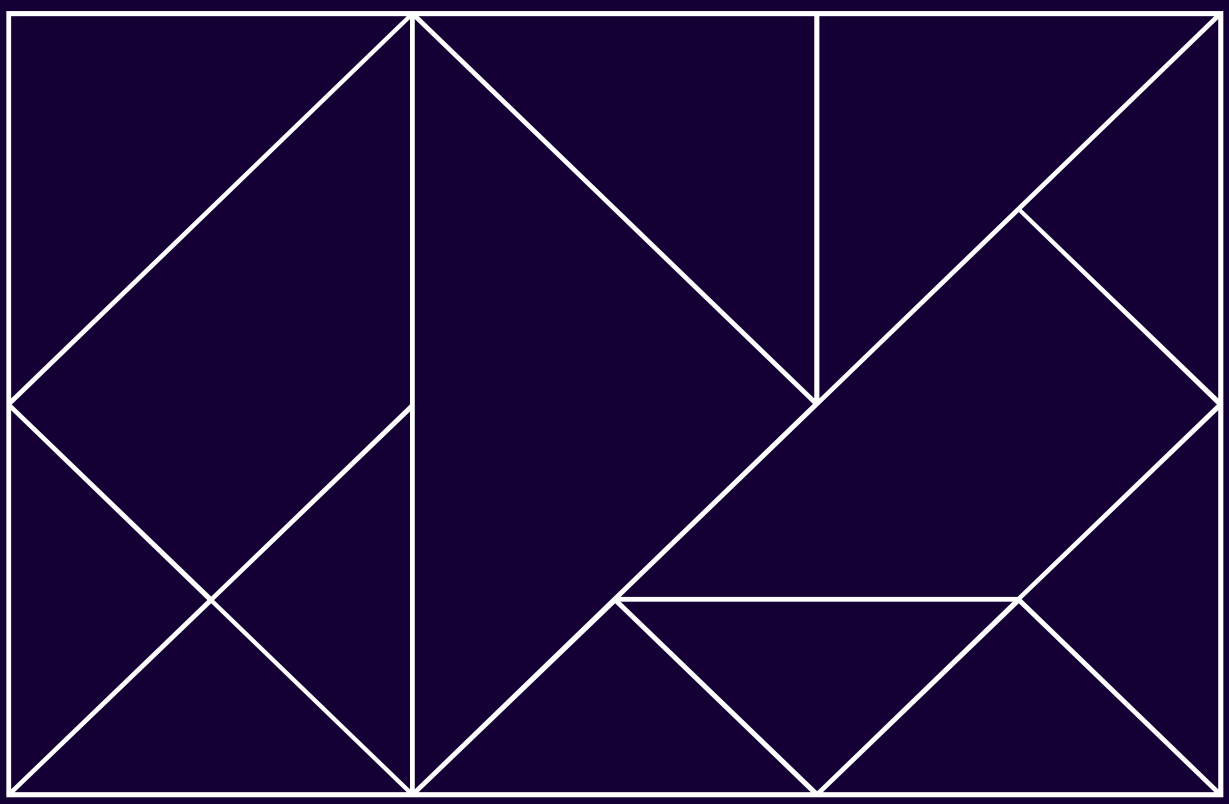
ACIL ALLEN

Biocontrol Research for Weed Management (Stage 1&2)

Final Report

December 2024



ACIL Allen acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land and its waters. We pay our respects to Elders, past and present, and to the youth, for the future. We extend this to all Aboriginal and Torres Strait Islander peoples reading this report.

Goomup, by Jarni

Contents

Glossary

Abbreviations	Definitions
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry; Commonwealth
DCCEEW	Department of Climate Change, Energy, the Environment and Water; New South Wales
DPI	Department of Primary Industries; New South Wales
IP; IP1; IP2	Implementation Plan; Implementation Plan 1; Implementation Plan 2
KEQs	Key evaluation questions
NRC	Natural Resources Commission
NSW	New South Wales
OEH	Office of Environment and Heritage; New South Wales
RFQ	Request For Quote
TRC	Technical Review Committee
USA	United States of America
USDA	United States Department of Agriculture

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Executive Summary

Executive Summary

Introduction

Weeds threaten Australia's biodiversity, agriculture, and overall ecosystem health. In New South Wales (NSW), the challenge of managing invasive weed species is critical to protecting and improving the natural environment. Traditional methods, such as physical removal and herbicides, while effective, are not always sustainable or cost-efficient. Biological control (biocontrol) offers a more effective alternative by leveraging the natural enemies of weeds, such as insects and fungi, to reduce their populations and impact.

The NSW Environmental Trust (the Trust) has funded a Commonwealth Scientific and Industrial Research Organisation (CSIRO) lead consortium to deliver the Biocontrol Research for Weed Management Project (the Project) to mitigate the adverse effects of priority environmental weeds in NSW through biocontrol agents.

The primary objectives of the Project are to:

- Identify and prioritise target weeds based on their impact on biodiversity and ecosystem health.
- Research and test biocontrol agents that are effective, target specific, and environmentally sustainable.
- Obtain regulatory approvals for releasing biocontrol agents, ensuring compliance with biosecurity guidelines.
- Monitor the establishment and effectiveness of biocontrol agents in reducing weed populations and restoring native habitats.

The Project is structured in multiple stages:

- **Stage 1:** Development and application of a framework to prioritise weed species for biocontrol research through stakeholder consultation. Completed in 2017.
- **Stage 2:** Research and testing of biocontrol agents in Australia and internationally, through laboratory and field studies. Completed in 2021.
- **Stage 3:** Research, testing, implementation, monitoring and evaluation of biocontrol agents. Consisting of 5 implementation plans, Stage 3 is ongoing. However, Implementation Plan 1 (IP1) and Implementation Plan 2 (IP2) are now complete.

This evaluation

The Trust has engaged ACIL Allen to conduct an independent evaluation of Stages 1 and 2. The evaluation has been guided by an evaluation framework (Appendix A), and involved consultation with 7 stakeholders, including representatives from the Trust, consortium members and technical review committee members involved in the Project, and analysis of program documentation.

Key findings

Overall, the funding and design of the Project was in line with identified needs from government reviews and stakeholder lobbying, and strategically appropriate in its focus on environmental weeds rather than agricultural weeds (to avoid duplication with existing NSW Department of Primary Industries (DPI) initiatives). The Project delivered value for money and was generally delivered on time and on budget, with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) providing significant in-kind contributions and often securing matching funding that effectively multiplied the initial investment.

The program management arrangements provided effective oversight through a multi-layered governance structure, with CSIRO demonstrating technical leadership and strong day-to-day management supported by Technical Review Committees and a consortium approach between key partners: DPI and the NSW Office of Environment and Heritage (OEH) (now known as NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW)).

The evaluation identified some gaps in the administrative arrangements, particularly in streamlining project variation processes and the need for more comprehensive lifecycle planning, including how biocontrol would be incorporated into ongoing weed control programs from the outset. The key findings for the evaluation are provided in Table 1.1 according to the key evaluation questions (KEQs).

Table 1.1 Overview of evaluation findings against each KEQ

Domain	KEQs		Finding	Rating
Appropriateness				
To what extent was the project design appropriate?	1.	How appropriate was the planning process in the initial scoping phase?	The initial planning phase demonstrated strong technical merit through CSIRO's expertise in weed prioritisation and effective partnerships with DPI and DCCEEW. The focus was primarily on developing robust scientific methodology for biocontrol agent selection and testing, though there were opportunities to further integrate this work with broader weed management approaches and post-control land rehabilitation strategies.	
	2.	To what extent did the Project address the identified need and was it the most appropriate thing to do?	The Project effectively addressed a critical gap in NSW's weed management capacity by focusing on environmental weeds and biocontrol research, directly responding to the 2014 Natural Resources Commission review that highlighted alarming declines in biocontrol expertise and resources.	
	3.	To what extent was the expenditure appropriate for the Project?	The consortium maximised the return on investment through significant in-kind contributions and securing co-funding from research partners. The comprehensive development of the prioritisation framework provided an approach that enabled rapid redirection of resources from non-viable options to promising opportunities, maximising return on investment.	
Effectiveness				
To what extent has the Project been effective in achieving its outcomes?	4.	To what extent was the Project on time and on budget	The Project was delivered within budget and largely on schedule, with the Trust providing valuable flexibility to accommodate necessary variations, enabling CSIRO to adapt timelines and reallocate resources in response to research findings and emerging opportunities.	
	5.	To what extent were the Project's activities implemented as intended? If not, why, and what was the impact?	The Project successfully delivered its intended outputs across both stages through effective consortium management and the Trust's flexible funding approach enabled adaptive management when biocontrol research findings necessitated shifts in priorities or approaches.	

