **Stage 4** Stage 4 engaged primarily with technical representatives from Corangamite CMA and Wannon Water, with some variation in representation. The process was critical is designing a case study which provided a really useful test of the CCO concept. From the project's perspective, the workshop has been critical in developing the learnings about the project. There were some unmet expectations from some

Evaluation questions	Jacobs' preliminary response
	stakeholders (e.g. having out of session "homework" and case study providing details on how to get offsets through the certification process), but participants generally participated effectively and were very interested. A second stakeholder workshop was held to report on the case study and discuss a way forward with the CCO concept. Again, stakeholder interest was strong, as was interest in follow up work on catchment carbon offsets. Information provided at the workshop was well-received and of interest to participants.
3 Were the key project deliverables (Stages 2-4) consistent with the needs of the project and the interests of the target audiences?	**Stage 2 Workshop report and CCO discussion paper:** The document provided a useful basis on which the detailed evaluation of CCO options and models was undertaken in Stage 3. The CCO principles developed in the stakeholder workshop and documented in this discussion paper provide a valuable point of reference in designing and evaluating CCO projects. The initial discussion paper underpinned some of the discussion in the Stage 2 workshop and was relevant to the target audiences. **Stage 3 Appraisal report:** While the report (in summary form) was circulated to the stakeholder group, it was mainly used internally by the consulting team in considering what models and options were appropriate to the CCO concept and should be considered in the case study. The report, particularly the detailed analysis, was useful in designing the case study and its evaluation framework. The reports provide a useful point of reference but are unlikely to be widely used by stakeholders. **Stage 4 Case study report and presentation:** Presentations on the case study have been well received by various stakeholder groups, including the case study working group, wider CCOT stakeholder group, the Victorian NRM climate change forum and the NRMs Australia Carbon Working Group (including the Carbon Market Institute, the Australian Climate Change Authority and offset project developers). The detail of design and depth and breadth of evaluation in the case study surprised (and pleased) most participants, including the consultants. The case study report and presentations demonstrate: • A replicable approach for designing and evaluating a CCO project; • That CCO projects – at least in some settings – are a cost effective method of achieving a variety of water quality, emissions abatement, environmental and social legacies; • That certifying carbon sequestered by vegetation in larger scale environmental projects can return more than it costs. The case study has demonstrated to stakeholders that CCO projects have potential to be relevant to their needs. Feedback from case study participants (Appendix F) included the following comment: • Case study deliverables met participants' needs as they were framed around the questions asked in the first workshop and the needs of the project partners. With more time, the trial and team of participants could build on the framework to allow a more tangible tool for use by an implementation team, leading to a web tool. **Project summary and legacy report:** This report provides a record of the process and legacy of the project. While the overall report may have limited value beyond the steering committee, it provides a useful reference for any further development of the CCO concept.
Effectiveness	
4 Were the stakeholder workshops (Stages 2 and 4) designed and facilitated in a way that provided good value to the project and participants? Did they	**Stakeholder group workshops:** Informal feedback from both workshops was positive. The willingness to participate in the second stakeholder workshop suggests that participants valued the experience of the first workshop (noting that while a similar group of organisations were represented in both workshops, there was considerable variation in personnel). Objectives of the two workshops are given in Table 2.1. • *Workshop 1:* was effective in informing about the CCO concept, testing the appetite for CCO

Evaluation questions	Jacobs' preliminary response
achieve their objectives?	projects and designing elements of the CCOT. While the workshop did not explicitly develop criteria for evaluating CCO models and options, the principles described in Table 1.1 ultimately formed a key part of the basis for that evaluation (particularly with respect to appropriateness). • *Workshop 2:* provided a detail presentation and discussion of the case study, including its learnings and outcomes. Facilitated discussion at the end of the workshop considered "where to next?" with the CCO concept. **Case study workshops:** Focus areas for the agenda for the three case study workshops are given in Table 5.2. An overview of the workshop outcomes is given below: • *Workshop 1 – Design:* the workshop spent a considerable time developing a common language around the CCO concept – which was important as most working group participants had not previously been exposed to the concept. With the field tour of the Gellibrand catchment, the case study provided sufficient information to develop a sound case study design which reflected the requirements of the key participants, Wannon Water and Corangamite CMA. While the agenda was overly ambitious and did not develop a work plan for the case study (as intended) it did set the case study up for success. • *Workshop 2 – Implementation pathway:* the introduction of new participants meant that significant time was spent reiterating details of the CCO concept. While this formed part of the agenda, it did slow progress. The consulting team demonstrated how the project design had been implemented and how key aspects of the project legacies and costs would be evaluated, but the overarching evaluation framework was lacking at that stage. The workshop included discussion about environmental improvement bonds, which are a potential financial mechanism for funding large-scale environmental works. While of general interest, Wannon Water reported that it had resources to implement a project of the scale anticipated by the case study. Discussion did not address governance and community engagement in detail. • *Workshop 3 – evaluation:* workshop participants were able to review and discuss the evaluation of the case study in detail. There was a good response to the information presented, although some participants struggled with the qualitative assessments. The workshop concluded with an evaluation of the case study (reported in Appendix F). Examples of comments from working group participants on the value they associated with the case study process is given below: • The workshops were very interesting and an example of excellent collaboration. Clear intent was set at the beginning of the process, defining the areas of interest for different stakeholders; framing the project around the key stakeholders. • We needed to have space for incorporating previous studies and supporting data (such as the catchment works and water quality data drawing on Brad Clingin's work). It was good to bring some of this previous work to a wider forum. • It does not seem that the period of time to complete the project could have been shortened in any way. The workshops moved through content well. Particularly enjoyed have the field trip component and the variety of locations for the workshops to ensure partner ownership in the process.
5 Has the project been delivered with the level of collaboration – with the steering committee and key stakeholders – sought?	The project has been delivered with a high degree of collaboration: • PSC: had representation and active input from DELWP catchment management and water and CMAs. The process may have been enhanced with some Water Corporation representation. • Case study: the case study attracted significant interest from Water Corporations and CMAs – sufficient to require an EOI process. The case study was conducted mainly with Wannon Water and Corangamite CMA. Input from Glenelg Hopkins was limited due to personnel changes. The case study developed from and appeared to enhance collaboration between the two main parties and may see a CCO project being delivered. While the case study did enhance collaboration between the main partner organisations (Wannon Water and Corangamite CMA), the case study working group considered that it would have been beneficial to include a wider group, including (potentially) DELWP, WestVic Dairy, landholders and Traditional Owners. • Stakeholder workshops: a large number of metropolitan and regional CMAs and Water Corporations

Evaluation questions	Jacobs' preliminary response
	were represented at the two stakeholder workshops. Interactions within the group were willing during the workshops.
6 Do they key project deliverables (Stages 2-4) provide accessible and useful information to the intended audiences?	See response to #3.
7 To what extent did the project accomplish its objectives and intended outcomes?	An assessment of the extent to which the CCOT project achieved the individual project objectives and intended outcomes is given below. **Objectives:** • Develop and pilot a framework that provides carbon offsets for Victorian Water Corporations and achieves climate change adaptation outcomes as identified by CMA Regional NRM Climate Change Adaptation Plans or Strategies: the CCOT has developed and piloted (in the case study) an effective framework by which Water Corporations and CMAs can collaborate in generating carbon offsets that also build landscape climate resilience and provide complementary environmental and socio-economic benefits. • Improve understanding of the opportunities for carbon offsetting at a regional scale: the Stage 3 option appraisal provides an overview of catchment carbon offset opportunities. The case study involved an at-scale project that could satisfy a Water Corporation's offset requirements while providing catchment-scale environmental benefits. • Increase alignment between regional NRM planning frameworks and water sector greenhouse gas emission mitigation actions arising from Water for Victoria: the CCOT has demonstrated that it is possible and (in some settings) cost-effective to implement CCO projects. In doing so, it potentially paves the way for CMAs and Water Corporations to deliver projects which align with NRM planning frameworks and Take2Pledge requirements. **Intended outcomes:** • Demonstrate how multi-benefit, integrated catchment management activities could produce certifiable carbon offsets: the case study and detailed option appraisal has demonstrated that there are several opportunities for generating certifiable offsets through the development of multi-benefit CCO projects. • Provide a process by which Water for Victoria goals for emissions reductions in the water sector could be progressed jointly with complementary goals for improved catchment condition and river health from that document and Our Catchments Our Future: the case study has provided a replicable process for designing and evaluating implementable CCO projects that would provide emissions reductions for water sector entities and advance environmental and catchment management policy objectives. • Enhance implementation of CMA Regional NRM Climate Change Adaptation Plans or Strategies: CCO projects have potential to assist in the implementation of CMA Regional NRM Climate Change Adaptation Plans. It is too early to comment on their effect on the actual implementation of these plans. • Build or strengthen partnerships and collaboration between CMAs and Water Corporations: the CCOT has achieved this through the cross-water sector stakeholder forums, the call for expressions of interest to participate in the case study and through the case study itself. The CCO concept, as defined by the CCOT, emphasises collaboration as a core attribute.
Efficiency	
8 Have the stakeholder workshops (Stages 2 and 4) appropriately valued participants' time by (e.g.) providing good information, getting the	The project has run five (almost) full day workshops with either the wider stakeholder group or the case study working group. The forums have all provided new information to participants, as well as opportunities for discussion and interaction. Workshops started and finished on time and, based on feedback provided, appeared to have valued participants' time. Stakeholder workshops have attracted a wide cross-section of water industry participants; CMAs, Water Corporations and relevant DELWP representatives. The key group not to have engaged strongly with

Evaluation questions	Jacobs' preliminary response
right people together and working through the process in a time efficient manner.	the project has been DELWP's climate adaptation "team".
9 Have steering committee meeting times been used effectively by the consultant and steering committee members.	The PSC has met at strategic points through the project and have been used to review key deliverables before finalisation or public release. Meeting agenda have been full, but managed effectively. PSC interactions have helped to ensure that the policy environment is supportive of CCO projects.
Cost-effectiveness	
10 Has the project provided appropriate value for the resources invested in it?	The total budget for the consultancy element of the project (including the second stakeholder workshop, which was a variation to the original contract) was approximately $87,000. This has been used to leverage significant in-kind inputs from case study and workshop participants (~70 person days: valued at >$50,000). The project has – as far as was reasonable – achieved its objectives and demonstrated that catchment carbon offsets will offer promise as a means of offsetting emissions and advancing CMA regional NRM programs and strategies. Details of the project have also been reported to the NRMs Australia Carbon Working Group, an Australian Water Association water industry forum on carbon neutrality and an Intelligent Water Networks conference. A paper on the case study may also be presented at the 2018 Australian Stream Management Conference. These have (or will) communicate the project to a wider audience and have leveraged additional time from the consultants, overall project manager and case study working group.
Impacts	
11 How has the project added to knowledge and understanding about the catchment carbon offsets concept with key stakeholders?	The project has defined the CCO concept for stakeholders. The CCOT has established the frame through which water sector stakeholders will view collaborative, multi-benefit carbon offset projects. The workshops and stakeholder engagement processes have emphasised the creation of a common language and concept about catchment carbon offsets.
Legacy	
12 What will form the main legacies of the project?	The main legacies of the CCOT are considered to include: • Establishing that CCO projects can be an appropriate means of generating carbon offsets, while simultaneously providing various environmental and social benefits. • A common vocabulary and conceptual framework for considering multi-benefit carbon offsets. • Collaborative interactions among water sector participants through the stakeholder workshops and case study. • Development of a replicable process for designing and evaluating CCO projects. • Development of information and tools to support the design, evaluation and implementation of CCO projects. Feedback from a case study participant on this point was: • The main legacy of the project is … *a coherent way forward for carbon sequestration implementation. Wannon Water and Corangamite CMA now have a blueprint to attract investment to achieve both carbon offset and NRM outcomes. The working relationship between the two agencies has been strengthened despite the outcomes of the project as well. It was good to see the different agencies working together and hopefully there's to be more of it.*

7. Conclusion and recommendations

The CCOT has developed and piloted (in the case study) an effective framework by which Water Corporations and CMAs can collaborate in generating carbon offsets that also build landscape climate resilience and provide complementary environmental and socio-economic benefits. The case study found that a project which could be practicably implemented was capable of satisfying a Water Corporation's offset requirements and provide catchment-scale environmental benefits.

By demonstrating that it is possible and (in some settings) cost-effective to implement CCO projects, the CCOT potentially paves the way for CMAs and Water Corporations to deliver projects which align NRM planning frameworks and net zero emissions requirements, as well as implement CMA Regional NRM Climate Change Adaptation Plans.

The CCOT has created an important legacy, which is considered to include:

- Establishing that CCO projects can be an appropriate means of generating carbon offsets, while simultaneously providing various environmental and social benefits;
- Creating a vocabulary and conceptual framework for considering multi-benefit carbon offsets;
- Collaborative interactions among water sector organisations through the stakeholder workshops and the case study.
- Development of a replicable process for designing and evaluating CCO projects, as well as supporting information and tools.

While the CCO project representing the case study could move to implementation, it is recommended that further work be done to prove the process and adapt the tools developed for the case study so that they are more generically applicable. This work would include the following:

- *Adaptation of the CCO project evaluation tools:* to make them more generically applicable to CCO projects. The main focus of this would be in adapting the financial analysis tool and project score card;
- *Additional collaborative water sector case studies:* these would be designed to evaluate the CCO concept for appropriateness and cost-effectiveness for other design requirements and landscape settings. These case studies would be undertaken and reported back to the stakeholder group gathered for the CCOT (and other interested parties);
- If the additional case studies provide further evidence of the appropriateness of the CCO concept, further work could be undertaken with CeRDI to develop and deliver web-based tools and information to support the wider implementation of CCO projects.

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- Wannon Water: Julie Rissman, Ian Bail, Brad Clingin, Ben Pohlner, Murray Dancey, Tim Harrold;
- Corangamite CMA: Chris Pitfield, Gene Gardiner, Amy Leith;
- Glenelg Hopkins CMA: Marty Gent, Jane Walker;
- CCOT Steering Committee and Goulburn Broken CMA: Kate Brunt.

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Appendix A. Methods for generating Australian Carbon Credit Units which align with the catchment carbon offset concept

There are a variety of methods by which carbon may be sequestered and/or emissions avoided by projects which align with the multi-benefit catchment carbon offset concept (Table A.1). The methods may be used to generate ACCUs in "formal" catchment carbon offset projects or to measure carbon sequestered or emissions avoided by "informal" projects.