Domain	KEQs		Finding	Rating
	6.	To what extent was the Project appropriately planned and scoped to ensure delivery of intended outcomes and effective measurement of these outcomes?	CSIRO's project planning and scoping throughout the Project ensured the intended outcomes were delivered and measured effectively, despite challenges in timelines and unpredictable processes, such as approvals and the outcomes of experimentation.	◕
	7.	Were the intended outputs delivered and do they represent value for money?	The intended outputs, including the prioritisation framework and identification of potential biocontrol agents, were successfully delivered and represented good value for money.	●
Efficiency				
To what extent has the Project operated efficiently?	8.	How efficient were the planned project activities?	Project activities were efficiently planned, using a robust prioritisation approach in Stage 1 that allowed for strategic allocation of resources and a flexible response to non-viable options in Stage 2. The planned activities were executed efficiently given challenging project management conditions (such as COVID-19) and delivered the intended outcomes.	◕
	9.	What were the project implementation costs, and were these efficient? To what extent could resources have been allocated more efficiently?	The Project demonstrated efficient resource allocation through systematic prioritisation and flexible management processes, keeping expenditure within budget while leveraging significant in-kind contributions to expand project capacity.	●
	10.	Did the Project deliver value for money?	The Project delivered good value for money, producing a reusable prioritisation framework that can be continuously applied as weed threats evolve to identifying further potential biocontrol agents. The potential for long-term cost savings in weed management through improved targeting and efficiency suggests ongoing benefits from the investment.	●
Process				
To what extent has management of the Project contributed to success?	11.	How well managed was the Project?	The Project was well-managed, with CSIRO providing effective day-to-day management guided by a consensus-based consortium approach.	●
	12.	To what extent were the methods for making decisions and managing the Project appropriate and likely to ensure success?	The decision-making methods, including the use of a subcommittee and consensus-based consortium, were appropriate and significantly contributed to the Project's success by ensuring both diverse inputs and buy-in.	●
	13.	What were the associated risks with governance, financial management and project planning and how were these managed?	Risks were managed through clear governance structures, flexible financial management, and adaptive planning processes that allowed for pivoting when needed.	●
Opportunities				
To what extent were learnings generated by the Project used and could these be applied differently in hindsight?	14.	What were the lessons learned and/or other opportunities related to the Project?	Key lessons included the importance of flexibility in biocontrol research and the value of a clear, adaptable prioritisation framework.	●
	15.	What could be done differently?	The initial planning process was strongly focused on scientific and technical aspects of biocontrol research without sufficient consideration of how biocontrol agents would integrate into broader weed management approaches.	◕

Legend: ○ no achievement ◔ minimal achievement ◑ moderate achievement ◕ strong achievement ● very strong achievement.

Source: ACIL Allen

Recommendations

The Biocontrol Research for Weed Management Project (Stages 1 and 2) demonstrated strong overall performance in addressing critical weed management needs in NSW. The Project successfully balanced technical rigor with practical implementation requirements, though opportunities for improvement were identified. CSIRO's leadership, supported by effective consortium partnerships and flexible Trust oversight, enabled the Project to achieve its core objectives while building foundations for future biocontrol research.

Recommendations for future biocontrol research and to improve the ongoing delivery of the Project are provided below.

Recommendation ES 1

Future biocontrol research projects should incorporate comprehensive lifecycle planning from the outset that explicitly addresses implementation pathways, including integration with existing weed control methods, monitoring protocols, and post-control site rehabilitation requirements, even if full implementation funding is not initially secured.

The initial project planning focused heavily on scientific methodology and the delivery of the prioritisation methodology and assessment processes. Broader implementation considerations received little attention. Although Stage 2 developed pathways from laboratory to field implementation, earlier planning around practical aspects like integration with existing weed control methods, monitoring protocols, and post-control rehabilitation requirements could have strengthened the project design. This more comprehensive planning approach would better support the transition into Stage 3 field implementation and provide a stronger framework for measuring long-term ecological outcomes.

Recommendation ES 2

Future biocontrol research projects should retain flexible funding mechanisms that allow rapid redirection of resources when initial approaches prove unsuccessful, supported by clear decision triggers for continuing or terminating specific research pathways.

The Project demonstrated that flexibility in resource allocation was crucial for research efficiency. The Trust's adaptable funding approach enabled CSIRO to quickly pivot from non-viable options to more promising opportunities, maximising the return on limited funding through strategic reallocation. This flexibility was made possible through transparent communication about research uncertainties and maintained stakeholder trust even when outcomes were negative.

Recommendation ES 3

The prioritisation framework developed in this Project should be adopted as a model for future biocontrol initiatives, with emphasis on maintaining its adaptability to incorporate new evidence while providing clear decision-making criteria.

The framework proved invaluable in guiding efficient resource allocation through its systematic, matrix-based approach to evaluating potential weed targets. Its success in balancing structured decision-making with flexibility to incorporate emerging evidence made it particularly effective for Stage 2 implementation and stakeholder consensus-building. The framework's ability to explicitly document assumptions while remaining adaptable demonstrates a practical model for managing complex biological research initiatives.

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Main Report

1 Introduction

This chapter provides an overview of the background and context to the evaluation.

1.1 Background and context

Biocontrol

Weeds pose a significant threat to Australia's biodiversity, agriculture, and overall ecosystem health. The challenge of managing invasive weed species is critical to protecting and improving the natural environment. Traditional methods, such as physical removal and herbicides are not always sustainable or cost-efficient. Biological control (biocontrol) can be more effective in managing weeds by leveraging the natural enemies of weeds, such as insects and fungi, to reduce their populations and impact.

A notable Australian biocontrol success story was the highly effective population control of prickly pear in the early 20th century. It was estimated that the area of infestation was growing by 1 million hectares per year. In Queensland and NSW, the use of the cactus moth (*Cactoblastis cactorum)* as a biocontrol agent saw the prickly pear population rapidly decrease – freeing up 7 million hectares of land that was previously infected with the cactus.[1]

As an isolated continent with distinctive ecosystems, Australia has been particularly vulnerable to invasive species, which cost the economy approximately $25 billion annually in agricultural losses and control measures.[2] The NSW Government Natural Resources Commission's (NRC) Report (2014) highlighted that the estimated cost of weeds in NSW alone is approximately $1.8 billion p.a.[3]

Managing weeds through traditional methods such as manual labour and mechanical devices to physically remove weeds and herbicides can be both costly and potentially harmful. Physical removal of weeds requires significant labour, which can be expensive and time-consuming, especially over large areas. Herbicides, while effective at reducing weed populations, can be harmful to sensitive environments through non-target effects (e.g., spray drift), have the potential to effect human health if not used properly within regulatory controls. Biocontrol offers a sustainable and environmentally friendly tool by using insects and naturally occurring pathogens to manage weed populations at broad landscape and regional scales, often in perpetuity, over many years to decades without further application.[4]

Biocontrol is most effective under conditions where the introduced natural enemies can thrive and establish themselves without causing harm to native species or the ecosystem. Careful selection of biocontrol agents is required to ensure they specifically target the invasive weed without affecting other plants or animals. Additionally, the success of biocontrol depends on thorough research and monitoring to adapt to changing environmental conditions and weed dynamics. It is particularly useful in areas where traditional methods are

[1] Queensland Department of Agriculture and Fisheries (2024). *Prickly pear story (Opuntia spp. other than O. ficus-indica).* Accessed 31 October 2024: https://www.publications.qld.gov.au/dataset/68f0e6d9-5460-4518-bccb-c28099fd0735/resource/74df8f28-2f97-4f78-9a6d-da8cb8aaaf06/download/prickly-pear-story.pdf

[2] Hoffmann, B.D., & Broadhurst, L.M. (2016). *The economic cost of invasive species in Australia*. NeoBiota, 31, 1-18.