Table A.1 : Methods for generation of ACCUs with potential application in catchment carbon offsets projects.

Sources: Jacobs (2016); Clean Energy Regulator. Opportunities for the land sector. http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector

Method	Potential alignment with catchment carbon offset concept
Agriculture sector	
Estimating sequestration of carbon in soil using default values. Soil carbon stores on agricultural land are increased as a result of specific management actions, potentially including: permanent conversion of cropland to pasture; retention of crop residues; increasing biomass yield through the use of fertiliser, lime and/or water.	Projects using this methodology will increase soil carbon stores and potentially improve other measures of soil health including soil acidity. They may lead to reduced overland flows, groundwater recharge and associated salinity, erosion and water quality issues.
Sequestering carbon in soils in grazing systems. Soil carbon stores on grazing lands are increased by activities that increase inputs of carbon to the soil and/or reduce losses of carbon from the soil. Activities may include conversion of cropland to permanent pasture, pasture renovation and changed grazing patterns.	Increased soil carbon may help to improve other measures of soil health. Together with improved pasture quality, these activities may reduce overland flows, groundwater recharge and associated salinity, erosion and water quality issues.
Vegetation management sector	
Avoided clearing of native regrowth. Projects avoid clearing of native forest regrowth which would otherwise have taken place. Land must have been cleared at least twice in the past and have been used for cropping or grazing after each clearing event before the forest regenerated. Clearing of the land must be legally permissible.	This method is most aligned with management of tropical and sub-tropical savannah woodlands and has limited to no applicability in Victoria. If a project was eligible, it could enhance vegetation cover and potentially improve connectivity and size of native vegetation patches in largely cleared landscapes. Avoided clearing may also lead to restoration of understory vegetation and improved habitat and biodiversity value.
Avoided deforestation 1.1. Projects will avoid emissions resulting from clearing of native forests (which would otherwise have occurred) and lead to continued sequestration of carbon in the retained forest. There must be consent for the native forest to be cleared and converted to cropland or grassland.	This method has limited application in Victoria and would only apply in the few areas of private native forest or woodland for which there is existing permission to clear. If a project was eligible, it would avoid clearance of native vegetation which would otherwise take place. This would maintain habitat and other biodiversity values associated with the area of native forest. The methodology does not account for any values associated with the native forest other than its carbon stocks.
Human-induced regeneration of a permanent even-aged native forest 1.1. Projects result in carbon being stored in native forest as a result of activities (e.g. stock exclusion, grazing management, feral management, ceasing mechanical or chemical control of regrowth) which result in regrowth of an even-aged native forest.	The method applies to land on which current management leads to the suppression of native forest regrowth. As such it is most aligned with management of tropical and sub-tropical savannah woodlands and is unlikely to have widespread applicability in Victoria. If a project was eligible, it could enhance vegetation cover and potentially improve connectivity and size of native vegetation patches in largely cleared landscapes. Regeneration may also lead to restoration of understory vegetation and improved habitat and biodiversity value.

Method	Potential alignment with catchment carbon offset concept
Measurement based methods for new farm forestry plantations. Projects must establish and maintain a tree planting which is either a permanent planting or will be harvested periodically in a farm forest setting (i.e. ≤100 ha/30% farm for land with ≥400 mm annual rainfall). Carbon is stored in the above and below ground biomass, soil and the litter layer. Land on which the project is undertaken must have previously been cleared and either fallow or used for cropping and/or grazing.	This method could apply to new permanent or harvested plantations on previously cleared land. The only requirement regarding species of planting is that they are able to grow to 2 m or more in height and achieve at least 20% canopy coverage. Such plantings could be undertaken in ways that enhance river health and biodiversity values. Plantings (particularly permanent plantings or locally Indigenous species) could be used to enhance vegetation connectivity and patch size, improve coverage along waterways, assist in erosion control and improve habitat values.
Native forest from managed regrowth. Carbon is stored in regrowth native forests established from *in situ* seed, lignotubers and the like. The project must be carried out on land that has previously been cleared, but has some regrowth (not to the extent of attaining "forest cover") which would be cleared in the absence of the project.	As with the avoided clearing and human-induced regeneration methods, this is more aligned with savannah woodlands than native forests in Victoria. However, it could (e.g.) apply to projects which facilitated natural regeneration in floodplain areas which currently support minimal tree cover. If a project was eligible, regeneration of native forest could enhance river health and biodiversity values resulting from increased extent and connectivity of native vegetation cover. Riparian regeneration could also lead to improved water quality.
Reforestation and afforestation 2.0. Projects store carbon in vegetation established on which has previously been cleared and fallowed or used for cropping and/or grazing.	This method would result in projects which are similar to new permanent plantings under the farm forestry plantation methodology (above). As with that method, the only requirement regarding species of planting is that they are able to grow to 2 m or more in height and achieve at least 20% canopy coverage. In some configurations, such plantings could provide additional environmental benefits.
Reforestation by environmental or mallee plantings – FullCAM. Projects store carbon in permanent plantings of locally native species or mallee eucalypts. Land must have previously been cleared of native vegetation and fallowed or used for cropping and/or grazing. Mallee plantings must be on land receiving ≤600 mm average annual rainfall.	This method creates similar projects to the Reforestation and afforestation method (above). For environmental plantings, species must be locally indigenous and (as with other project types) reach 2 m height and 20% canopy cover when mature. Mallee plantings could be used to protect land which is vulnerable to wind erosion in low rainfall areas. Permanent environmental plantings could complement a wider range of regional NRM priorities and provide multiple environmental benefits (as above).
Designated verified carbon standard projects. The method sets out rules for implementing and monitoring offsets projects that were previously validated under the Verified Carbon Standard (VCS) and implemented the approved VCS methodology VM0010— Methodology for improved forest management: Conversion from logged to protected forest. Such projects reduce emissions by avoiding harvesting that would have occurred in the project area in the absence of the project, and by sequestering carbon that would not otherwise have been sequestered had the harvesting taken place.	The VCS method results in projects which protect forests which would otherwise have been harvested from being harvested. Avoidance of harvest may protect habitat and other biodiversity values and, in some wet forest types, help to maintain long-term water yields.

Appendix B. Detailed appraisal of catchment carbon offset concepts

B.1 Overview

This appendix provides a detailed appraisal of potential options by which catchment carbon offsets may be implemented. This options appraisal shaped the final stage of the project, a case study of the catchment carbon offset concept. Specifically, it:

- Identifies offset project options which best align with the catchment carbon offset concept; and
- Develops the scope for issues which will be considered during the virtual trial of the concept.

This detailed appraisal is summarised in Section 4 of this report.

B.2 Carbon offset models

Consistent with the agreed characteristics of catchment carbon offsets (Table 1.1), there are considered to be two main "models" for carbon offset projects. Under the "certified" model, carbon sequestration or emissions avoidance resulting from catchment management projects is measured and verified in compliance with an applicable standard and the offsets are certified. The "flexible" model is characterised by projects in which the carbon sequestered (or emissions avoided) is estimated using credible methodologies, but there is no formal or certified offset generated and greater flexibility in project governance and implementation.

B.2.1 Certified offsets

Certified offsets are provided through processes that are consistent with the Australian Government's National Carbon Offset Standard (NCOS; Department of the Environment [DoE], 2015a). Carbon offset units which are applicable include:

- *Australian Carbon Credit Units (ACCUs):* which are issued by the Australian Clean Energy Regulator in accordance with the framework established by the *Carbon Credits (Carbon Farming Initiative) Act 2011* (CFI). ACCUs are most commonly issued for greenhouse gas abatement activities undertaken as part of the Australian Government's Emissions Reduction Fund (ERF), although they may be traded as offsets outside of that initiative. A variety of land sector methodologies can be used to accrue carbon offsets from vegetation management and agriculture.
- *Voluntary Emissions Reductions (VERs):* issued by the Gold Standard Foundation. These can be generated by land sector methodologies for agriculture and afforestation/reforestation. Unique among the offset frameworks, the Gold Standard explicitly requires projects to assess, measure and achieve social and environmental sustainability outcomes.
- *Verified Carbon Units (VCUs):* issued by the Verified Carbon Standard (VCS). Carbon offsets can be generated by land sector methodologies in agriculture, forestry and wetlands. At present it is the only NCOS-eligible source of methodologies for creation of "blue" (i.e. wetland or marine) carbon offsets.

Methods by which offsets may be generated for projects which are broadly consistent with the requirements of catchment carbon offsets are summarised in Appendix A and Table B.1.

The NCOS specifies eligibility requirements for offsets which it would certify. These are based on the integrity framework established by the *Carbon Credits (Carbon Farming Initiative) Act 2011* and include (DoE, 2015a):

- *Additional*: offset generating activities must result in emissions reductions which are unlikely to occur in the ordinary course of events, including due to any existing commitment or target publicly agreed by the entity responsible for issuing the units. Any emissions abatement must not be double counted.
- *Permanent*: emissions must be permanently reduced. Where offsets are based on sequestration activities, the carbon must not be released into the atmosphere for a period of 100 years. The offset is discounted where the sequestration period is less than 100 years.

- *Measurable*: methods used to quantify the emissions reductions or sequestration must be supported by clear and convincing evidence.
- *Transparent*: consumers and other interested stakeholders must have access to information about the offset project that generated the abatement, including the applied methodology and project monitoring arrangements.
- *Leakage avoidance*: the action generating the emissions reduction must not lead to increased emissions elsewhere which would otherwise nullify the abatement. The offset must be discounted if leakage takes place.
- *Independently audited*: the circumstances responsible for the generation of the unit must be verified by an independent, appropriately qualified third party and not found to be in contradiction with these integrity principles.
- *Registered*: the offset unit must be listed and tracked in a publicly transparent registry.

Victorian Water Corporations' *Statements of Obligations* (SoO) specified that any offsets with which they meet their emissions reductions targets must satisfy NCOS requirements.

NCOS integrity requirements are solely concerned with the quality of carbon offsets and do consider how or whether other environmental or social benefits may accrue.

B.2.2 Flexible offsets

The flexible offset model does not require that offsets are formally certified. While this means that not all of the NCOS integrity requirements must necessarily be met to align with the CCO concept, the offsets must at least be additional, permanent and measurable. Not certifying the offset conceptually allows some greater flexibility in project governance and implementation.

By their nature, flexible offset options are not necessarily defined by recognised carbon offset frameworks. However, the CCO requirement to generate credible and quantified emissions (Table 1.1) means that options will generally align with existing methodologies. This assessment (Table B.2) identifies a set of flexible offset options which may satisfy the requirements of the CCO concept, but without adding some of the more onerous integrity elements of the NCOS requirements. These definitions draw on the 'voluntary' schemes described in GBCMA (2016).

Water Corporations' SoO require offsets to be certifiable to NCOS integrity standards, which reduces opportunities to take advantage of any potential flexibility with this model of offset. However, flexible offsets may still form part of the benefit narrative for a CCO project and could contribute to State level reductions in greenhouse gas emissions – even if they were not able offset emissions by a Water Corporation.

B.3 Catchment carbon offset trial appraisal

A three-step process was developed for the appraisal of catchment carbon offsets (Section 4.1). This was designed to complement the CCOT's evaluation framework and considered:

- *Appropriateness*: options were assessed in terms of their consistency with the characteristics of the CCO concept and the needs, objectives, policies and strategies of key stakeholder organisations. This included an analysis of alignment with NCOS integrity requirements. Flexible and certified carbon offset models were considered. Only green and blue carbon options were assessed, as agricultural and soil carbon options were considered to be unlikely to provide sufficient non-carbon environmental benefit to align with the CCO concept. Details of this assessment are given in Table B.3.

  This initial assessment was used to shortlist a set of offset types which were most closely aligned with the agreed characteristics of the CCO concept and therefore most appropriate for more detailed consideration.
- *Effectiveness:* which was assessed in terms of the types of inputs required to plan and implement various kinds of carbon offset project (e.g. land area, cost, skills required) and the direct outputs of those activities (e.g. narrative about project benefits, on-ground works measures). The assessment only considered the

options which were short-listed in the appropriateness appraisal. Details of this assessment are given in Table B.4.

- *Legacy:* which evaluated the potential carbon offset project legacies, in terms of the long-term carbon and non-carbon benefits which may accrue and the risks (e.g. fire, water interception) which may be posed over a project's life. Again, the assessment considered whether the offset model or short-listed option affected the potential project legacy. Details of this assessment are given in Table B.5.

B.4 Appraisal results

The options listed in Table B.1 and Table B.2 were included in the appropriateness assessment, with the exception of the measurement based method for new farm forestry plantations, as this was deemed to be more applicable to private landholders than CMAs and their likely partners[13].

Following the first step in the appraisal, four options were deemed appropriate for further consideration. These were new environmental plantings and managed natural regeneration, each considered under both the certified and flexible models. Outcomes of the appraisal for each option considered is summarised in Table B.6. Strengths and weaknesses for certified and flexible options are typically similar. They are only differentiated where a strength or weakness is not applicable to both.

[13] Note that this option was included in the case study (as a farm forestry option) as a complement to environmental plantings. On their own, non-environmental farm forestry plantings are unlikely to adequately align with CCO principles (Table 1.1).

Table B.1 : Potential methods by which certified catchment carbon offset options may be generated

Name	Characteristics of projects	Sequestration or abatement calculation method	Consistency with CCO characteristics	Classification[1]	
				Carbon sequestered	Offset credit
Avoided Deforestation 1.1 (DoE, 2015b)	Protection of native forest that was to be cleared. This method applies to native forest which received government consent prior to 1 July 2010 to be cleared, for the purpose of converting the land to cropland or grassland for perpetuity. The crediting period is 15 years. Additional carbon credits can be generated through managing the forest in a manner that improves the carbon stock.	Carbon stocks are calculated using allometric equations and biomass survey, and compared to a calculated baseline (expected carbon stocks had the deforestation occurred). The offset must be monitored, reported on and audited as per the requirements under the CFI.	Method is credible and transparent. Carbon sink defined as 'new' in that creation of the offset is the only reason clearing has not occurred. Maintains existing non-carbon benefits, although methodology does not specifically require these be considered.	Green	ACCU, VCU
Human-induced regeneration of a permanent even-aged native forest 1.1 (DoE, 2016)	Facilitating native regeneration of cleared land. This method involves changing land management practices to allow the regeneration of a native forest. The area in question must have been clear of forest cover for at least 10 years, yet have the capacity to support a native forest. Native regeneration is to be allowed to occur through methods such as excluding livestock or stopping habitual clearing activities. Sequestration potential cannot be supplemented through seeding or tree planting.	Carbon stocks are modelled using the Full Carbon Accounting Model (FullCAM). The permanence obligation is for 25 or 100 years. The offset must be monitored, reported on and audited as per the requirements under the CFI.	Method is credible and transparent. Somewhat limited scalability, due to spatial constraints on factors that promote native regeneration; i.e. proximity to existing forest vegetation. Limited scope for partnerships.	Green	ACCU
Reforestation and Afforestation 2.0 (DoE, 2015c)	Establishment of a permanent forest on previously cleared land. For this method, seedlings/trees are planted and maintained on land that has been cleared (used for grazing, cropping, or in fallow) for at least 5 years. The mix and density of species is to be such that, when mature, the planting meets the standards of a forest: i.e. covering a minimum of 0.2 ha, with vegetation that includes trees that are at least 2 m in height and provide crown cover of at least 20%.	Carbon stocks are estimated through establishing and updating a forest inventory with use of sample plots and appropriate equations including allometric functions. The planting must be permanent, which under CFI legislation means it must be maintained for 100 years. The offset must be monitored, reported on and audited as per the requirements under the CFI.	Capacity to support CMA and Water Corporation (WC) objectives in C and non-C benefits. Method is credible and transparent. Projects are scalable and offer potential for partnerships, providing social and/or cultural benefits. Projects are easy to understand.	Green	ACCU, VER

Name	Characteristics of projects	Sequestration or abatement calculation method	Consistency with CCO characteristics	Classification[1]	
				Carbon sequestered	Offset credit
Reforestation by Environmental or Mallee Plantings – FullCAM (DoE, 2015d).	This method establishes plantings of local tree or mallee species on land that has been cleared and is used for grazing or cropping or is in fallow for at least the previous 5 years, in an area for which FullCAM data exists. The mix and density of species is to be such that, when mature, the planting meets the standards of a native forest: i.e. covering a minimum of 0.2 ha, with vegetation that includes trees that are at least 2 m in height and provide crown cover of at least 20%. Plantings of mallee species are restricted to areas where the annual rainfall is less than 600 mm.	Carbon stocks are estimated using FullCAM. The permanence obligation is for 25 or 100 years. The offset must be monitored, reported on and audited as per the requirements under the CFI.	Permanent environmental plantings offer similar project benefits as the Reforestation and Afforestation option. Mallee plantings are not considered to be 'environmental plantings' (outside the natural range of the species used), and their biodiversity co-benefits are more limited. However, they can be used to protect land which is vulnerable to wind erosion in lower rainfall areas.	Green	ACCU, VER
Tidal Wetland and Seagrass Restoration (VCS, 2015)	This method recognises the creation, restoration and management of tidal wetlands through managing any of the following, including combinations thereof: • Hydrological conditions; • Sediment supply; • Salinity; • Water quality; and • Native plants. This method can be applied to all tidal wetland systems, including tidal forests (mangroves), seagrass meadows, and tidal marshes. It is important to note that tidal ecosystems are at threat due to sea level rise. The methodology stipulates how to plan for and calculate the offset in the case of its loss due to sea level rise. This includes accounting for carbon stored in wood products made from harvested mangroves prior to dieback.	Carbon offsets are calculated in comparison to a project baseline. Carbon in tree and shrub biomass is calculated using the CDM tool *AR-Tool14 Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities*. The methodology also provides equations to calculate carbon stored in herbaceous vegetation, soil, and sediment. Accumulations of and emissions from soil organic carbon are factored in, to be estimated using methods such as proxies, modelling, default factors, local published values etc. Methane and nitrate emissions are included in the assessment. The offset must be monitored according to the methodology. Under the VCS, projects require assessment prior to certification, and are audited.	Good alignment with characteristics regarding biodiversity, water quality, social and cultural outcomes. Credible and transparent. Potential for partnerships and easy communication of project goals. No applicability to non-coastal CMAs. Carbon sequestered may not be considered permanent, as these systems are susceptible to increased storm surge and sea level rise under climate change. No stated length of time to be considered 'permanent' under the methodology, but projected sea level rise and coastal retreat will need to be considered in project planning.	Blue	VCU

Name	Characteristics of projects	Sequestration or abatement calculation method	Consistency with CCO characteristics	Classification[1]	
				Carbon sequestered	Offset credit
Measurement based method for new farm forestry plantations (DoE, 2014)	This method applies to establishment and maintenance of tree plantings, either permanent or which will be harvested periodically. Land must have been previously cleared and either fallow or used for cropping/grazing. There are limits on the areas used for this method depending on average annual rainfall.	Carbon is estimated using a forest inventory. If harvesting occurs, FullCAM is used to incorporate this into the calculations of the long-term average carbon stored. The permanence obligation is for 25 or 100 years. The offset must be monitored, reported on and audited as per the requirements under the CFI.	Alignment is closest for permanent plantations of native species. Biodiversity and other co-benefits more limited if harvesting occurs. However, the additional source of income from harvesting may make this option more attractive to some landholders, and make more land available for offsets.	Green	ACCU, VER

Note:

1. Classification of the carbon offset generated using the particular method. Carbon sequestered: green (vegetation) or blue (marine systems); Offset credit issued: ACCU, Verified Emissions Reduction (VER), Voluntary Carbon Unit (VCU).

Table B.2 : Potential methods by which flexible catchment carbon offset options may be generated.

Name	Characteristics of projects	Sequestration calculation options	Consistency with CCO characteristics	Alignment with NCOS principles					
				Additional	Permanent	Measurable	Transparent	Avoids leakage	Audited
Avoided deforestation or harvesting	Protection of native forest that was to be harvested or cleared. This option could apply to any parcel of native forest which is intended to be cleared, and holds the appropriate approvals. The forest would accrue carbon credits for as long as it is maintained, without the set permanency requirements of the certified option. The main large-scale opportunity would be in avoiding harvesting in State forest areas.	Allometric relationships Biomass survey FullCAM Other as defined by proponent	Carbon abatement not inherently credible or transparent unless an approved method is followed. Extent of new carbon sequestration depends on maturity of vegetation community which is protected. Potential to maintain or improve environmental outcomes from land management.	Not inherently – must be specified in project design	Not inherently – must be specified in project design	✓ Appropriate measures are widely available and accepted	Not inherently – must be specified in project design	Not inherently – must be specified in project design	Not inherently – must be specified in project design

Name	Characteristics of projects	Sequestration calculation options	Consistency with CCO characteristics	Alignment with NCOS principles					
				Additional	Permanent	Measurable	Transparent	Avoids leakage	Audited
Human-induced regeneration	This option is to facilitate the natural regeneration of native forest, through methods such as excluding livestock or stopping habitual clearing activities, not through seeding or tree planting. Cleared areas on the boundaries of existing forests as well as areas with low density tree cover are likely to be the most effective, as these provide a source for seeds.	FullCAM Allometric relationships Biomass survey Other as defined by proponent	Carbon abatement not inherently credible or transparent unless an approved method is followed. Significant potential to improve environmental outcomes from land management.	Not inherently – must be specified in project design	Not inherently – must be specified in project design	✓ Appropriate measures are widely available and accepted	Not inherently – must be specified in project design	Not inherently – must be specified in project design	Not inherently – must be specified in project design
Environmental planting	Seeding or planting to establish or re-establish a forest or woodland. Species and planting density are chosen to support biodiversity or other environmental co-benefit, such as water quality.	Allometric relationships Biomass survey Forest inventory Other as defined by proponent	Carbon abatement not inherently credible or transparent unless an approved method is followed. Significant potential to improve environmental outcomes from land management.	Not inherently – must be specified in project design	Not inherently – must be specified in project design	✓ Appropriate measures are widely available and accepted	Not inherently – must be specified in project design	Not inherently – must be specified in project design	Not inherently – must be specified in project design
Non-environmental planting, including mallee belt and block plantings (outside their natural range)	Storage of carbon in woody biomass. This option involves plantations of species that are not local to a region and may include non-local natives or exotics. Species selection may enable greater rates of carbon sequestration than would be the case for local natives. This option may allow harvest.	FullCAM Allometric relationships Biomass survey Other as defined by proponent.	Carbon abatement not inherently credible or transparent unless an approved method is followed. While some non-carbon environmental benefits may accrue, this option may pose greater environmental risk (e.g. to water yields, biodiversity).	Not inherently – must be specified in project design	Not inherently – must be specified in planning project. If option allows harvest, the effects of this on carbon stocks would need to be accounted.	✓ Appropriate measures are widely available and accepted	Not inherently – must be specified in project design	Not inherently – must be specified in project design	Not inherently – must be specified in project design

Name	Characteristics of projects	Sequestration calculation options	Consistency with CCO characteristics	Alignment with NCOS principles					
				Additional	Permanent	Measurable	Transparent	Avoids leakage	Audited
Freshwater wetland restoration	Restore wetlands (freshwater and marine). The large extent of degraded wetlands across Victoria means that their restoration presents a significant opportunity in storing blue carbon. However, research into freshwater blue carbon is still building sufficient data to allow robust estimation of carbon sequestration (Dr P Carnell, pers. comm.). Until there is more information available, including methods of estimating greenhouse gas emissions from these ecosystems, it is unlikely that freshwater blue carbon can be part of the offsets trial at this time. Restoration of marine wetlands as per the certified options.	Biomass survey As defined by VCS, 2015 Other as defined by proponent.	Carbon abatement may not be credible for freshwater projects as evidence base for methodologies is still under development. Significant potential to improve environmental outcomes from land management.	Not inherently – must be specified in project design	Some marine wetlands vulnerable to sea level rise and storm surge. Permanency of carbon in freshwater wetlands may be more readily managed.	✓ Marine systems: appropriate measures are available and accepted × Freshwater systems: Measures still under development	Not inherently – must be specified in project design	Not inherently – must be specified in project design	Not inherently – must be specified in project design

Table B.3 : Catchment carbon offset appraisal: appropriateness of carbon offset options.

Evaluation criteria	Notes	Certified green carbon offsets		Certified blue carbon offsets	Flexible green carbon offsets	
		New plantings and regeneration	Vegetation protection		New plantings and regeneration	Vegetation protection
Description:		New plantings of woody vegetation on previously cleared land, managed natural regeneration of cleared land adjacent to or which includes (low density) remnant vegetation. New plantings may be locally indigenous native species (environmental plantings), non-local natives or non-native species.	Avoidance of clearing and permanent removal of native vegetation where there is valid pre-2010 permission to do so.	Creation, restoration and/or management of tidal wetlands (including mangroves), leading to sequestration of carbon. *N.B. there are currently no valid methodologies for generating certified freshwater/inland blue carbon offsets and hence these forms of blue carbon have not been considered.*	As per certified carbon offsets for new plantings and regeneration.	Avoidance of clearing and permanent removal of native vegetation where there is valid permission to do so. Avoidance of the planned harvesting of native forests or existing plantations and eliminating the need for regeneration.
Alignment with stakeholder needs		CMA: potential alignment with biodiversity, climate resilience, soil health, river health and water quality programs and need for projects which restore tree cover into landscapes. May contribute to community engagement objectives. WC: potential alignment with projects to protect source water quality, improve amenity and environmental values associated with water storages and offset emissions. May contribute to community engagement objectives. DELWP: potential alignment with policy objectives and programs for biodiversity, catchments, climate change mitigation and adaptation and water.	CMA: protection of remnant vegetation *per se* aligns with biodiversity and river health programs and objectives, however vegetation protection offset projects are largely irrelevant to programs due to limited existence of (pre-2010) permits to clear among CMA community stakeholders. WC: protection of remnant vegetation *per se* aligns with environmental obligations, however it is unlikely that WCs will hold permits to clear which would enable certification of this type of project. DELWP: projects potentially provide DELWP with a mechanism to recapture any remaining permits to clear private land with high biodiversity values.	CMA: potential alignment with coastal CMA coastal and marine programs, particularly for restoration of degraded coastal environments. WC: marginal alignment with WC needs, except where they have ocean outfalls or manage coastal wetlands. DELWP: potential alignment with coastal management objectives, including building resilience to sea level rise and coastal recession. Potentially aligned with climate change mitigation programs. Coastal Boards: similar to DELWP.	As per certified carbon offsets.	CMA: as per certified carbon offsets for avoidance of clearing. Avoidance of harvesting of native forests and plantations could align with CMA biodiversity and river health objectives. WC: as per certified carbon offsets for avoidance of clearing. Avoidance of harvesting of native forests and plantations on WC or other land align with source water protection and water yield objectives. If on WC-owned land, could align with emissions reduction obligations. Potential harvesting avoidance projects would only have direct application to a limited number of WCs. DELWP: as per certified carbon offsets for avoidance of clearing. Avoidance of harvesting potential aligns with objectives and programs for biodiversity and climate change mitigation.
	Qualifications to alignment	Contribution to biodiversity and river health objectives limited to mixed plantings with locally indigenous species.	Methodology is based on carbon stocks and does not specifically consider biodiversity value of retained habitat.	Satisfying coastal management objectives may be subject to the provision of space for the coastal wetland to retreat with sea level rise and any coastal recession. Contribution to DELWP/Victorian government climate mitigation objectives may be subject to permanence of sequestration, given sea level rise and coastal retreat and national carbon accounting framework considering carbon stocks in these ecosystems.	As per certified carbon offsets.	As per certified carbon offsets.
	Areas of potential misalignment	If option is taken up at large scale (c.f. Blue Gum plantations in SW Victoria), communities are likely to be concerned about land use, population and demographic change, fire hazard etc. New plantings (at scale) in higher rainfall areas (even environmental plantings) could reduce catchment yields, which would be inconsistent with CMA, WC and DELWP objectives. Non-environmental plantings have potential to detract from biodiversity outcomes.			As per certified carbon offsets.	Main at scale opportunity would be in avoiding harvesting in State forest areas. These areas are subject to an allocation order to VicForests and a Regional Forest Agreement. Under current arrangements, it is unlikely this opportunity could proceed.