[3] NSW Govt. Natural Resources Commission (2014*) Weeds – Time to get serious*. Accessed 31 October 2024: https://www.nrc.nsw.gov.au/Weed%20management%20-%20Final%20report%20-%20May%202014.pdf

[4] CSIRO (n.d.). *Weed Biological Control*. Accessed 1 November 2024: https://research.csiro.au/weed-biocontrol/

impractical or cannot provide long-term solutions.[5] Biocontrol can also be utilised in complementary ways with other traditional weed control tools, to enhance overall management outcomes.[6]

Biocontrol is a globally recognised strategy for managing invasive species. Many countries have successfully implemented biocontrol programs to address their unique weed challenges. In the United States of America (USA), the use of beetles to control invasive aquatic weeds like hydrilla has shown promising results. International collaboration and sharing of biocontrol research and techniques can enhance the effectiveness of these programs worldwide.[7] Non-governmental organisations such as the Food and Agriculture Organisation of the United Nations[8] and CABI[9] provide authoritative voices on the use and legislation of biocontrol agents, while international collaboration in biocontrol research also occurs between governmental organisations, for instance, between CSIRO and United States Department of Agriculture (USDA).[10]

The Biocontrol Research for Weed Management Project

The Biocontrol Research for Weed Management Project (the Project) aims to mitigate the adverse effects of priority environmental weeds in NSW through the use of biocontrol agents. The Project is structured in multiple stages:

Stage 1: Framework Development and Prioritisation: The first stage developed and applied a framework to prioritise weed species for biocontrol research. This framework was designed through consultation with stakeholders, including environmental scientists, ecologists and land managers. It incorporates criteria such as the weed's impact on biodiversity, its spread and prevalence, and the potential effectiveness of biocontrol agents. Stage 1 was completed in 2017.

Stage 2: Research: The second stage researched potential biocontrol agents and identified candidate agents from previous or ongoing biocontrol projects both in Australia and internationally. Laboratory and field studies were conducted to gather data on the safety and effectiveness of these agents, to ensure selection of biocontrol agents for potential release that pose no threat to non-target species and that can effectively control the target weed populations. Stage 2 was completed in 2021.[11]

Stage 3: Research, release and evaluation: Stage 3, which commenced in 2019, consists of 5 'Implementation Plans' (IPs), each of which involves research, release and monitoring of new biocontrol agents. These Implementation Plans focus on separate biocontrol subjects and run concurrently, with one IP commencing every year from 2019 to 2023, each with a duration of 2-4 years. As Stage 3 commenced prior to the completion of Stage 2, the Project does not necessarily build directly upon the research conducted in Stage 2, instead conducting work upon new biocontrol agents. Project timelines and the Stages subject to evaluation in this report are outlined in Figure 1.1.

[5] Cullen, J.M., Sheppard, A.W. and Raghu, S. (2022). Effectiveness of classical weed biological control agents released in Australia. *Biological Control*, 166, p.104835. doi:https://doi.org/10.1016/j.biocontrol.2021.104835.

[6] Department of Primary Industries (n.d.). *Integrated weed management*. Accessed 13 December 2024: https://www.dpi.nsw.gov.au/biosecurity/weeds/weed-control/general-management/integrated-weed-management

[7] AgriFutures Australia (2023). *Australian landowners engage new biological control agents for problem weeds*. Accessed 1 November 2024: https://agrifutures.com.au/news/australian-landowners-engage-new-biological-control-agents-for-problem-weeds/

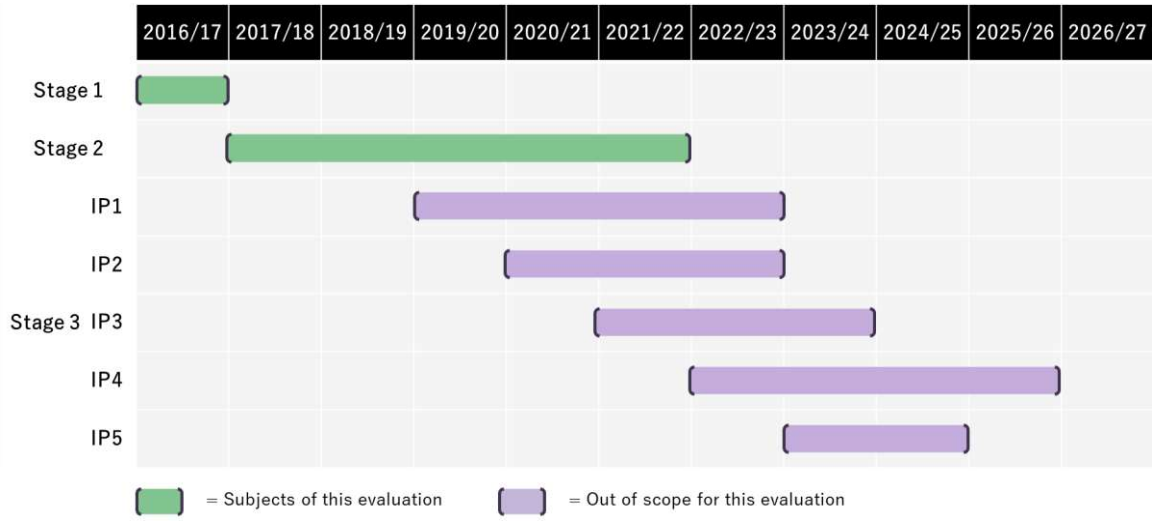
[8] Food and Agriculture Organisation of the United Nations (n.d.). *Introduction: Biological Pest Control Agents*. Accessed 12 November 2024: https://www.fao.org/pesticide-registration-toolkit/special-topics/biological-pest-control-agents-bpca/introduction/en/

[9] CABI (n.d.). *BioProtection Portal*. Accessed 12 November 2024: https://bioprotectionportal.com/

[10] USDA (2024) *USDA ARS Australian Biological Control Laboratory*, Accessed 13 December 2024: https://www.ars.usda.gov/office-of-international-research-engagement-and-cooperation/australia/

[11] With the exception for a variation approved to conduct supplementary work on the biocontrol of the leaf-cactus. This is discussed further in **Table 2.3**.

Figure 1.1 Timeline



Note: A variation was approved at the end of Stage 2 for an 18-month extension for additional testing, bringing the ultimate completion of Stage 2 to 2022-23.

Source: ACIL Allen

The NSW Environmental Trust (the Trust) funded a CSIRO led consortium to the total value of $1 million (ex. GST) from 1 June 2016 to 29 October 2021 to deliver Stages 1 and 2 of the Project.

The primary objectives of the Project were to:

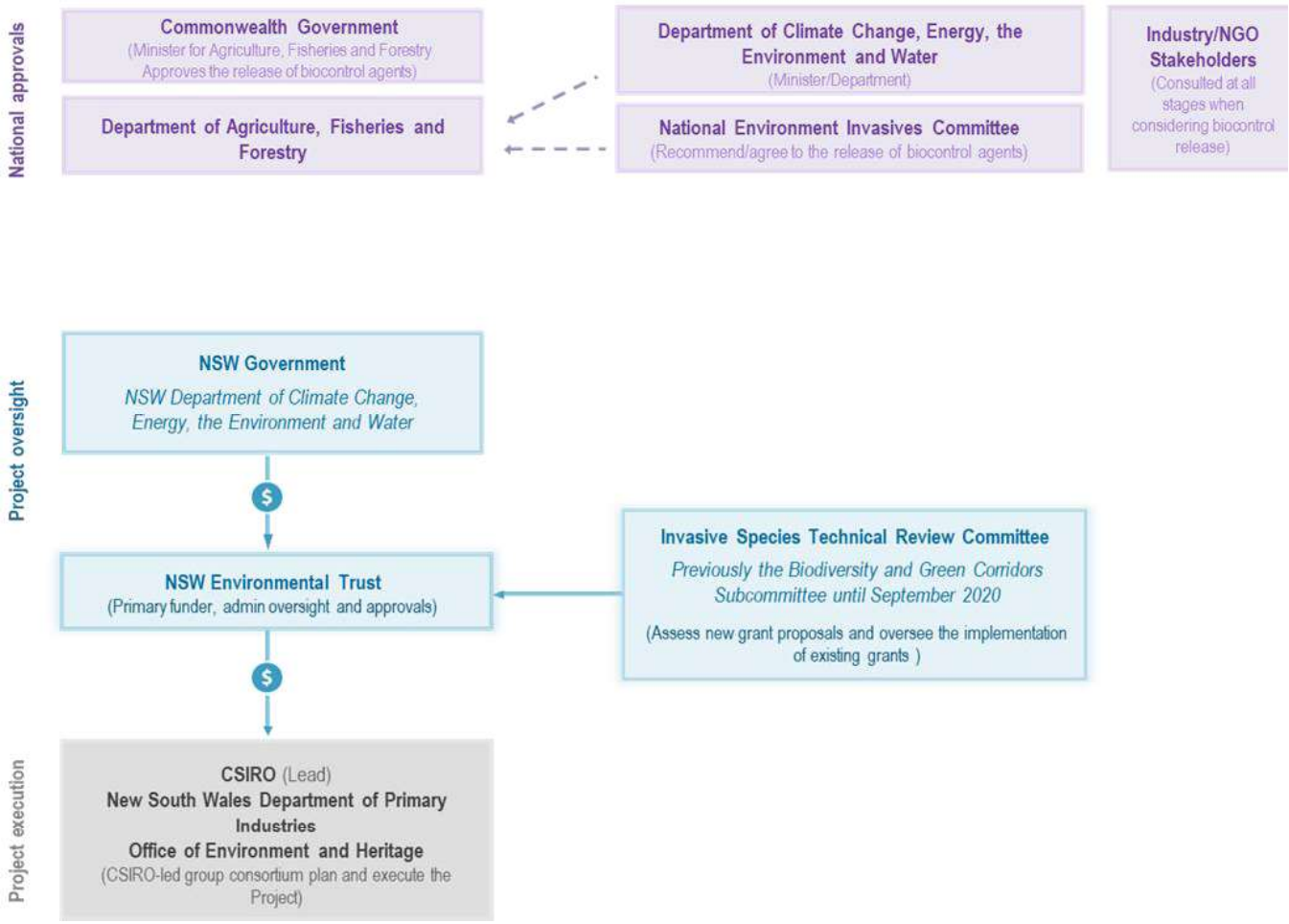
- Identify and prioritise target weeds based on their impact on biodiversity and ecosystem health.
- Research and test biocontrol agents that are effective, target-specific, and environmentally sustainable.

The oversight and governance arrangements for the project are shown in Figure 1.2 and are organised into three key areas:

- **National approvals process**: Requests for approval to release candidate biological control agents for a target weed are made to the Australian Department of Agriculture, Fisheries and Forestry (DAFF) – Plant Import Operations Branch. The assessment of the application is made using a risk analysis undertaken by DAFF in accordance with the Biosecurity Import Risk Analysis guidelines. The draft risk analysis report is then distributed to state and territory departments of primary industry and the CSIRO through the Plant Health Committee, with independent comments received incorporated into the draft risk analysis report. For weed biocontrol agents that are animals, further approvals for import and release are required to be sought through the Australian Department of Climate Change, Energy, the Environment and Water under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- **NSW project oversight**: The NSW Environmental Trust, as primary funder, provides administrative oversight and approvals through its technical committee structure. These committees, established under Part 2 section 9 of the *Environmental Trust Act 1998*, independently assess grant proposals and oversee implementation. For this Project, oversight transitioned from the Biodiversity and Green Corridors Subcommittee to the Invasive Species TRC in September 2020, which assesses grant proposals and oversees implementation.

— **Project execution**: A CSIRO-led consortium, including the NSW Department of Primary Industries (DPI) and NSW Office of Environment and Heritage (OEH) (now known as NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW)), provides recommendations for investment to the TRC, and plans and executes the Project. The consortium operates under the funding and administrative framework established by the Trust.

Figure 1.2 Oversight map of the Project



Source: ACIL Allen

This evaluation

The Trust engaged ACIL Allen to conduct an independent evaluation of Stages 1 and 2. The evaluation has been guided by an evaluation framework (Appendix A) and involved consultation with 7 stakeholders (Appendix B), including representatives from the Trust, consortium members, research partners and landholders involved in the Project, and analysis of program documentation.

2 Evaluation findings

This chapter provides the evaluation findings according to the evaluation domain and KEQ.

2.1 Overview of evaluation findings

Overall, the Project has been successful. The funding and design of the Project was in line with needs identified from government reviews and stakeholder lobbying, and appropriate in its focus on environmental rather than agricultural weeds. The Project delivered value for money and was generally delivered on time and on budget, with CSIRO providing significant in-kind contributions and often securing matching funding that effectively multiplied the initial investment.

The program management arrangements provided effective oversight through a multi-layered governance structure, with CSIRO demonstrating strong day-to-day management supported by advice received from the Technical Review Committees and a consortium approach between key partners, DPI and DCCEEW.

The evaluation identified some opportunities to improve administrative arrangements, particularly in streamlining project variation processes and the need for more comprehensive lifecycle planning, including how biocontrol could be incorporated into ongoing weed control programs from the outset.

An overview of the evaluation findings is provided in Table 2.1. We have used Harvey balls to summarise the evaluation findings and demonstrate the degree to which the Project has been assessed as meeting the KEQs. The KEQs have been grouped into 3 thematic areas - Design, Implementation & Governance, and Opportunities - to provide a logical structure for analysing related aspects of the Project. Within each thematic area, the KEQs are ordered based on their relative interconnectedness, rather than numerical sequence, to facilitate clearer analysis of the findings. The evaluation findings are discussed below.

Table 2.1 Overview of evaluation findings

KEQs	Assessment
Design	
2. To what extent did the Project address the identified need and was it the most appropriate thing to do?	
1. How appropriate was the planning process in the initial scoping phase?	
6. To what extent was the Project appropriately planned and scoped to ensure delivery of intended outcomes and effective measurement of these outcomes?	
Implementation & Governance	
Project management	
11. How well managed was the Project?	
12. To what extent were the methods for making decisions and managing the Project appropriate and likely to ensure success?	
5. To what extent were the Project's activities implemented as intended? If not, why, and what was the impact?	
Efficiency	
8. How efficient were the planned project activities?	
4. To what extent was the Project on time and on budget?	

KEQs	Assessment
9. What were the project implementation costs, and were these efficient? To what extent could resources have been allocated more efficiently?	●
Risk Management	
13. What were the associated risks with governance, financial management and project planning and how were these managed?	●
Value for money	
3. To what extent was the expenditure appropriate for the Project?	●
7. Were the intended outputs delivered and do they represent value for money?	●
10. Did the Project deliver value for money?	●
Opportunities	
14. What were the lessons learned and/or other opportunities related to the Project?	●
15. What could be done differently?	◕

Legend: ○ no achievement ◔ minimal achievement moderate achievement ◑ moderate achievement ◕ strong achievement ● very strong achievement.

Source: ACIL Allen

2.2 Design

KEQs in this section focus on addressing the questions related to the design of the Project.

Findings

The Project effectively addressed a critical gap in NSW's weed management capacity by focusing on environmental weeds and biocontrol research, directly responding to the 2014 Natural Resources Commission review that highlighted alarming declines in biocontrol expertise and resources. ●

The initial planning phase demonstrated strong technical merit through CSIRO's expertise in weed prioritisation and effective partnerships with DPI and DCCEEW. The focus was primarily on developing robust scientific methodology for biocontrol agent selection and testing, though there were opportunities to further integrate this work with broader weed management approaches and post-control land rehabilitation strategies. ◕

CSIRO's project planning and scoping throughout the Project ensured the intended outcomes were delivered and measured effectively, despite challenges in timelines and unpredictable processes, such as approvals and the outcomes of experimentation. ◕

KEQ 2. To what extent did the Project address the identified need and was it the most appropriate thing to do?