Evaluation criteria	Notes	Certified green carbon offsets		Certified blue carbon offsets	Flexible green carbon offsets	
		New plantings and regeneration	Vegetation protection		New plantings and regeneration	Vegetation protection
Project objectives: link to catchment carbon offset concept objectives. *Rating:* ++ type of project and offset consistent with objective and has potential to make meaningful contribution to its achievement + type of project and offset consistent with objective, but cannot be undertaken at a scale which meaningfully addresses it 0 objective not relevant to project and offset type - type of project and offset inconsistent with or would detract from objective	Biodiversity protection & enhancement: improve the condition, connectivity and extent of native vegetation, improve habitat condition for native species.	++ Environmental plantings: can supplement extent and connectivity of native vegetation habitats and increase native vegetation cover. Intended outcomes accrue over decades. ++ Regeneration: can supplement extent and connectivity of habitats and increase native vegetation cover. Extent likely limited by land availability. May allow recruitment of understorey species if remnants or seed are present. Intended outcomes accrue over decades. - Non-environmental plantings: minimal biodiversity benefit and may lead to genetic contamination and environmental weeds.	+ Avoidance of clearing: if remnant has high biodiversity value, this may be maintained. Limited applicability to land in Victoria.	++ Tidal wetland creation/restoration: could supplement extent and connectivity of coastal habitat and biodiversity. Intended outcomes accrue over decades. Scale of potential application uncertain, but likely considerable in coastal areas.	As per certified carbon offsets.	+ Clearing avoidance: as per certified carbon offsets. ++ Harvesting avoidance: potential benefit for species requiring mature habitat. With extensive area of State forest available for harvest, there is at scale opportunity for biodiversity enhancement –although adoption unlikely under current policy.
	Carbon sequestration: increase landscape carbon stores, offset organisational greenhouse gas emissions.	++ Environmental and non-environmental plantings: rate of sequestration will vary with climate and soils. Potentially applicable to large areas of land, hence high sequestration potential. + Regeneration: amount of sequestration likely limited by availability of suitable land.	+ Avoidance of clearing: retains landscape carbon store that might otherwise be lost. Limited new carbon stores.	++ Tidal wetland creation/restoration: high potential for carbon sequestration. Scale of potential application uncertain, but likely considerable in coastal areas.	As per certified carbon offsets.	+ Clearing avoidance: as per certified carbon offsets. ++ Harvesting avoidance: would lead to retention and further development of carbon stocks. Significant area potentially available, although adoption unlikely under current policy.
	Climate resilience: improve habitat condition and connectivity across landscapes to enable movement of species with changing climate. Improve resilience of soils, waterways and wetlands.	++ Environmental plantings and regeneration: potential to significantly improve habitat connectivity. Improves soil cover and protection for waterways (depending on location). Likely to improve landscape climate resilience. + Non-environmental plantings: may assist in protecting core habitat, but offer limited additional value. Long-term, climate adapted non-indigenous natives may be required to replace any highly climate sensitive native species.	+ Avoidance of clearing: beneficial for climate resilience, but limited applicability means that it has no value at landscape scale.	++ Tidal wetland creation/restoration: with appropriate design and location, may enhance resilience to coastal recession. However, in the very long term, the value may be limited without capacity to retreat landwards as seas rise.	As per certified carbon offsets.	+ Clearing avoidance: as per certified carbon offsets. + Harvesting avoidance: most State forest areas to which this option is applicable are relatively resilient because of large habitat patch size and landscape connectivity. Key challenges relate to fire and climate change, which are unlikely to be (beneficially) affected by harvesting avoidance project.
	Coastal environment and habitat protection: improve the condition, connectivity and extent of coastal habitat. Strengthen habitat resilience for sea level rise and any coastal retreat. Facilitate landwards migration of coastal habitat.	+ Environmental and non-environmental plantings, regeneration: potential to influence sediment and nutrient delivery to estuaries and near shore environments. Scale of application in coastal areas likely to be limited.	0 Avoidance of clearing: unlikely to be relevant to coastal environments.	++ Tidal wetland creation/restoration: as per climate resilience and biodiversity protection. This is a key objective of this type of project.	As per certified carbon offsets.	0 Clearing and harvesting avoidance: unlikely to be relevant to coastal environments.
	Cultural values: protect and enhance landscape features and processes with high Indigenous cultural value.	++ Environmental plantings and regeneration: potential to protect and enhance cultural values associated with native vegetation and waterways, particularly. 0 Non-environmental plantings: unlikely to enhance cultural values. Potential for adverse effect.	+ Avoidance of clearing: potential to protect any existing cultural values. Overall benefit limited by general inapplicability of offset type.	++ Tidal wetland creation/restoration: potential improve cultural values associated with coastal wetlands.	As per certified carbon offsets.	+ Clearing avoidance: as per certified carbon offsets. 0 Harvesting avoidance: known cultural values are generally protected by harvesting regulations.
	Recreation and amenity: maintain or improve landscape values and recreational uses of waterways, wetlands and remnant native vegetation.	++ Environmental plantings and regeneration: potential to improve recreation and amenity values over time, particularly where fragmented vegetation (including along waterways) is reconnected. 0 Non-environmental plantings: level of benefit will vary with individual perceptions. In some cases, these may improve amenity and in some other cases or for some users, they may detract from amenity.	+ Avoidance of clearing: small potential benefit, depending on location. Overall benefit limited by general inapplicability of offset type.	++ Tidal wetland creation/restoration: improve landscape amenity and may add value to recreational fisheries by improving habitat.	As per certified carbon offsets.	+ Clearing avoidance: as per certified carbon offsets. ++ Harvesting avoidance: cessation of harvesting likely to improve landscape values and recreational use of (formerly) harvested forest areas. Extent of change in recreational use value may be limited if forest harvesting road network not maintained.

Evaluation criteria	Notes	Certified green carbon offsets		Certified blue carbon offsets	Flexible green carbon offsets	
		New plantings and regeneration	Vegetation protection		New plantings and regeneration	Vegetation protection
	River health enhancement: improve the condition, extent and connectivity of riparian vegetation and the protection it offers to waterways and wetlands. Improve water quality and aquatic ecosystems.	++ Environmental plantings and regeneration: see climate resilience and biodiversity. - Non-environmental plantings: may help with some measures of river health, but overall use on non-locally indigenous species and potential water interception, means the option is likely to be detrimental overall (unless used to buffer environmental plantings along a waterway).	0 Avoidance of clearing: unlikely to be relevant to riparian environments.	0 Tidal wetland creation/restoration: not relevant.	As per certified carbon offsets.	0 Clearing avoidance: as per certified carbon offsets. + Harvesting avoidance: may contribute to improved river health, but current condition in harvested forest areas is generally superior to that in agricultural landscapes.
	Soil protection: improve soil carbon stocks and groundcover. Provide protection against erosion, soil acidification and salinity.	++ Environmental and non-environmental plantings, regeneration: likely to improve soil health.	+ Avoidance of clearing: will maintain current conditions. Limited value at landscape scale.	0 Soil health is a terrestrial construct and not relevant to coast environments. Dealt with under coastal protection.	As per certified carbon offsets.	+ Clearing avoidance: as per certified carbon offsets. ++ Harvesting avoidance: would reduce disturbance to forest soils associated with harvesting.
	Water quality protection: maintain or improve water quality.	++ Environmental and non-environmental plantings, regeneration: likely to protect or improve water quality. Use of non-native species in riparian areas may alter carbon cycling in ways which is detrimental to water quality for aquatic ecosystems.	0 Avoidance of clearing: unlikely to be relevant to water quality protection due to scale limitations.	+ Tidal wetland creation/restoration: potential to contribute to small, local-scale improvement in water quality in coastal environments.	As per certified carbon offsets.	0 Clearing avoidance: as per certified carbon offsets. + Harvesting avoidance: although harvesting regulations are intended to protect water quality, cessation of harvesting may lead to improvements because of reduced road construction and road use and reduced harvesting disturbance to soils.
	Water resource protection: maintain favourable flow regimes and volumes for consumptive and environmental uses	- Environmental and non-environmental plantings: if adopted at scale, likely to reduce catchment water yields in higher rainfall environments 0 regeneration: potential scale and location of this type of offset protect unlikely to result in detrimental effect on flows.	0 Avoidance of clearing: unlikely to be relevant to water resources due to scale limitations.	0 Tidal wetland creation/restoration: not applicable.	As per certified carbon offsets.	0 Clearing avoidance: as per certified carbon offsets. + Harvesting avoidance: may lead to increased flows from some wet eucalypt forests (e.g. Mountain Ash in Central Highlands), but marginal effects likely elsewhere.
Policy: consistency of offset option with Victorian government policies and strategies. *Rating:* + type of project and offset consistent with policy 0 policy not relevant to project and offset type - type of project and offset inconsistent with policy *Refer to relevant catchment carbon offset concept objective for discussion.*	Biodiversity 2037	+ Environmental plantings + Regeneration - Non-environmental plantings	+ Avoidance of clearing	+ Tidal wetland creation/restoration	As per certified carbon offsets.	+ Clearing avoidance + Harvesting avoidance
	Climate change adaptation plan	+ Environmental plantings + Regeneration + Non-environmental plantings	0 Avoidance of clearing	+ Tidal wetland creation/restoration	As per certified carbon offsets.	0 Clearing avoidance 0 Harvesting avoidance
	Climate change framework	+ Environmental plantings + Regeneration + Non-environmental plantings	0 Avoidance of clearing	+ Tidal wetland creation/restoration	As per certified carbon offsets.	0 Clearing avoidance + Harvesting avoidance
	Coastal strategy	0 Environmental plantings 0 Regeneration 0 Non-environmental plantings	0 Avoidance of clearing	+ Tidal wetland creation/restoration	As per certified carbon offsets.	0 Clearing avoidance 0 Harvesting avoidance
	Our Catchments, Our Communities	+ Environmental plantings + Regeneration 0 Non-environmental plantings	0 Avoidance of clearing	0 Tidal wetland creation/restoration	As per certified carbon offsets.	0 Clearing avoidance + Harvesting avoidance
	Sustainable water strategies	+ Environmental plantings + Regeneration - Non-environmental plantings	0 Avoidance of clearing	0 Tidal wetland creation/restoration	As per certified carbon offsets.	0 Clearing avoidance + Harvesting avoidance
	Water for Victoria, Water Plan	+ Environmental plantings + Regeneration - Non-environmental plantings	0 Avoidance of clearing	0 Tidal wetland creation/restoration	As per certified carbon offsets.	0 Clearing avoidance + Harvesting avoidance

Evaluation criteria	Notes	Certified green carbon offsets		Certified blue carbon offsets	Flexible green carbon offsets	
		New plantings and regeneration	Vegetation protection		New plantings and regeneration	Vegetation protection
Offset assurance requirements	Permanence: greenhouse gas emissions are permanently reduced (100 years for sequestered carbon; abatement discounted if permanency less).	Certified environmental plantings, regeneration and non - environmental plantings satisfy this requirement. Methods specify permanency period as 100 or 25 years. Given that CCO options are required to provide long-term environmental and social benefits, the 100 year permanence period would be preferable.	Avoidance of clearing: any project would satisfy this requirement. Methods specify permanency period as 100 or 25 years.	Tidal wetland creation/restoration: any project would be required to satisfy this requirement to be credited with ACCU. Given potential effects of climate change-sea level rise, it is not clear how permanence can be assured.	Permanence period not defined, although some assurance of the continuity of sequestered carbon would be required to meet CCO requirements.	
	Additionality: emissions reduction would not have occurred in the absence of the project.	Certified environmental plantings, regeneration and non - environmental plantings satisfy this requirement as specified in methodologies.	Avoidance of clearing: any project would be required to satisfy this requirement.	Tidal wetland creation/restoration: any project would be required to satisfy this requirement.	Additionality likely to be required to satisfy CCO requirements.	
	Transparency: consumers and others must have access to information about the offset project. Registered in a public registry.	Certified environmental plantings, regeneration and non - environmental plantings satisfy these requirements. Projects generating ACCUs are registered with Clean Energy Regulator.	Avoidance of clearing: any project would satisfy these requirements. Projects generating ACCUs are registered with Clean Energy Regulator.	Tidal wetland creation/restoration: any project would be required to satisfy these requirements. Projects generating VCUs are registered with VCS.	Transparency to at least CMA and WC would be required. DELWP, Essential Services Commission (ESC) and WC customers likely to require transparency carbon accounts for offsets. Registration not required.	
	Leakage avoidance: the project must not lead to increased emissions elsewhere.	Certified environmental plantings, regeneration and non - environmental plantings satisfy this requirement. Unlikely to be a major risk.	Avoidance of clearing: any project would be required to satisfy this requirement.	Tidal wetland creation/restoration: any project would be required to satisfy this requirement.	Unlikely to be considered. Likely to be low risk issue for clearance avoidance, but may be relevant for harvesting avoidance. Cessation of harvest in Victorian State forests may lead to increased harvesting elsewhere.	
	Measurability: methods used to estimate carbon sequestration must be supported by clear and convincing evidence.	Certified environmental plantings, regeneration and non - environmental plantings satisfy this requirement. Emissions abatement determined by modelling or field survey combined with allometric relationships.	Avoidance of clearing: any project would satisfy this requirement. Emissions abatement determined by field survey combined with allometric relationships	Tidal wetland creation/restoration: any project would be required to satisfy this requirement. The applicable VCS methodology specifies a series of measurements and calculations.	CMA and WC would want assurance that carbon abatement/sequestration “measured” using an established, evidence based method.	
	Independently audited.	Certified environmental plantings, regeneration and non - environmental plantings satisfy this requirement.	Avoidance of clearing: any project would satisfy this requirement.	Tidal wetland creation/restoration: any project would be required to satisfy this requirement.	May not be specifically required, although DELWP or ESC may want independent assurance of sequestration.	May not be specifically required, although DELWP or ESC may want independent assurance of sequestration.
Ownership of carbon and carbon offset	What legal provisions for ownership of carbon apply and are there any gaps or areas of uncertainty.	*Climate Change Act 2017* provides for ownership of carbon stored by vegetation on private and public land.	As per certified new plantings.	Under *Coastal Management Act 1995*, coastal Crown land includes shoreline and Victorian sea bed. This suggests that the *Climate Change Act 2017* provisions for ownership of carbon on Crown land may apply, although ownership is currently uncertain.	*Climate Change Act 2017* provides for ownership of carbon stored by vegetation on private and public land. Ownership is not dependent on certification. As per flexible new plantings.	
Overall assessment of appropriateness		Environmental plantings and regeneration align very strongly with CCO concept and all other appropriateness criteria. Offsets have high integrity and clear ownership. *Appropriate for inclusion in the CCOT case study and further appraisal*. Non-environmental plantings: use of non-indigenous species weakens alignment with CCO concept and some other key appropriateness criteria. High integrity offsets with clear ownership. *Not appropriate for CCO projects on their own. Potential for use to complement environmental planting projects in some settings.*	Aligns with key appropriateness criteria. However, the requirement for valid permission to clear greatly restricts the applicability of this type of offset in Victoria and hence its appropriateness for consideration in the CCOT case study. *Not appropriate for further consideration.*	Aligns well with stakeholder needs, policies and strategies, where they relate to coastal management. Marine blue carbon has some alignment with landholdings and interests of WCs in coastal areas. Legal frameworks for generating and owning carbon offsets generated by marine/coastal blue carbon projects are currently unclear and as a result, this option *is considered not to be appropriate for inclusion in the CCOT case study or other aspects of this appraisal.* Inland blue carbon projects may have greater application to the CCO concept, once there are appropriate methodologies for generating certified offsets.	As per certified new plantings.	Avoidance of clearing has limited relevance in Victoria for the reasons stated for the certified form of this offset type. Avoidance of harvesting has stronger alignment with the CCO concept. However, its adaptation at scale would involve cessation of harvesting in State forests. Since this is inconsistent with State government policy (and commercial arrangements), the option is not considered to be appropriate for further consideration at this stage.
					The use of flexible or uncertified offsets will be predicated on a design which satisfies some integrity requirements, particularly permanence, additionality, measurability and transparency. Under the Water Corporations’ Statements of Obligation, flexible offsets generated by a CCO project could not be used as offsets in achieving emissions reduction targets.	