Stakeholders reported that the Project directly responded to critical needs identified in the 2014 NRC review of weed management in NSW.[12] Following the release of the 2014 NRC report and the subsequent *Biosecurity Act 2015*, the Trust Administration met with the NRC and identified biocontrol options for weed management as an opportunity for investment that aligns with the *Biosecurity Act 2015*.

This review highlighted significant concerns about the declining state of weed research and development in NSW, particularly in critical areas such as biocontrol. The report noted:

> *"The increasing loss of weeds research capacity at both national and state levels has been a consistent theme of this review. There is additional concern that some capability, such as biological weed control, is at risk of being lost altogether."*

The review provided stark evidence of this decline:

> *"Today NSW has three biocontrol scientists, no technical officers, no biocontrol officers funded through consolidated revenue and no biocontrol budget."*

This situation underscored the urgency and relevance of the Project. The review's Recommendation 7 explicitly called for action to address this decline:

> *"The NSW Government should:*
>
> *a. commit long-term funding for the strategic rebuilding and maintenance of NSW weeds research capacity*
>
> *b. prioritise and coordinate strategic research investment"*

Furthermore, the review emphasised the importance of collaboration and long-term commitment:

> *"d. actively participate in this organisation through secure long-term investment, expertise and in-kind contributions"*

This external validation, coupled with ongoing lobbying efforts calling for the state government to address various weed issues, provided a strong impetus for the Project. The review's emphasis on rebuilding weeds research capacity, particularly in areas like biocontrol, provided robust justification for increased investment and focus in this area.

The Project was structured in two phases with specific objectives:

- Phase 1: Develop a prioritisation framework to identify suitable weed targets for biocontrol
- Phase 2: Conduct preliminary testing to assess biocontrol suitability for priority species.

The Project strategically focused on environmental weeds rather than agricultural weeds, addressing a critical gap in weed management efforts at the time. While DPI was responsible for coordinating and funding weeds research in NSW, its work primarily centred on agricultural impacts. This Project's environmental focus complemented existing agricultural weed management initiatives without duplicating them. The Project's emphasis on developing a prioritisation framework and identifying biocontrol agents aligned directly with the Commission's recommendations for strategic research investment and long-term capacity building.

[12] NSW Govt. Natural Resources Commission (2014) *Weeds – Time to get serious*. Accessed 31 October 2024: https://www.nrc.nsw.gov.au/Weed%20management%20-%20Final%20report%20-%20May%202014.pdf

KEQ 1. How appropriate was the planning process in the initial scoping phase?

The planning process in the initial scoping phase was well-executed in terms of its technical approach but had strategic limitations, particularly in long-term planning and integrating clear long-term objectives into the overall design.

Planning process was compartmentalised, focusing primarily on the technical aspects of weed prioritisation and biocontrol agent selection (Stages 1 and 2) without sufficient consideration of how agents, if successful could form part of integrated weed management strategy.

Even though there seemed to be a general understanding of the future direction and goals of the activities undertaken across current and future stages, this wasn't clearly documented or shared. The initial planning and scoping processes focused primarily on the immediate phase of the project, without sufficiently anticipating or preparing for potential future phases. This approach missed an opportunity in the initial planning for Stage 1 or for Stage 1 activities to look ahead, predicting the broader trajectory of the project and laying the groundwork for subsequent stages. Ideally, the initial phase should have included planning for later phases, ensuring a more cohesive and strategic progression beyond the immediate scope.

This lack of forward planning could create gaps in several critical areas in the future:

- pathways from successful biocontrol to practical field implementation
- planning for post-weed control land rehabilitation requirements integration with holistic weed management approaches on the ground.

This segmentation arose given the practical constraints at the time, including limited initial funding and the need to demonstrate success in the core technical areas before securing support for broader implementation. The Project team needed to balance ambitious long-term goals with the reality of securing initial support and demonstrating concrete progress. While this pragmatic approach enabled the Project to proceed, it meant later stages (Stage 3) were not fully integrated from the start.

The initial planning phase was therefore appropriate for its immediate technical objectives but would have benefited from a more comprehensive lifecycle approach, even if full funding for later stages wasn't initially secured.

Regarding delivery partners, CSIRO's extensive experience in weed prioritisation positioned them as a technically capable delivery partner, and their partnership with DPI and DCCEEW brought together appropriate expertise and stakeholder representation.

In terms of the consortium's project execution of the defied scope established for the project, this was delivered as intended as discussed in Section 2.3 Implementation & Governance.

KEQ 6. To what extent was the Project appropriately planned and scoped to ensure delivery of intended outcomes and effective measurement of these outcomes?

The Project demonstrated a high level of appropriate planning and scoping, which significantly contributed to the delivery of intended outcomes and facilitated effective measurement. CSIRO followed standard procedure in the development of key tools included in the business plan to guide and track their performance and progress, such as a Gantt chart for each sub-project (each biocontrol target). The sub-project Gantt charts were updated to reflect and mitigate any complications that would impact timelines. Similarly, an outcomes hierarchy and evaluation framework was produced to guide the planning, scoping and monitoring of activities.

Stage 1 was appropriately planned to ensure delivery of intended outcomes. However, the planning/scoping of Stage 2 was more challenging due to the complex requirements and myriad considerations that inform the decision to approve/decline the release of each biocontrol agent. As a result, there was an added a degree of unpredictability to project timelines. This is best exemplified in the variation approved at the end of Stage 2 that allowed for additional testing over 18-months on the biocontrol agent for *Cardiospermum grandiflorum* (balloon vine) (see Table 2.3).

Metrics used to populate the outcomes hierarchy and evaluation framework were meaningful and allowed the Project's outcomes to be measured effectively.

2.3 Implementation & Governance

KEQs in this section focus on addressing the questions related to the project implementation and governance.

Project management

Findings

The Project was well-managed, with CSIRO providing effective day-to-day management guided by a consensus-based consortium approach.

The decision-making methods, including the use of a subcommittee and consensus-based consortium, were appropriate and significantly contributed to the Project's success by ensuring both diverse inputs and buy-in.

The Project successfully delivered its intended outputs across both stages through effective consortium management and the Trust's flexible funding approach enabled adaptive management when biocontrol research findings necessitated shifts in priorities or approaches.

KEQ 11. How well managed was the Project?
KEQ 12. To what extent were the methods for making decisions and managing the Project appropriate and likely to ensure success?
KEQ 5. To what extent were the Project's activities implemented as intended? If not, why, and what was the impact?

Overall organisational structure

The organisational structure of the Project was comprehensive, involving multiple layers of governance and implementation (Figure 1.2). The Trust served as the primary funder and had administrative oversight of both stages, supported by technical review committees.

Consortium and day-to-day management

CSIRO led the day-to-day management of the Project as part of a consortium that included DPI and DCCEEW. This consortium structure brought together complementary expertise and capabilities from each partner organisation.

The decision-making process was guided by a consensus-based approach, which provided important checks and balances while fostering collective ownership of Project outcomes. While CSIRO managed daily operations, all major decisions incorporated input from DPI and DCCEEW representatives. This collaborative model enabled efficient allocation of tasks based on each partner's strengths, ensuring comprehensive coverage of both technical and policy requirements.

Technical oversight and review

Strategic direction and technical oversight were initially provided by the Biodiversity and Green Corridors Subcommittee from the inception of Stage 1 until 14 September 2020. After this date, oversight transitioned to the Invasive Species Technical Review Committee (TRC). Throughout both periods, these committees provided technical review and approval, offering advice to the Trust which generally endorsed their recommendations, ensuring alignment between technical expertise and funding decisions.

In Stage 1, the Biodiversity and Green Corridors Subcommittee considered the prioritisation framework developed by the consortium and provided recommendations to the Trust Board, which ultimately decided on the top 6 priority weeds to be included in the development of the Implementation Plan for Stage 2.

The Project's prioritisation process in Stages 1 and 2 strategically incorporated Commonwealth-level considerations, with the TRC's advice on weed targets and biocontrol agents reflecting its understanding of the complex approval requirements from the Department of Agriculture, Fisheries and Forestry and potential Environment Protection and Biodiversity Conservation Act triggers. This early consideration of Commonwealth approval likelihood - including intergovernmental consultation requirements and environmental impact assessment - helped ensure research resources were directed towards biocontrol agents with higher prospects of successful release approval.

The technical committees structure provided an additional layer of expert input and oversight at key milestones in the project. These committees offered technical approvals and reviews, ensuring that decisions were grounded in technical expertise and aligned with broader environmental and biosecurity objectives. The technical oversight provided by the TRC further strengthened this arrangement, ensuring alignment between technical expertise and funding decisions. For example, the Invasive Species TRC consisted of academics with expertise in relevant areas, as well as senior members of DPI, Local Government NSW, NSW National Parks and Wildlife Service, the Invasive Species Council and private sector experts in topics such conservation and invasive species.

This collaborative approach was particularly effective in facilitating smooth project administration, with the relationship between CSIRO and Trust staff was highlighted by stakeholders as especially productive.

Trust's role and flexible implementation

The Trust's role in administrative oversight, coupled with its collaborative approach with CSIRO, facilitated efficient decision-making processes. The Trust's guidance through complex administrative procedures, such as the business plan process, was instrumental in navigating potential bureaucratic hurdles.

Stakeholders valued the degree of flexibility built into the process to allow for adaptive management. This flexibility proved to be a key strength of the project implementation.

> *"The Trust provided a lot of flexibility to pivot as needed if things weren't working ...and reprioritise to another target with good success."*
>
> *CSIRO*

The Trust's willingness to allow for reprioritisation was particularly valuable in the context of weed biocontrol research, where the effectiveness of control measures can be unpredictable and dependent on various environmental and biological factors. This flexibility enabled the consortium to shift focus and resources to alternative targets when initial approaches proved less promising, ensuring the Project maintained momentum and maximised its potential impact.

Project delivery

The Project's activities were implemented as intended, Stage 1 successfully delivered its intended outputs, including the development of a comprehensive prioritisation framework. Stage 2 successfully delivered its intended outputs, including the identification of suitable biocontrol agents. Key to these activities being implemented as intended was the consortium approach and the flexibility applied to the funding arrangement.

Framework development and prioritisation - Initial target selection (Stage 1)

CSIRO initially evaluated 266 weed species using a prioritisation matrix, resulting in a two-tiered shortlist of 17 species for potential biocontrol investment. The results were presented to the Biodiversity and Green Corridors Subcommittee which selected 5 priority species for Stage 2: balloon vine, *Euphorbia paralias* (sea spurge), *Pereskia aculeata* (leaf cactus), *Schinus terebinthifolius* (broadleaved pepper tree), and *Tecoma stans* (yellow bells) (see Table C.1 for targets and their respective biocontrol agent names).

Research and preliminary evaluation – Laboratory and field studies (Stage 2)

The Stage 2 investigations yielded limited success, with only sea spurge's biocontrol agent receiving approval for release. Other targets faced various challenges:

- balloon vine and broadleaved pepper tree agents were not sufficiently host-specific
- the agent for leaf cactus required additional testing (see Table 2.3) but ultimately proved unsuitable
- yellow bells, while endorsed as a target, wasn't pursued due to budget constraints and being seen as relatively lower priority, instead left as a 'back up' if funding could be reallocated from any other sub-projects that were unsuccessful.

The rapid identification of unsuitable agents through systematic testing represents an efficient research outcome, as it allows for timely redirection of resources toward more promising biocontrol candidates.

Research, mass release and evaluation (Stage 3 – out of scope of this evaluation)

Stage 3 commenced in 2021, and consists of 5 separate 'Implementation Plans', each of which involves the release and evaluation of one or more biocontrol agents, as well as additional research to gain approval for new biocontrol agents. The sea spurge biocontrol agent approved in Stage 2 was mass-released as part of Stage 3 - Implementation Plan 3, which is currently ongoing at the time of this evaluation.

Efficiency

Findings

Project activities were efficiently planned, using a robust prioritisation approach in Stage 1 that allowed for strategic allocation of resources and a flexible response to non-viable options in Stage 2. The planned activities were executed efficiently given challenging project management conditions (such as COVID-19) and delivered the intended outcomes.

The Project was delivered within budget and largely on schedule, with the Trust providing valuable flexibility to accommodate necessary variations, enabling CSIRO to adapt timelines and reallocate resources in response to research findings and emerging opportunities.

The Project demonstrated efficient resource allocation through systematic prioritisation and flexible management processes, keeping expenditure within budget while leveraging significant in-kind contributions to expand project capacity.

KEQ 8. How efficient were the planned project activities?
KEQ 4. To what extent was the Project on time and on budget?
KEQ 9. What were the project implementation costs, and were these efficient? To what extent could resources have been allocated more efficiently?

Project design and approach

A key strength of the Project's design was the clear sequencing between stages, where the Stage 1 prioritisation framework created efficiencies for Stage 2 by systematically identifying the most promising weed targets through a transparent, matrix-based approach. This framework explicitly laid out assumptions about weed impacts and biocontrol prospects, enabling efficient allocation of Stage 2 research resources towards the most viable biocontrol opportunities while maintaining flexibility to adapt as new evidence emerged through laboratory and field studies.

Importantly, the Trust and CSIRO recognised the inherent complexities and uncertainties in weed management research. By acknowledging that identifying ineffective strategies can be as valuable as finding successful ones, the Project maintained a balanced and realistic approach to assessing its impact.

> *"It's hard to know what success is...sometimes ruling out the options that don't work can be just as helpful."*
>
> *CSIRO*

This allowed the team to stop work once a dead end was reached or to reallocate funding for further testing when warranted. By quickly identifying non-viable options and redirecting efforts to more promising avenues, this approach enabled more efficient use of resources.

Financial management

The Project demonstrated strong financial management staying by and large on budget. CSIRO's significant in-kind contributions and success in securing matching funding effectively expanded the Project's resources. This financial performance was supported by efficient project administration and a collaborative relationship between CSIRO and Trust staff.

CSIRO provided $44,026 in in-kind contributions that exceeded the allocated grant funding amount. Actual grant expenditure was closely aligned with the approved project budget, with each item varying no more than 2%, as highlighted in Table 2.2. Furthermore, approximately 5% of the direct project costs were utilised for administration, which is well below the cap of 10% of direct project costs (excluding salary on-costs).

Table 2.2 Stage 1 and 2 total grant expenditure by item

Item	Approved Trust Grant Funding ($ ex. GST)	Actual Expenditure of Trust Funding ($ ex. GST)	Variation
Salaries - officer/s	620,486	636,960	2%
Salary on-costs	155,121	161,622	1%
Consultancies	64,000	77,006	1%
Materials	51,930	50,769	0%
Transport Costs	2,000	10,004	1%
Salary for NSW DPI	14,623	15,825	0%
Salary oncosts for NSW DPI	3,770	3,770	0%
Administration	38,000	38,000	0%
Total	949,930	993,956	5%*

Source: Project Final Financial Report, ACIL Allen

**$44,026 overspend provided as in-kind contributions from CSIRO*

Despite limited initial funding, CSIRO maximised project value through significant in-kind contributions and a flexible, tiered approach that enabled rapid redirection of resources from non-viable options to promising opportunities, while securing co-contributions of funds from research partners that effectively multiplied the initial investment.

Project Variations

CSIRO has sought 3 variations to the Grant Agreement with the Trust. These include one extension of timelines, and two variations for changes to the project activities, each outlined briefly in Table 2.3. These variations were approved by the Trust.