TableB.4 : Catchment carbon offset appraisal: effectiveness of carbon offset options.

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offset model	Flexible offset model	Certified offset model	Flexible offset model
Project description	New plantings of woody vegetation on previously cleared land using locally indigenous native species.		Managed natural regeneration of cleared land adjacent to or which includes (low density) remnant vegetation.	
Project inputs				
Land: amount and key characteristics of land on which offsets project must be undertaken. *The CCOT will be used to define land requirements which are relevant to the catchment carbon offset concept.*	Minimum area of project for certification is 0.2 ha. Land must not have been cleared illegally and must have been cleared for at least 5 y. Opportunity exists to define land requirements for catchment carbon offset. These are likely to include: • Minimum project size: to apportion the transaction costs associated with the project and achieve material or measurable non-carbon benefits. Suggested minimum size: 100 ha. • Maximum project size: to manage potential impacts of water interception by new plantings. Suggested maximum size: up to 5000 ha, depending on water interception risk. • Location: to ensure opportunities to provide measurable non-carbon benefits and manage potential water interception impacts. Location may relate to CMA NRM-climate resilience priorities and/or WC owned land or asset areas. • Tenure: projects may or may not be specific to particular land tenures.	As per certified offsets, as apart from minimum area, certification is largely insensitive to the amount and characteristics of land on which offset projects are undertaken. Projects would follow characteristics defined for catchment carbon offsets. Given the history of land clearing in Victoria, it is unlikely that insufficient clearing period would be a relevant consideration for certified or flexible offset projects.	As per new environmental plantings, except that land must have been cleared 10 years previously. Recommended maximum/minimum size: 500/25 ha, respectively.	As per certified natural regeneration offsets.
Cost: what types of cost would be incurred in establishing and operating the project? *The CCOT will be used to identify all potential areas of cost and estimate unit rates for catchment carbon offset projects.*	Relevant potential areas of project cost include: • Land: may be an in-kind contribution of a project partner or undertaken on land owned by WC or managed by CMA (e.g. Crown water frontage). Access to private land for a large scale project may need to be secured via an outreach program of some kind. Cost may range $1-20k/ha, depending on location. • Project registration: with offset crediting agency, establishment of carbon ownership • Project management-governance: establishment of the entity which will own, manage and/or maintain the project by which the offsets and other benefits are generated. • Establishment: fencing, ripping, weed control, planting, early tending (etc.). Cost may range $1-5k/ha, depending of site and scale. Off-stream watering may be required for projects linked to waterways. • Management: maintenance of fences, weed and pest animal control (etc.). Costs may range $10-20/ha/y. • Carbon sequestration measurement/assessment: using modelling or field measurement techniques, as per the applicable crediting methodology. This assessment is undertaken periodically through the project and may be required if there is an event which results in a loss of carbon (e.g. fire, drought causing losses of trees). Cost approximately $2-10k for each measurement period. • Assessment of non-carbon benefits: not required for certification, but is a feature of catchment carbon offset projects. Cost approximately $2-10+k for each measurement period. • Audit and verification: of project characteristics and carbon sequestration. Cost $2-10k, depending on project size and method. • Reporting and claim for carbon offset units: based on measurements and verification. • Reporting to project partners and stakeholders. • Landholder payment: for projects undertaken on private land which is not owned by the party or parties owning the carbon offsets. Potentially $10-20/t CO_2e sequestered. For higher value agricultural land uses, the payment (or at least the real cost) may reflect the value of agricultural production foregone by introducing the CCO plantings.	As per certified offsets, with the likely exception of: • Project registration with crediting agency (but not establishment of carbon ownership). • Audit and verification: independent audit/verification may not be required. • Reporting and claim for carbon offset units. The method of carbon sequestration measurement may differ in its requirements to a certified project. However, the method would need to be evidence-based and independently recognised.	As per new environmental plantings, except that some project establishment costs may not be necessary.	As per certified natural regeneration offsets.
Skills: what types of skills are required to undertake the project through its life cycle?	Relevant skills and skill-inputs required for projects potentially include: • Landholder engagement: to identify and secure access to land on which the project is to be undertaken. • Project management: for overall project delivery. • Legal: for landholder agreements, carbon ownership, project registration etc. • Site establishment and management: to prepare the site, establish the plantings and maintain them and the land on which they are growing. • Carbon abatement assessment: for offset reporting and credit claims. • Audit and verification: of carbon abatement. • Carbon offset reporting: to crediting authority.	As per certified offsets, with the likely exception of: • Audit and verification. • Carbon offset reporting to crediting agency. Some other skill areas may not be required to the same extent as for certified offset projects.	As per new environmental plantings, except that some requirements for site establishment and management are less.	As per certified natural regeneration offsets.

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offset model	Flexible offset model	Certified offset model	Flexible offset model
	• Non-carbon benefit assessment or description: which would be required for a CCO project. Where cultural benefits are to be included, this will require consultation with Traditional Owner representatives.			
Benefit measurement methods: how may the benefits of the project be measured? *The CCOT will be used to summarise relevant methods for the assessment of carbon and non-carbon benefits of projects. This will include the requirements of any applicable non-carbon crediting scheme.*	Net project carbon abatement is the only benefit that is required to be measured or assessed if the project is to generate ACCUs. If a project is certified through the VCS, other environmental and social benefits and impacts must be assessed and reported. Project carbon abatement for new environmental plantings is assessed using an applicable methodology (for the offset crediting agency), which will typically involve: • Modelling of carbon stocks using the Department of Environment and Energy (DoEE) FullCAM model; • Field sampling to derive allometric relationships by which carbon stocks are estimated; and/or • Records of project activities generating greenhouse gas emissions. Other potential areas of benefit which may be assessed include: • Amenity value; • Biodiversity: vegetation extent, connectivity and condition (habitat ha), species diversity; • Ecosystem services; • River health; • Soil health; • Water flows and/or groundwater levels; • Water quality in receiving waters. The set of benefits to be assessed would depend on: the objectives of the project; its size and capacity to influence environmental and/or social values; and the requirements of investors and/or other key stakeholders. If the project was to generate non-carbon credits, the measurement methods would follow those of the particular crediting process. Processes would also be required to capture story lines about the project, which may have greater meaning to (e.g.) WC customers, Traditional Owner groups engaged in the project.	With the exception of carbon, the measurement of project benefits is a characteristic of catchment carbon offsets and is not influenced by the certification process (at least for ACCUs). Carbon benefit measurement for flexible offsets may potentially differ from certified offsets, however the calculation need to be transparent and robust and therefore unlikely to differ materially. The measurement of other benefits will be the same as for a similar style of certified offset project.	As per new environmental plantings.	As per certified natural regeneration offsets.
Investment/funding sources: what types of investor may this style of project appeal to?	Core catchment carbon offset partners: CMAs, WCs, private landholders NRM investors: DELWP, DoEE. NGO and private sector offset providers. Third parties with interest in securing carbon and/or non-carbon offsets. Environmental improvement bonds and other similar mechanisms provide a potential mechanism for enabling private sector investment into CCO projects.	As per certified environmental planting offsets.	As per certified environmental planting offsets.	
Stakeholder engagement: who are the stakeholders who need to be engaged in this type of project and why?	As per the catchment carbon offset concept, the project would be undertaken as a partnership between one or more CMAs and one or more WCs. Other key stakeholders potentially include: • Private landholders: on whose land the project may be delivered and the carbon and non-carbon benefits achieved. • Landcare networks: with whose activities the catchment carbon offset project may link. • DELWP: as a potential investor and because of their oversight of water sector NZE activities. • Traditional Owner groups: with interest in the land/country on which the project is to be undertaken. • WC customers: to communicate the project storyline and ensure acceptance that their water charges are providing value.	As per certified environmental planting offsets.	As per certified environmental planting offsets.	
Governance: are there any specific governance requirements for the type of project?	The certification process has few specific governance requirements. For ACCUs, the main requirement is that the party claiming the offset/carbon credit is legally “fit and proper”. While this would not be a specific requirement for flexible offset projects, the main partners involved in delivering catchment carbon offset projects should satisfy this test. The CCO concept is predicated on the idea of projects facilitating or coming out of long-term partnerships between CMAs and WCs. Project governance options are flexible and may be adapted to suit local partnership arrangements. Any monetised benefits (and credited carbon) will need to be owned by an entity.			
Project outputs				
Project narrative: story line about the project, particularly its benefits	The story line about the new environmental planting carbon offset project is unlikely to differ greatly between the certified and flexible models. The key elements of the story will depend on its objectives, location, what non-carbon benefits are measured or assessed and the nature of the partnerships it involves. They may include: • Carbon offset: the level of carbon offset provided and the contribution to the WC’s (or CMA’s) NZE pathway. For certified projects, the securing of certified offsets would add to the strength of the story line. • Project benefits: non-carbon environmental benefits, including changes in natural resource condition and stories about why this is important to landholders and communities.		As per new plantings. The narrative about project benefits may be somewhat weaker because the works (managing natural regeneration) are less obvious and may seem less intentional than new planting. The outcomes may be slower to emerge because they rely on seedfall and recruitment from trees adjoining or with the project area.	

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offset model	Flexible offset model	Certified offset model	Flexible offset model
	• Project partnerships: the value associated with partnerships between CMAs, WCs and others involved in the project (e.g. Traditional Owner groups). • Social and economic benefits of the project. Aspects of the story, particularly the level of carbon and non-carbon benefit would develop as the plantings mature.			
On-ground works: characteristics of the delivered offset project	The nature of the outputs of on-ground works to support implementation of the project are likely to be independent of the certification status of the project. Descriptions of on-ground works will vary between projects, but are likely to reference: • Plantings: area of new planting, increased level of connection across previously fragmented remnant vegetation, length of waterway with protection from riparian vegetation. • Associated works: length of fencing constructed, area treated for weeds and/or pest animals. • Participation by landholders and the community: in delivering the works. • Publicity and communications: how the project has been used to communicate about NRM programs and objectives to the community.		For managed natural regeneration, descriptions of on-ground works will reflect the somewhat different nature and reduced intensity of activities. Measures of "plantings" will be similar, but refer to areas in which management is changed to support natural regeneration. The lower intensity of activities is likely to simplify measures of participation.	
Partnerships: the types and intention of partnerships developed for the project, including the possibility of partnerships with Traditional Owner groups.	Partnerships are a characteristic of the project and not a specific reflection of the offset certification process. As previously notes, the partnerships for the project would primarily be between CMAs and WC. However, depending on project location, land ownership/tenure the partnerships may extend to Landcare and/or Traditional Owner groups.		As per new plantings.	
Overall assessment of effectiveness	**Project inputs:** The types of project input are largely independent of whether the carbon offsets are certified or uncertified. With the exception of a few key types of cost and skill (mainly relating to offset audit and verification and reporting to the certifying authority), offset project inputs are characterised by the requirements of the CCO concept. Minimum and maximum project sizes have been proposed. These have been defined on the basis of scale efficiency and environmental impact (minimum size) and water interception and perception of social impact (maximum size). Certification adds complexity and cost to a carbon offset project. However, satisfying core attributes of CCO projects and measuring or demonstrating non-carbon environmental benefits also does this, independently of certification. **Project outputs:** most project outputs reflect the project objectives and design, rather than certification status. The value of certification is that it provides greater assurance of the carbon outputs of the project and strengthens the project narrative. **Overall,** the explicit inclusion of multiple environmental benefits and partnerships between CMAs and WCs in the catchment carbon offset concept adds to cost and complexity. While this may not materially alter the carbon benefit, the focus of catchment carbon offset projects on non-carbon benefits should ensure a wider set of benefits, a richer story line about the project and a greater level of effectiveness.		The main difference to the overall assessment for natural regeneration projects is that they seem passive (relative to new plantings) in that they are concerned with facilitating natural regeneration rather than creating or building new systems. While this reduces input costs, storylines about such projects may be weaker and hence this style of project is likely to be less attractive to project partners and less effective.	

TableB.5 : Catchment carbon offset appraisal: legacies of carbon offset options.