Table 2.3 Variations

Description	Date of Submission	Date of Approval
Change of candidate agent for balloon vine due to technical feasibility concerns.	March 2018	April 2018
Reallocation of resources from balloon vine to sea spurge agent.	November 2020	November 2020

Description	Date of Submission	Date of Approval
An 18-month extension and additional activities to be undertaken including: – import and establish colonies of agent – perform host-specificity tests[13] – submit to DAWE* for review – while waiting for review, maintain colony of agent and undertake field surveys. These activities were completed by April 2023.	October 2021	November 2021

Note: *former Commonwealth Department of Agriculture, Water and the Environment; now the Department of Agriculture, Fisheries and Forestry

Source: Project Final Report, ACIL Allen

CSIRO considered that the Trust had provided a flexible and timely approach to variations and understood the unpredictable nature of biocontrol research. The Trust's understanding of the need for adaptability in biocontrol research enabled the project to maintain progress while accommodating necessary adjustments.

Resource constraints and prioritisation

The project implementation costs were carefully managed to maximise efficiency within the constraints of the available budget. A key challenge in resource allocation was balancing the ambitious scope desired by the subcommittee with the limited funds available. This situation required strategic prioritisation and careful management of expectations.

Stage 1 identified additional weed species that could benefit from investigation in Stage 2, though the available budget necessitated focusing on a prioritised subset of targets. This situation required the consortium to carefully balance scope with available resources, prioritising weeds based on potential impact and likelihood of successful intervention. This prioritisation was highlighted in the case of the targeting of yellow bells. CSIRO first aimed to see whether yellow bells could be endorsed for targeting due to potential conflicts, but (in the case that it was approved for targeting) would not conduct further research unless another sub-project failed and funds could be reappropriated. Indeed, yellow bells were endorsed for targeting, but not pursued. Without budget constraints present, further research may have been pursued in the biocontrol of yellow bells in Stage 2.

While this approach helped to maintain efficiency within the given budget constraints, it also highlighted potential areas where resources could have been allocated if additional funding had been available.

Risk Management

Findings

Risks were managed through clear governance structures, flexible financial management, and adaptive planning processes that allowed for pivoting when needed.

[13] Host-specificity tests aim to measure whether the biocontrol agent is specific to the target weed, or whether it could potentially impact non-target flora.

KEQ 13 What were the associated risks with governance, financial management and project planning and how were these managed?

The project demonstrated effective risk management through a combination of structured governance and flexible financial management. Project documentation included consideration and development of mitigation strategies to prevent risks such as the possibility of adverse community reaction, inadequate quality and transparency, or difficulty in establishing a consortium.

Governance risks were mitigated through a multi-layered structure that provided clear lines of responsibility and oversight. The consortium approach, led by CSIRO but involving key stakeholders like DPI and DCCEEW, ensured shared responsibility and diverse expertise in decision-making. This structure helped to distribute governance risks and prevent single-point failures in project management.

Financial management risks were addressed through flexible approaches tailored to the unpredictable nature of biocontrol research. The biocontrol discovery process inherently carries risks where significant resources may be invested in testing potential agents that ultimately prove unsuitable or face import/approval barriers. The Project managed this risk through ongoing assessment of agent viability, with research teams redirecting efforts and resources when specific agents proved unsuitable or faced regulatory challenges. These adjustments were managed through the Technical Review Committee's variation process.

The Trust's role in administrative oversight, combined with its collaborative relationship with the consortium, enabled a responsive approach to research allocation. The Trust's role in administrative oversight, combined with its collaborative relationship with the consortium, enabled a responsive approach to resource allocation. This flexibility was particularly valuable where needs shifted based on scientific findings, import restrictions, or technical challenges, ensuring research funds were used effectively despite the inherent uncertainties of biocontrol research.

Value for money

Findings

The consortium maximised the return on investment through significant in-kind contributions and securing co-funding from research partners. The comprehensive development of the prioritisation framework provided an approach that enabled rapid redirection of resources from non-viable options to promising opportunities, maximising return on investment.

The intended outputs, including the prioritisation framework and identification of potential biocontrol agents, were successfully delivered and represented good value for money.

The Project delivered good value for money, producing a reusable prioritisation framework that can be continuously applied as weed threats evolve to identifying further potential biocontrol agents. The potential for long-term cost savi in weed management through improved targeting and efficiency suggests ongoing benefits from the investment.

KEQ 3 To what extent was the expenditure appropriate for the Project?
KEQ 7 Were the intended outputs delivered and do these represent value for money?
KEQ 10 Did the Project deliver value for money?

Overall value assessment

In assessing the Project's overall value for money, it is important to consider both the tangible outputs and the broader impacts of the Project. Stakeholders, including CSIRO representatives (who were closely involved in the Project's implementation) expressed the belief that the Project represents good value for money. This assessment is based on both the direct outputs and also the potential long-term benefits of the research and the capacity building that occurred throughout the Project.

Efficient resource management

The Project's staged funding approach proved strategically effective. Stage 1 was sufficiently resourced to develop the comprehensive prioritisation framework and complete thorough weed assessments. While Stage 2's biocontrol agent testing could have utilised additional funding, the limiting factors extended beyond financial resources to include laboratory capacity and regulatory processes. Importantly, the overall funding allocation ($950,000, with only 3% over expenditure) successfully achieved its broader strategic objective of re-establishing biocontrol research as a priority in NSW's weed management agenda.

CSIRO further enhanced this investment through significant in-kind contributions and co-funding from research partners.

> *"CSIRO often got matching funding for projects, so the little money ended up going a long way."*

Furthermore, the Project's ability to leverage matched funding significantly enhanced its value for money. This ability to attract additional resources effectively multiplied the initial investment, allowing for a broader scope and more comprehensive outcomes than would have been possible with the original funding alone.

Flexible implementation

The Project's flexible implementation was particularly valuable, with the Trust supporting necessary adaptations as the Project progressed. The Trust approved 3 variations to allow CSIRO to adapt its approach to changes in circumstances, particularly in response to certain biocontrol agents being found to be unviable or unsafe for release. This allowed CSIRO to reallocate funding to the most promising biocontrol agent(s) as the Project progressed. The framework allowed for adjustments as new information became available, maintaining the ability to pivot in response to research findings - a crucial element for biocontrol research success.

COVID-19 presented a significant challenge to the logistics of the research in Stage 2, especially in regard to international research partnerships and sourcing of biocontrol agents from international organisations (such as in South Africa and the USA). For example, savings on international travel which could not be conducted due to COVID-19 were repurposed to test the agent for the leaf cactus on additional species.

Outputs and outcomes

The Project successfully delivered its intended outputs, demonstrating a high degree of effectiveness in achieving its core objectives. The primary deliverables included the development of a comprehensive prioritisation framework and the identification of suitable biocontrol agents. CSIRO developed a lean, focused approach, employing a tiered testing approach for biocontrol agents that allowed quick termination of non-viable options. This strategic resource management successfully reduced potential weed targets from

266 to <20, focusing resources on critical species while balancing the need to address important weeds with achieving early wins.

Of the 5 agents investigated in Stage 2, only the biocontrol agent for the control of sea spurge was approved for release. The other agents were not pursued by CSIRO or not approved for release. Although more approved agents would be a favourable outcome, the complexity of the testing approval process means the ability to get one agent approved was a significant success. Additional finding for Stage 2 may have yielded more agents being pursued, subject to laboratory capacity.

The prioritisation framework, in particular, stands out as a valuable tool for future weed management efforts. By providing a systematic method for assessing and ranking weed species based on their impact and the potential for biocontrol, this framework enables more efficient allocation of resources in future weed management initiatives. This output alone has the potential to enhance the cost-effectiveness of weed control efforts across the state for years to come.

Long-term value

The Project's outputs have the potential to generate significant cost savings in future weed management efforts by improving targeting and efficiency. While a full cost-benefit analysis would be required to quantify the exact value for money, the successful delivery of intended outputs, coupled with positive stakeholder assessments and the potential for long-term impacts, strongly suggest that the Project has provided good value for the investment made.

2.4 Opportunities

KEQs in this section focus on addressing the questions relates to opportunities.

Findings

Key lessons included the importance of flexibility in biocontrol research and the value of a clear, adaptable prioritisation framework.

The initial planning process was strongly focused on scientific and technical aspects of biocontrol research without sufficient consideration of how biocontrol agents would integrate into broader weed management approaches.

KEQ 14. What were the lessons learned and/or other opportunities related to the Project?
KEQ 15. What could be done differently?