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offset model	Flexible offset model	Certified offset model	Flexible offset model
Project description	New plantings of woody vegetation on previously cleared land using locally indigenous native species.		Managed natural regeneration of cleared land adjacent to or which includes (low density) remnant vegetation.	
Project benefits				
Carbon sequestration or abatement	Carbon sequestered in vegetation and soils within project area: amount of carbon sequestered (per unit area over the life of the planting) will vary, depending on: • Time since establishment: sequestration rate will be low initially and increase as the plantings mature. Sequestration rate will ultimately slow and reduce to a minimal level. • Species composition: growth rate potentially of the locally indigenous species used in the plantings. • Establishment success: particularly in the early life of the plantation, the rate of sequestration will be influenced by the success in getting the plantings through their establishment phase. • Site characteristics and climate: soil conditions, availability of water from waterways or shallow aquifers and climate will influence the rate of growth and carbon sequestration. Rates will be higher in areas with deeper soils and better water availability. • Disruptive events: fire, drought and insect attack among other hazards have potential to slow growth and/or kill some trees within the plantings. Any carbon lost by the plantings would need to be restored (by regrowth) before any additional offsets were credited. • Method of calculation: carbon abatement by new environmental plantings may be determined by at least two methods under the NCOS: use of the FullCAM model or by direct measurement and biomass sampling. Model-based estimates have traditionally been considered to be more “conservative”, in that they estimate lesser carbon stocks than may be indicated by direct measurement. Carbon sequestration is estimated to range between <5 t CO_2e/ha in parts of the Mallee to as much as 25+ t CO_2e/ha in some higher rainfall regions (Polglase *et al.* 2011).	As per certified environmental planting offsets. Alternative, evidence based methods to those prescribed by formal crediting schemes could be used to estimate the rate of carbon sequestration.	As per certified environmental planting offsets, noting that for: • Time since establishment: naturally regenerated vegetation may, depending on climate during the early phases of the project, be slower than for environmental plantings. It may take longer for the vegetation to reach the minimum required canopy cover (20%). • Establishment success: as above, it may take many years for the naturally regenerated areas to achieve the required canopy coverage. Conversely, it is possible that regeneration may be excessive under good conditions, with stand densities reaching levels which are detrimental to the growth of the trees. • The limitations in land availability for this type of offset means that less carbon is likely to be sequestered using this method, compared to environmental planting offsets. Modelling suggests that rates of carbon sequestration from natural regeneration projects will be about 50-60% of those for environmental planting projects (England *et al.,* 2006).	As per certified natural regeneration offsets.
Non-carbon benefits: environmental, cultural, social, economic	The types and quanta of non-carbon benefits achieved the project will depend on its design and implementation. The types of benefit achieved will potentially include some or all of the objectives described in Table B.3. As with carbon sequestration, the level of benefit claimed will be influenced by the method and level of investment in benefit estimation. Non-carbon benefits may also be captured in the project storyline.	As per certified environmental planting offsets, as (apart from the VCS), the estimation of non-carbon benefits is not in scope for the crediting method.	As per certified environmental planting offsets, noting the influence of factors such as time since establishment and establishment success (as above). Natural regeneration projects may provide additional biodiversity value due to the presence of mature trees and (possibly) key native understorey elements.	As per certified natural regeneration offsets.
Project risks				
Land use change flexibility	Permanence obligations lock the land use in for 25 or 100 years, depending on the choice of the project developer. The risk associated with this is diminished to the extent that the project provides other benefits, including other environmental benefits and a revenue stream for the land owner (if the project is established on private land). Given the objectives of CCO projects, a commitment to permanent (100+ years) and use would be preferable. Some flexibility for land use change remains, as arrangements could be made between the land owner and the carbon right holder to source the offset from another project. The feasibility of this approach would depend on the value to be derived from the proposed land use change and the cost of sourcing alternative carbon offsets. The risk associated with land use flexibility is enhanced with larger projects and (most likely) those providing fewer non-carbon benefits.	There would be no externally mandated permanence requirement under this option. However, as assurance of the continuity of the carbon offset would be required, there is likely to be some risk to land use change flexibility. Even if permanence is not defined, arrangements would still need to be made between the land and carbon right owners (as per certified environmental planting offsets) if land use was to change and the carbon offset was to no longer be available. Given carbon ownership rights, the land owner could not change land use unilaterally.	As per certified environmental planting offsets. The likely smaller size of projects may mean that this risk is diminished in comparison with environmental planting projects.	As per certified natural regeneration offsets.

Evaluation criteria	New environmental plantings		Managed natural regeneration	
	Certified offset model	Flexible offset model	Certified offset model	Flexible offset model
Water flows	New environmental plantings have potential to "intercept" water and reduce the amount available for the environment and consumptive uses. Interception occurs because the plantings use more water than the agricultural crops and pasture they replace. Interception notionally becomes material in areas with more than about 600 mm average annual rainfall. Water interception by carbon offset plantings using non-environmental plantings is regulated (the CFI Regulations). Despite their potential for interception, this does not apply to environmental plantings. Water interception risk is not a material consideration for smaller projects, unless there are a large number of these within a particular area. Water interception may be beneficial in catchment areas with dryland salinity issues or there are major issues with some forms of water erosion.	As per certified environmental planting offsets. The certification process may manage this risk for some forms of sequestration project (but not environmental plantings), but it does not create the risk. This is inherent in the type of activity.	As per certified environmental planting offsets, noting that it may take longer for the plantings to be sources of interception than environmental plantings. Interception effects of naturally regenerated plantings are not regulated by the CFI Regulations. Natural regeneration is unlikely to be as applicable at scale as environmental plantings and so the risk of water interception from such projects is most likely lower than for environmental plantings.	As per certified natural regeneration offsets, noting that natural regeneration is unlikely to provide the scale needed for a material effect.
Fire	With the exception of young plantings and those with some wet eucalypt species, environmental plantings should be relatively resilient to fire. A bushfire may lead to the loss of some carbon, but this may be recovered over time. If established at scale, environmental plantings could influence perceived and/or actual fire risk. If established at scale, consideration would need to be given to the management of on and off site bushfire risk.	As per certified environmental planting offsets. Certified offsets (using ERF methods) have mechanisms for managing carbon lost (temporarily) as a result of fire.	As per certified environmental planting offsets. Likely smaller size of projects may mean that the perceived risk of spreading fire in the landscape is diminished in comparison with environmental planting projects.	As per certified natural regeneration offsets.
Pests	Invertebrate pests (at any stage) and vertebrate pests (early in the life of the plantings) have potential to disrupt growth and carbon stocks. The use of indigenous species may diminish this risk. Offsets under the ERF methodologies have processes for dealing with such losses, as with bushfires.	As per certified environmental planting offsets.	As per certified environmental planting offsets.	As per certified natural regeneration offsets.
Population and demographics	If adopted at scale, environmental plantings could lead to changes in land use and the population base of any regional focus areas. The effect would be similar to the real or perceived effect of the expansion in Blue Gum plantations in south-west Victoria. This risk is relevant at the upper end of the potential size of CCO projects or in instances of multiple large-scale CCO projects in a district.	As per certified environmental planting offsets.	As per certified environmental planting offsets, noting that naturally regenerated vegetation is unlikely to proceed at a similar scale to environmental plantings and may pose a lesser risk.	As per certified natural regeneration offsets, noting that naturally regenerated vegetation is unlikely to proceed at a similar scale to environmental plantings and may pose a lesser risk.
Overall assessment of legacy	**Project benefits:** these are largely a function of the design and implementation of the project and are only marginally related to certification processes. CCO projects are, by definition, designed and implemented to generate non-carbon benefits. Within this style of project – environmental plantings – it is unlikely that design for multiple benefits would significantly compromise the (unit area) level of carbon abatement. **Project risks:** these are largely inherent in the type of project and reflect the scale and location of implementation (much) more than whether projects are certified or not. Or whether they are multiple or single benefit. **Overall,** with good design and project execution, most risks associated with environmental planting projects can be effectively mitigated. The level and type of benefit and risk reflect design and implementation and are largely independent of the certification process. These projects have potential to provide a rich legacy of environmental benefit and carbon sequestration.		The overall potential level of benefit and risk is likely to be less for naturally regenerated sequestration projects, due to the likely smaller scale of application. However, the level of benefit and risk reflect design and implementation more than certification. If well designed, managed natural regeneration projects should provide significant carbon and non-carbon benefits.	

Table B.6 : Strengths and weaknesses summary

Option	Strengths	Weaknesses	Conclusion
Avoided deforestation	• Protection of remnant vegetation *per se* aligns with CMA, WC and DELWP needs for biodiversity, river health and possibly climate resilience. • Protects existing biodiversity, cultural values. • Clear methodology for measurement and assurance for certified options. Measurement methods available for flexible options. • Flexible model potentially includes avoided, planned and legally permitted harvesting of native vegetation. This could apply in State forest areas and may be associated with significant net abatement.	– It is highly unlikely that eligible land (i.e. approved for clearing prior to 1 July 2010 and not yet cleared) is available in Victoria at scales or in locations useful for catchment carbon offsets. – The scale of benefits is considered small due to the limited areas available. – Harvesting avoidance is inconsistent with forest industry policies and allocation orders to VicForests.	This option aligns with the CCO concept, but is either unlikely to be implementable at sufficient scale within Victoria to provide material quantities of carbon offsets or is inconsistent with current forest policy. It is not recommended for further consideration.
Human-induced regeneration	• Alignment with CMA, WC and Victorian Government policies and needs for biodiversity, climate resilience, river health, water quality, climate change mitigation. • Can supplement extent and connectivity of native vegetation habitats and increase native vegetation cover, protecting and enhancing biodiversity, cultural values and social values. May offer greater biodiversity value than new plantings, due to the presence of mature trees in the landscape and the possible presence of retained native understorey elements. • Clear methodology for measurement and assurance for certified options. Measurement methods available for flexible options. • Several project legacy risks reduced due to likely smaller scale of implementation.	– Likely limited by availability of suitable land: land must be in relatively close proximity to existing native vegetation and/or remnant trees for regeneration to occur. – Intended outcomes accrue over decades. Outcomes may be slower to emerge than for environmental plantings because they rely on seedfall and recruitment from trees adjoining or within the project area. – The narrative about the project benefits may be somewhat weaker than for environmental plantings because the works (managing natural regeneration) are less obvious and may seem less intentional than new planting.	This option aligns with the CCO concept, but its applicability to particular projects will depend on the extent to which remnant vegetation cover has been retained. Projects could be developed which incorporate human-induced regeneration and environmental plantings. Recommended for detailed consideration and inclusion in the case study (if applicable to the project area).

Option	Strengths	Weaknesses	Conclusion
Reforestation and afforestation	• Strong alignment with CMA, WC and DELWP policies and needs (if locally indigenous native species present): biodiversity, climate resilience, river health, water quality, landscape tree cover, climate change mitigation. • High potential to supplement extent and connectivity of native vegetation habitats and increase native vegetation cover, with associated improvements to water quality, cultural values, recreation and amenity. • Potentially applicable to large areas of land, hence high carbon sequestration potential. • Clear methodology for measurement and assurance for certified options. Measurement methods available for flexible options.	– Community concern about land use, population and demographic change, fire hazard etc. if taken up at large scale. – New plantings at large scales in higher rainfall areas could reduce catchment water yields (inconsistent with CMA, WC and DELWP objectives). – Intended outcomes accrue over decades. – Some environmental benefits diminished if non-locally indigenous species used.	This option has potential for alignment with CCO concept, where the species used are locally indigenous natives. Environmental benefits are diminished if non-indigenous species are used. Recommended for further consideration in case study as a methodological option for environmental plantings.
Environmental or mallee plantings	As per reforestation and afforestation		
New farm forestry plantations	• Likely more carbon sequestered than options involving locally indigenous native species. • May attract participants that may not otherwise be involved, due to alternate source of income. • Potential alignment with some CMA, WC, DELWP objectives, including water quality and soil health. • Potentially applicable at scale and able to contribute significant carbon offsets. • Clear methodology for measurement and assurance for certified options. Measurement methods available for flexible options.	– Poor alignment with some CMA, WC and DELWP policies and requirements, e.g. biodiversity, river health. – New plantings at large scales in higher rainfall areas could reduce catchment water yields (inconsistent with CMA, WC and DELWP objectives). – Community concern about land use, population and demographic change, fire hazard etc. if taken up at large scale.	This option has some alignment with the CCO concept, but this is not as strong as other options based on environmental plantings or regeneration. Not recommended for consideration in their own right as a CCO project type. As demonstrated in the case study (Section 5), new farm forestry plantations may be used to complement environmental plantings in some settings without unduly compromising CCO principles.

Option	Strengths	Weaknesses	Conclusion
Tidal wetland restoration	• Wetland systems have considerable potential for carbon sequestration. • Alignment with coastal CMA, DELWP and Coastal Board programs, including extent and connectivity of coastal habitat, building resilience to sea level rise and coastal retreat, cultural values associated with coastal wetlands, social values e.g. fisheries. • Clear methodology for measurement and assurance for certified options. Measurement methods available for flexible options.	– Susceptible to sea level rise, may have issues with permanency requirements. – Land appropriate for tidal wetland restoration yet with avenues to retreat from sea level rise may not be available. – Ownership of carbon rights and consistency with some NCOS integrity requirements somewhat uncertain. – Legal frameworks currently under development.	The uncertain status of blue carbon (currently) means that it is not recommended for detailed evaluation in the project or case study – despite the potentially strong alignment with the CCO concept.

Appendix C. Case study participation expression of interest form

Case study participation

Key contact:	Name:	
	Email:	
	Phone:	
List lead and all participating organisations.	Lead (s):	
	Support:	
Describe the case study governance and project management arrangements. (1-2 para of prose or dot points)		
Briefly describe any previous experience of collaboration between case study participants. (1-2 para of prose or dot points)		
Describe any previous experience project partners have with carbon offsets projects. (1-2 para of prose or dot points)		

Scope, context and objectives

Use dot points or no more than 4 paragraphs of prose for each response. No response to an individual "question" should exceed ½ page.

Describe what project partners hope to achieve/learn by participating in the case study.	
Describe the project or priority area that you would like the case study to align with.	*Note: If the project aligns with an existing CMA river health or biodiversity restoration project, provide a brief description of that project and the location in which it is to be undertaken. The case study is a virtual one and will not directly result in on-ground works. However, it will help the case study exercise to link it with an actual project or area of land with real opportunities and limitations.*
Describe how the project would be consistent with the catchment carbon offset concept (see Section 2.3 of the CCOT discussion paper).	

How would you characterise success for your case study?	
Describe the learnings your case study might offer to other organisations and regions in Victoria.	
Why should your group and concept be selected to participate in the case study? *No more than 3 points.*	

Contributions of case study participants

Use dot points or no more than 4 paragraphs of prose for each response. No individual response should exceed ½ page.

What are the anticipated contributions of participants to the case study? e.g. # people, venue, catering	
Describe how you think the case study outcomes may be translated into a "real" project, with actual catchment carbon offsets generated.	

Other supporting comments or information

If you wish, you can provide additional information here to support your EOI. Please limit the additional information to 1 page at most.

Additional information (optional):

Appendix D. Guidance for designing and evaluating a catchment carbon offset project

This appendix provides a step-by-step guideline for assessing potential catchment carbon offsets (CCO) projects.

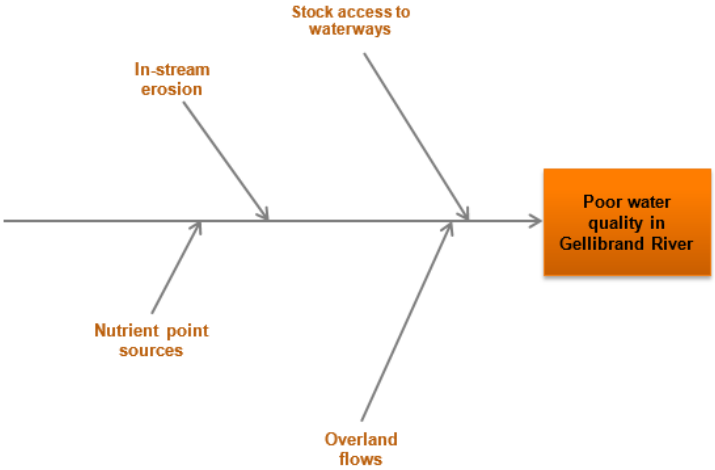
D.1 Review the CCO characteristics

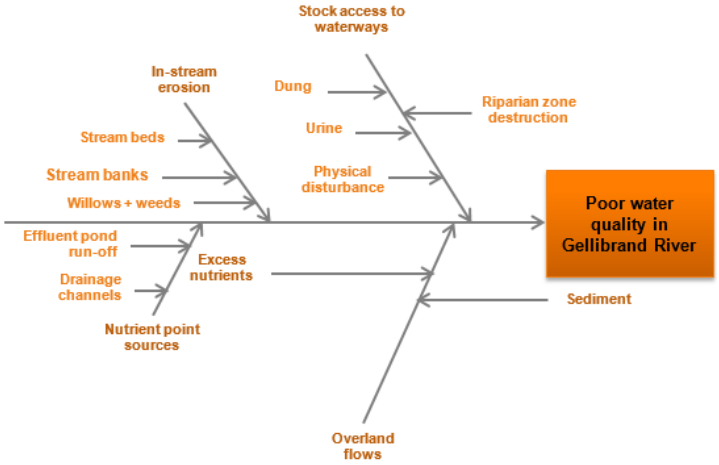
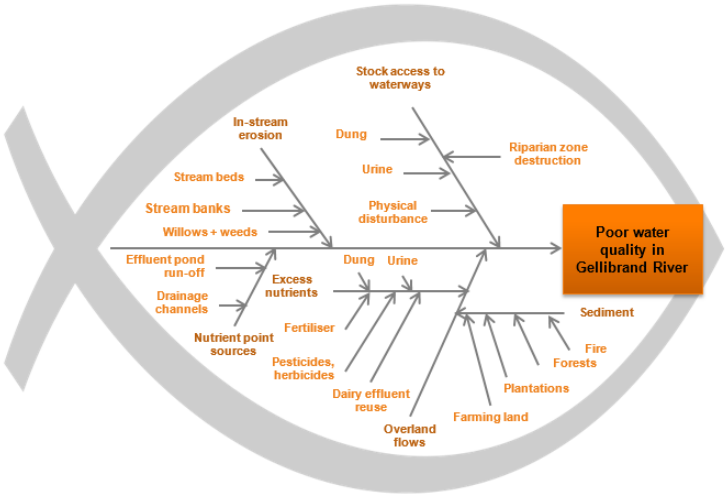
CCO projects should be framed by the CCO characteristics (Table 1.1). Revisit these characteristics before starting, and periodically during project design, planning and delivery.

D.2 Define the problem

What other, non-carbon problem should the project address? What is the main driver for seeking co-benefits with a CCO project? For this step, the general project area should be identified, with known issues and limitations incorporated into the causes.

We recommend the use of a Fishbone Diagram (otherwise known as an Ishikawa Diagram) as a tool to identify the root causes of a problem. This is a visual tool to help organise critical thinking, and see past symptoms to the true root cause. The process to develop a Fishbone Diagram is provided below.

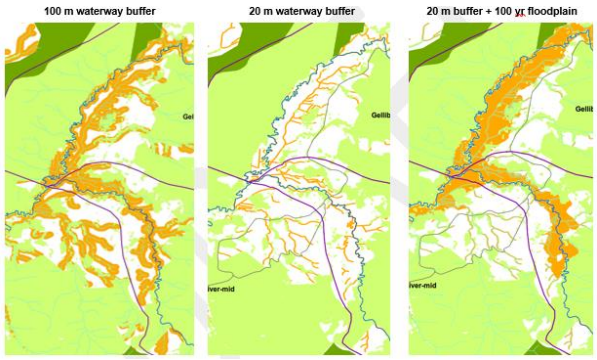
Steps	Example
Succinctly articulate the problem (effect).	Poor water quality in the Gellibrand River
Write the problem at the centre-right of the page, with an arrow pointing to it (the fish's 'spine').	
Brainstorm the main causes of the problem. Sort into groups if necessary, and feed into the 'spine'.	

Steps	Example
Brainstorm the causes of each main cause. Feed into the main causes.	
Continue to identify potential causes in further sub-categories as appropriate.	

Project teams can use the completed diagram to identify the most material root causes, and consider design responses that directly and efficiently address these.

D.3 Identify potential legacies

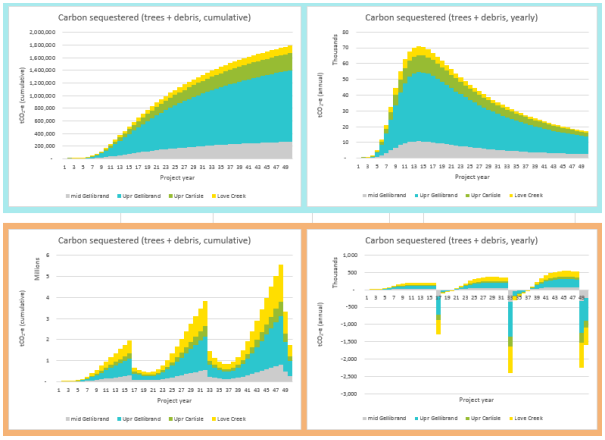
Drawing on the CCO characteristics and the root causes identified in the previous step, identify the potential project legacies. This can also be done as a Fishbone Diagram, with the CCO project as the effect, the main project legacies as the main branches, and contributing factors to each legacy as appropriate. Both positive and negative legacies should be included. These should again be relevant to the project area, incorporating local knowledge and values where appropriate.



D.4 Design the project

Define a set of project options that align with the CCO characteristics, address as many of the root causes (Step 2) as possible, and will result in as many of the positive project legacies (Step 3) as possible. Several of the vegetation methodologies certified under the National Carbon Offset Standard closely align with the CCO concept, and are a good place to start. Potential project areas, activities and timeframes will need to be defined. Set up the potential project areas in GIS, including current land uses.

D.5 Calculate project impacts



See the case study report (Jacobs, 2018) for details of the methods used to calculate project impacts.

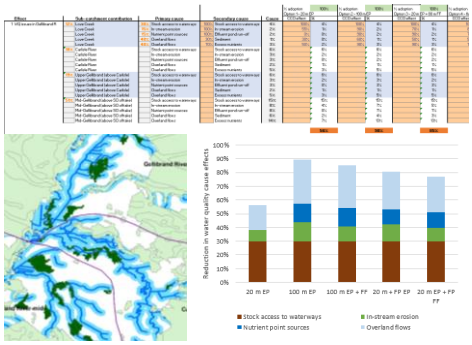
D.5.1 Carbon sequestration

Use FullCAM to calculate potential carbon sequestration over the course of the project. This provides an estimate of the certified benefits which could be generated by green carbon projects involving the establishment of new environmental or farm forestry plantings.

D.5.2 Flexible offsets and greenhouse abatement

Alternative calculation methods may be used for greenhouse emissions abatement estimates which would not be considered as part of the formal, certified offsets for a project. These may include calculations of emissions reductions from agricultural or energy-use sources and would be based on emissions factors from national greenhouse gas accounting procedures.

D.5.3 Environmental and social impacts



Use appropriate available data, metrics and/or calculation tools to characterise other potential benefit or risk impacts of the CCO project. In the Gellibrand case study, data or metrics from the following were used:

- Water and Land Use Change Study outputs to calculate likely impacts on flow of the various revegetation scenarios;
- A Wannon Water staff member's post graduate study into water quality contributions of each sub-catchment and the causes of water quality impairment;
- Index of Stream Condition metrics were adapted to evaluate impacts of the case study on river health;
- "Habitat hectares" metrics were adapted to evaluate impacts of the case study on biodiversity values.

Where metrics or data to support evaluation were not readily available, project impacts were assessed qualitatively on a -4 to + 4 scale, relative to the current base case (with ± 4 representing an outcome very much better or worse than the current base case).

D.6 Cost-benefit analysis

Compile project costs and benefits. Be sure to include:

- Costs of project start-up, including on-ground works
- Project management costs, including stakeholder engagement, at start-up and ongoing
- Ongoing monitoring and maintenance
- Costs of running the project for carbon offsets, such as regular reporting and certification requirements
- Opportunity cost of project land
- Income and savings from the change in land use

Project costs and benefits are compiled to calculate the net present value (NPV) of each project option, using an appropriate discount rate.

D.7 Evaluation framework

Compare the project options using a triple bottom line approach, including a 'do nothing' option. The detail of the evaluation framework will depend on the project type, its goals and legacies. The framework used in this case study is as follows:

- Carbon sequestered
- Financial impacts
- Environmental impacts
  - Greenhouse gas emissions sequestered/avoided (where not already covered by the 'carbon sequestered' measure)
  - Water quality
  - River heath
  - Terrestrial biodiversity
  - River flow regime
- Socio-economic impacts
  - Waterway cultural values
  - Waterway social and recreational values
  - Bushfire risk
- Governance
  - Confidence in level of implementation
  - Community partnerships.

Effect	Base case	Engineered WQ treatment	Riparian buffer			Floodplain + 20 m	
			20 m EP	100 EP	20 m EP + 80 m FF	EP	20 m EP + FP FF
Certified carbon							
Average yearly sequestration (tCO_2-e)	0	0	7.8k	40k	35k	17k	16k
Financial							
Financial cost	0	-$8.3M	-$6.2M	-$79M	-$113M	-$36M	-$46M
Financial benefit	0	-	$1.8M	$6.9M	$70M	$3.3M	$21M
NPV	0	-$8.3M	-$4.4M	-$72M	-$43M	-$32M	-$25M
Environmental							
Change in GHG emissions (flexible, average tCO_2-e pa)	0	-0.30k	0	20k	21k	8.9k	9.1k
Changed source/catchment water quality	-ve	-ve	56%	90%	85%	80%	80%
Change in river health increase in length of waterway with connected vegetation)	-ve	-ve	13%	13%	13%	13%	13%
Change in terrestrial biodiversity (additional area of connected vegetation)	0	0	356 ha	391 ha	391 ha	356 ha	356 ha
Change in river flow regime (ML/yr)	0	0	-0.4%	-1.7%	-2.7%	-0.8%	-1.1%
Socio-economic							
Change in waterway cultural values	-1	-1	1	1	1	1	1
Change in waterway social and recreational values	-1	-1	1	2	1	2	1
Change in bushfire risk with new plantings	0	0	0	0	-1	0	-1
Governance							
Confidence in level of implementation	0	4	3	1	2	1	2
Development of community partnerships	0	0	3	3	2	3	2

Where possible, the evaluation should be based on measured or calculated metrics. Where this is not possible, project options should be assigned a score based on their relative performance against that metric. This should be done in discussion with stakeholders representing different interests in the project; i.e. the CMA, Water Corporation, DELWP, Traditional Owners, local government, and/or members of the local community.

The evaluation framework should be constructed to avoid double counting of effects. All aspects which can readily be denominated in dollar terms should be included in the financial analysis/CBA.

If the evaluation does not result in a clear 'best' project choice (i.e. one with a positive NPV), project stakeholders will need to determine if the complementary benefits warrant the investment.

The score card and financial analysis tool are available from the overall project manager, Kate Brunt (katebr@gbcma.vic.gov.au). These may be adapted for use in other CCO projects.

D.8 Craft the narrative

The outcomes of all of the previous steps should provide the project team with a compelling narrative to support the chosen project. Questions to guide a potential narrative structure are provided here:

- Set the context: CCO characteristics, problem to be addressed (Steps 1 and 2). Why is the project needed?
- What do you intend to do? (Best project option from Step 4)
- What will be the results? (Impacts and legacies, Steps 3 and 5)
- Why is this best option? (Overview of evaluation results, other options considered and their weaknesses from Step 7).

Appendix E. Overview of tools used to design and evaluate the case study catchment carbon offset options

E.1 Fishbone diagrams

The consulting team used Fishbone Diagrams (otherwise known as Ishikawa Diagrams, Figure E.1) to identify the root causes of water quality issues in the Gellibrand River catchment, as well as define the potential legacies of the project. These diagrams are a helpful visual tool to organise the critical thinking process. They can support identification of indirect or root causes of a problem, allowing more targeted approaches to resolve the issue. The approach to building Fishbone Diagrams is detailed in Appendix D.

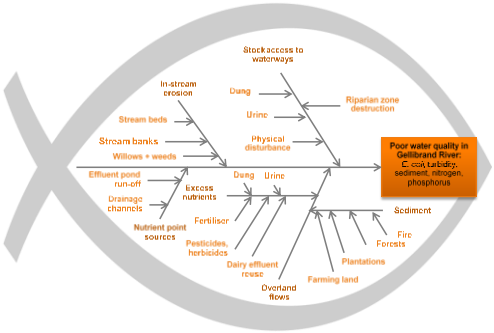


Figure E.1 : Example Fishbone Diagram

E.2 Water quality cause and effect

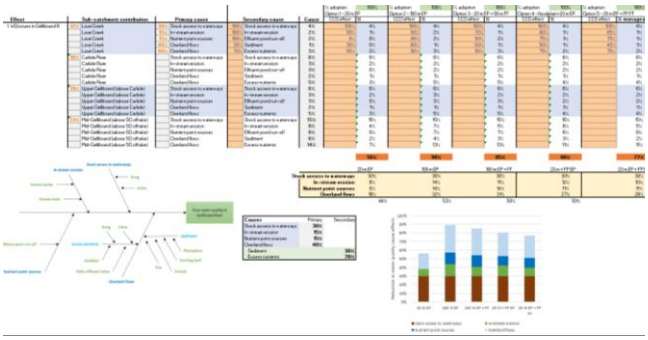


Figure E.2 : Water quality cause and effect tool

We built a tool in Microsoft Excel (Figure E.2) to model how effectively each project option could improve water quality, by addressing the major causes of poor water quality in the region. The model drew on research previously conducted by Wannon Water which characterised several water quality parameters and their distribution between the various waterways in the catchment. Using these results, a proportion of the water quality "problem" was assigned to each project sub-catchment.

Each major cause of poor water quality, as identified in the problem definition phase, was assigned a proportion to represent its contribution to the problem. When multiplied by the sub-catchment's contribution, the user can calculate (for example) that 6% of the overall water quality issues in the Gellibrand catchment are caused by sediment carried by overland flows in the Mid Gellibrand River. Metrics were assigned to indicate how well each CCO project option addressed each issue; i.e. all options were 100% effective at preventing stock access to waterways, as all involved fencing to exclude stock from the riparian zone. The model then calculates how well the project addresses the underlying causes of water quality in the Gellibrand catchment.

The model is set up to allow testing of the differences in water quality outcomes with partial roll-out of each project, i.e. 80% adoption of the 100 m environmental planting achieves the same overall level of water quality improvement as 100% roll-out of the 20 m environmental planting project. This functionality is an interesting indicator, but does not take into account spatial variability of the factors underpinning the calculations: not all waterway reaches are equal when it comes to water quality impacts and improvements.

E.3 Carbon and financial assessment

Per hectare carbon accumulation was modelled for each sub-catchment and project option using the Full Carbon Accounting Model (FullCAM), following the guidelines in the relevant methodology determinations for these types of carbon projects. The results were incorporated with the financial assessment, as sequestered or offset carbon can be a source of revenue.

We built a tool in Microsoft Excel that allows exploration of the carbon and financial outputs of the project options, and the effect of some of the key assumptions. The tool allows the user to select a range of conditions to calculate carbon abatement and the financial metrics. These include choosing the project option (environmental planting or farm forestry), setting the opportunity cost for foregone agricultural production,

Key Assumptions	
Fixed	
Analysis start year (financial year)	2019
Analysis period (years)	50
Flexible	
Discount rate (real)	7%
Length of project roll out (years)	5
Project type	Environmental planting
Number of blue gum tree seedlings per hectare	1100
Number of native vegetation tree seedlings per h	500
Number of blue gum trees harvested per hectare	1000
Off-stream watering	No
Cost per km of off-stream watering	7500
Agricultural opportunity cost (leakage)	80%
Water treatment OPEX (pa)	$948,980
Average emissions (tonnes) per hectare for grazing land use	7.14
Destructive sampling	Yes
Increase to carbon estimate through direct measurement	0%
Carbon price ($/tCO2-e)	11
Permanence period (years)	100
Blue gum pulp price ($AUD/bone-dry tonne)	198

Results - economic analysis	
Environmental planting - 100 m buffer	
Total PV Cost	-$79,309,686.58
Total PV Benefit	$6,866,959.55
Net Present Value (NPV) of the project	-$72,442,727.03
Present value of costs	
Establishment and management of plantings	$78,854,451.91
Operation as a carbon offset	$455,234.67
Present value of benefits	
Carbon revenue	$6,182,657.06
WQ treatment savings	$684,302.50
Average yearly carbon sequestered (t CO2-e)	
Certified	40,276
Flexible	20,146

Figure E.3 : Carbon and financial analysis tool front page

whether or not destructive sampling occurs, and the carbon price. For the full list of adjustable parameters, refer to the Case study report (Jacobs, 2018).

The tool calculates how much carbon is sequestered over a 50 year timeframe, including consideration of a staged roll-out over five years for the environmental planting projects. Cumulative and yearly carbon sequestration is calculated. Fixed and per hectare project costs are calculated based on cost reference tables in the workbook, as well as any opportunity cost. Carbon revenue is calculated, based on the amount sequestered and the carbon price set by the user. For farm forestry projects, harvest and replanting costs and income from pulpwood sale are added. All costs and income over the 50 year timeframe are discounted following standard economic practice.

The front page of the tool (Figure E.3) presents the user with the results of the economic analysis: the total costs and benefits in present value, and the net present value of the project. The financial results are also broken down into "normal" project costs and income, i.e. those that would be expected to be incurred in the usual course of running these projects; and the costs and income specific to the project being run as a carbon project. Total certified and flexible (based on offset agricultural emissions) are also reported here. The second page provides a series of figures to illustrate the carbon sequestration, costs and revenue across the 50 years (Figure E.4).

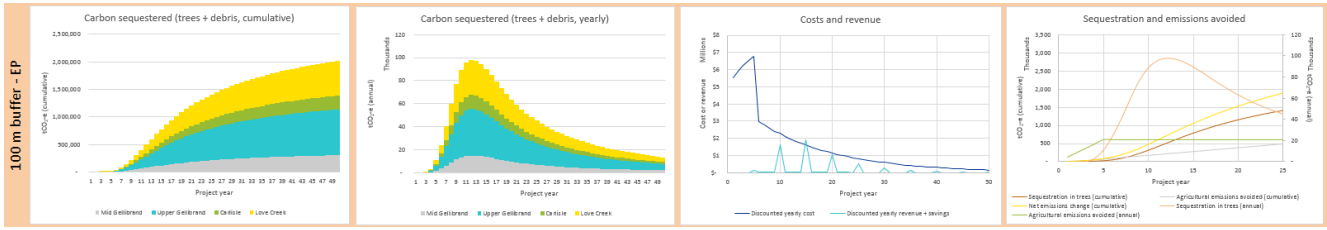


Figure E.4 : Carbon and financial analysis tool figures

Disclaimer:

The tool assumes that all carbon credits generated by the project are sold in the carbon market; i.e. none are surrendered to meet Wannon Water's emissions reduction requirements. Reduction in income from either surrendering certified carbon units as offsets or purchasing additional carbon credits would need to be calculated by the user.

Please note that this tool was iteratively built for this specific region and projects. Results for several project option areas are shown at once, and the user needs to look at only the output relevant to their query. There are multiple instances of hard-coding in the tool that are appropriate for its current settings and results, but may not stand up to significant changes in the inputs. The tool requires further development and fine-tuning to make it more user-friendly and robust.

Appendix F. Feedback from case study participants

F.1 Learnings from the case study

At the conclusion of the third case study workshop, participants were engaged in a discussion about learnings about the project. A summary of the key points is provided below.

F.1.1 General comments

- This process uses a new methodology and fresh approach, considering the whole of the catchment and appreciation of the viewpoints of all stakeholders, beyond water and plants. These projects could result in win-win situations for all stakeholders.
- This has been a useful exercise, of facilitated learning. Gathered a group with diverse expertise across different aspects of this issue, and all learnt from each other.
- Opportunity for next time: include community members in the workshops (farmers, Agriculture Victoria)
- Getting policy into practice. Carbon policy is very complex, and this process is a pathway to apply on the ground.
- Farm forestry can be a useful tool in the carbon context.
- Blue gums maybe not the best solution for this area – would be good to think about other commercial pursuits (e.g. Blackwoods). This project's messaging around blue gums will be very important. Recommend using the term 'farm forestry' rather than 'blue gum'.
- Planting for carbon is complex. This project accepts the complexity and works with it.
- We started from a gut feel that there is value here. This project helps us learn how we would do this. This has been a process of taking the wild ideas that may or may not have been implementable, and converting them into a hard analytical model, coming out at the end with meaningful comparisons.
- Creating momentum for the CCO concept, and the transition from focus on carbon to focus on multi-benefits.
- Combing policy, modelling and the reality of on ground outcomes was crucial for this project and it looks like it has delivered – such a hard thing to do. The key test for it however will be if Wannon Water and the CMAs can work with landholders and investors (DELWP) to deliver.
- The project tools used during the process were very useful.

F.1.2 The catchment carbon offset concept

The case study has clearly shown that projects designed along the CCO concept can demonstrate multiple benefits and outcomes. It's part of integrated catchment management, and many stakeholders can benefit.

F.1.3 Certified and flexible models of catchment carbon offset

The certified models are clearly real. Flexible models were intended to allow a broader range of options and/or cheaper implementation, and potentially to make the case to the State Government that carbon sequestration could be achieved through lower-cost methods. However, it was clear at the first workshop that the WCs wanted carbon abatement to be real and credible. This set the bar very high for flexible models, resulting in very little differences (including time cost) between certified and flexible approaches.

F.1.4 Carbon abatement options

It is clear that both environmental plantings and farm forestry have a role to play in sequestering carbon in this catchment. However, the environmental planting projects are much more strongly aligned to the CCO principles. Note that blue gums are not planted in wet areas, so the floodplain forestry option may not work (albeit factoring in the 20 m distance from the river)

Natural regeneration wouldn't work in the Gellibrand catchment, but may have an important role in other areas. It is important to note recent published concerns from the Climate Change Authority that the method (including carbon modelling) overestimates the amount of carbon sequestered by this approach[14]. There are so many variables determining whether or not you get a good result with this method – seed bank, weeds, rain, natural events etc. Uncertainty is too high.

With environmental plantings, you have the option of choosing climate change-resilient species (while still complying with the requirements that they be native to the region).

F.1.5 Catchment carbon offset principles

The CCO characteristics, originally defined at the first stakeholder workshop (Table 1.1), have held up well throughout this process. One change would be to extend "Build or result from stable, long-term relationships within water sector: CMA(s)-Water Corporation(s)" to other stakeholders, as these projects have the potential for wide-reaching benefits.

F.1.6 Thinking and analysis tools

Another case study might not have had another clear "problem" to address in addition to carbon. Could look at biodiversity, social license etc. The fishbone diagrams used here would still be useful in defining and exploring these problems.

The evaluation tool (scoring system) was difficult, as it is hard to consider all the complexities in the short timeframe required, and you ended up going with a gut feel. There may be easy ways to get some of this information. It is very subjective – if we'd had community members in the group, we may have ended up with different outcomes. Strengths are that it allows you to be explicit about how you arrived at your outcomes, and that there is no better way to do this. Important to have the right people in the room when using this approach.

F.2 Case study evaluation

Responses to key evaluation questions (adapted from Table 2.2) during or following the third case study workshop are collated below.

Were the catchment carbon offset models and options considered in the trial relevant to the needs of CMAs and Water Corporations? Why/why not?

Yes, the first workshop invited all organisations to put forward their needs and explored the areas of overlap and shared benefits. Both the carbon offset models and options presented were the same or with similar NRM options that the Corangamite CMA has for improving the catchment health and achieving specific NRM outcomes for the Gellibrand River, both within and outside the project area.

Were the processes to engage case study participants (over the 3 workshops) appropriate for the objectives of the case study and interests of participants and effective? What was done well and what could have been improved?

The workshops were very interesting, and an example of excellent collaboration. Clear intent was set at the beginning of the process, defining the areas of interest for different stakeholders; framing the project around the key stakeholders.

We need to have space for incorporating previous studies and supporting data (such as the catchment works and water quality data drawing on Brad Clingin's work). It was good to bring some of this previous work to a wider forum.

[14] Climate Change Authority (2017) *Review of the Emissions Reduction Fund*, http://climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/files/CFI%202017%20December/ERF%20Review%20Report.pdf, Section 3.4.1.

The scoring system for co-benefits was difficult, as it is hard to consider all the complexities in the short timeframe required, and you ended up going with a gut feel. Some queries raised in one workshop were not addressed with the entire project team either in-between workshops or at the workshops.

Jacobs' expertise in carbon offset markets, policy, modelling and NRM in general was evident throughout this project.

Have the case study workshops appropriately valued participants' time by (e.g.) providing good information, getting the right people together and working through the process in a time efficient manner? What might have been done differently?

Overall, yes. It might have been good for everyone to have tasks between workshops, to keep momentum and be involved in the full process. Others felt this was covered by Jacobs to deliver on specific task/seek further information quite well. Start of workshop 2 included an extensive recap and rehashing of the project to date – this was not optimal but normal for a complex process. Might have been avoidable if people were engaged between workshops.

We had a core group attend all three workshops, and additional people attend one or two. This worked well, although it would have been better to have consistent representatives from participating stakeholders.

It does not seem that the period of time to complete the project could have been shortened in any way. The workshops moved through content well. Particularly enjoyed have the field trip component and the variety of locations for the workshops to ensure partner ownership in the process.

Were the key case study deliverables consistent with the questions asked of the case study and the needs of the project partners? Why/why not?

Yes, as the deliverables were framed around the questions asked in the first workshop and the needs of the project partners. With more time, the trial and team of participants could build on the framework to allow a more tangible tool for use by an implementation team, leading to a web tool

Has the project been delivered with the level of collaboration sought? Explain. What lessons about collaboration might be learned for any future case study or actual catchment carbon offset project?

Would have liked more collaboration with GHCMA but understand the circumstances with respect to their involvement. The fact that there is now an example of a NRM/carbon offset model that has been applied to a real case study is a great platform for any other similar project in Victoria and indeed Australia. It might have been interesting to get some feedback from farmer's groups or a few landholders to get an idea of how much frontage might be picked up.

Do you think the case study has provided appropriate value for the resources invested in it? What more (if anything) would you have liked it to achieve?

Yes, having a confined catchment with existing NRM modelling data (i.e. from Wannon Water) as well as a strong relationship between the agencies and landholders was crucial for the project to succeed.

The key thing will be the next steps, what happens from here. If it becomes an implementation tool or web tool then yes, it has been worth it. It has been a good thought provoker for participants. If nothing happens, then no, not worth the resources spent.

What do you think will form the main legacies of the case study?

A coherent way forward for carbon sequestration implementation. Wannon Water and Corangamite CMA now have a blueprint to attract investment to achieve both carbon offset and NRM outcomes. The working relationship between the two agencies has been strengthened despite the outcomes of the project as well. It was good to see the different agencies working together and hopefully there's to be more of it.