While the Project successfully delivered its core research objectives through Stages 1 and 2, the evaluation identified opportunities to strengthen long-term planning and future implementation pathways. This is particularly important to consider as the Project continues to implement Stage 3 which includes field implementation phases.

Planning limitations

The initial planning phase demonstrated strong technical merit through CSIRO's expertise and effective partnerships with DPI and DCCEEW. However, the planning process was overly compartmentalised,

focusing primarily on the scientific methodology of weed prioritisation and biocontrol agent selection. This segmentation, while enabling detailed attention to core technical areas, created gaps in several critical aspects of future implementation planning.

A limitation was the lack of early consideration of how successful biocontrol agents would integrate into broader weed management approaches in the field. While the pathway from laboratory research to potential field implementation was developed in Stage 2, earlier integration of these considerations into project design could have enhanced ultimate implementation success.

Future stages of the Project, and similar future projects, should consider including detailed implementation planning from the outset, such as:

- How biocontrol integrates with other weed control methods and practices?
- What monitoring protocols might be needed for biocontrol agent establishment?
- What post-control site rehabilitation requirements might be needed?
- How long-term ecological outcomes could be monitored?

While the pragmatic approach of securing initial support and demonstrating concrete progress through focused research stages was understandable given funding constraints, future biocontrol projects would benefit from more comprehensive lifecycle planning. This planning should explicitly consider implementation pathways during the research design phase, even if full funding for implementation is not initially secured. Such planning would help ensure research directions align with practical implementation needs from the outset.

Successful elements to build upon

The prioritisation framework developed in Stage 1 emerged as a cornerstone of project success, providing a systematic and transparent foundation for decision-making. This matrix-based approach enabled comprehensive evaluation of potential weed targets against clear criteria related to biodiversity impact and biocontrol potential. The framework's strength lay in its ability to explicitly document assumptions about weed impacts while remaining adaptable to incorporate new evidence as research progressed. This systematic approach proved particularly valuable in Stage 2, where it guided efficient allocation of research resources and facilitated stakeholder consensus-building around research priorities.

The Trust's flexible funding approach was instrumental in enabling efficient research progress. When initial approaches proved unsuccessful or new opportunities emerged, this flexibility allowed CSIRO to rapidly redirect resources while maintaining project momentum. This adaptability was particularly valuable given the limited funding available, as it enabled early termination of non-viable options and strategic reallocation of resources to more promising avenues.

Transparent communication about research uncertainties was what allowed for such flexibility. Open acknowledgment of biocontrol research complexities and potential setbacks helped manage stakeholder expectations effectively. This transparency fostered trust with TRC's and funding bodies, maintaining their support even when research outcomes were uncertain or negative. The consortium structure further enhanced this communication, enabling effective decision-making through shared understanding of challenges and opportunities.

3 Conclusion

This chapter provides concluding remarks and recommendations.

The Biocontrol Research for Weed Management Project (Stages 1 and 2) demonstrated strong overall performance in addressing critical weed management needs in NSW. The Project successfully balanced technical rigor with practical implementation requirements, though opportunities for improvement were identified. CSIRO's leadership, supported by effective consortium partnerships and flexible Trust oversight, enabled the Project to achieve its core objectives while building foundations for future biocontrol research. The evaluation findings across the key domains are summarised below.

Appropriateness

The Project effectively addressed a critical gap in NSW's weed management capacity by focusing on environmental weeds and biocontrol research. This approach directly responded to the 2014 NRC review that highlighted alarming declines in biocontrol expertise and resources. The Project's focus on environmental rather than agricultural weeds was strategically sound, avoiding duplication with existing DPI initiatives while addressing an underserved area.

Effectiveness

The Project successfully delivered its core objectives across both stages. Stage 1 developed a comprehensive prioritisation framework that enabled systematic evaluation of weed targets. Stage 2 successfully identified and tested biocontrol agents, with one agent for sea spurge approved for release while testing ruled out unsafe agents for balloon vine and broadleaved pepper tree. This demonstrated both the effectiveness of the research process and the robustness of the host-specificity testing protocols.

Efficiency

Resource management was notably efficient, with CSIRO maximising value through significant in-kind contributions ($544,000) and securing additional partner co-contributions. The Project stayed within 3% of its allocated budget while maintaining flexibility to redirect resources when needed. The tiered testing approach enabled quick termination of non-viable options, ensuring efficient use of limited resources.

Process

The Project's management structure proved effective, combining CSIRO's technical leadership with a consensus-based consortium approach that incorporated diverse expertise from DPI and DCCEEW. The Trust's flexible administrative oversight enabled timely adaptation to research findings, while technical committees provided crucial scientific oversight. This multi-layered governance structure ensured both technical rigor and administrative efficiency.

Opportunities

While successful in its core objectives, the evaluation identified opportunities for improvement in future biocontrol initiatives. Primary among these is the need for more comprehensive lifecycle planning from the outset, particularly regarding how biocontrol agents integrate with broader weed management approaches and post-control land rehabilitation. The successful elements - including the adaptable prioritisation framework and flexible funding approach - provide valuable models for future biocontrol research initiatives.

Recommendation 1

Future biocontrol research projects should incorporate comprehensive lifecycle planning from the outset that explicitly addresses implementation pathways, including integration with existing weed control methods, monitoring protocols, and post-control site rehabilitation requirements, even if full implementation funding is not initially secured.

The initial project planning focused heavily on scientific methodology and the delivery of the prioritisation methodology and assessment processes. Broader implementation considerations received little attention. Although Stage 2 developed pathways from laboratory to field implementation, earlier planning around practical aspects like integration with existing weed control methods, monitoring protocols, and post-control rehabilitation requirements could have strengthened the project design. This more comprehensive planning approach would better support the transition into Stage 3 field implementation and provide a stronger framework for measuring long-term ecological outcomes.

Recommendation 2

Future biocontrol research projects should retain flexible funding mechanisms that allow rapid redirection of resources when initial approaches prove unsuccessful, supported by clear decision triggers for continuing or terminating specific research pathways.

The Project demonstrated that flexibility in resource allocation was crucial for research efficiency. The Trust's adaptable funding approach enabled CSIRO to quickly pivot from non-viable options to more promising opportunities, maximising the return on limited funding through strategic reallocation. This flexibility was made possible through transparent communication about research uncertainties and maintained stakeholder trust even when outcomes were negative.

Recommendation 3

The prioritisation framework developed in this Project should be adopted as a model for future biocontrol initiatives, with emphasis on maintaining its adaptability to incorporate new evidence while providing clear decision-making criteria.

The framework proved invaluable in guiding efficient resource allocation through its systematic, matrix-based approach to evaluating potential weed targets. Its success in balancing structured decision-making with flexibility to incorporate emerging evidence made it particularly effective for Stage 2 implementation and stakeholder consensus-building. The framework's ability to explicitly document assumptions while remaining adaptable demonstrates a practical model for managing complex biological research initiatives.

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Appendices

A Evaluation framework

This evaluation framework including key evaluation questions (KEQs) was provided by the Trust in Appendix 2 of the Request For Quote (RFQ) for this independent evaluation. These KEQs are the foundation of the evaluation approach. ACIL Allen has omitted one sub-question listed in the RFQ as it was a duplicate of sub-question 12.

Table 1 Indicative evaluation framework

KEQs	Sub-questions
Appropriateness	
To what extent was the project design appropriate?	1. How appropriate was the planning process in the initial scoping phase? 2. To what extent did the Project address the identified need and was it the most appropriate thing to do? 3. To what extent was the expenditure appropriate for the project?
Effectiveness	
To what extent has the project been effective in achieving its outcomes?	4. To what extent was the Project on time and on budget? 5. To what extent were the Project's activities implemented as intended? If not, why, and what was the impact? 6. To what extent was the Project appropriately planned and scoped to ensure delivery of intended outcomes and effective measurement of these outcomes? 7. Were the intended outputs delivered, and do they represent value for money?
Efficiency	
To what extent has the Project operated efficiently?	8. How efficient were the planned project activities? 9. What were the project implementation costs, and were these efficient? To what extent could resources have been allocated more efficiently? 10. Did the Project deliver value for money?
Process	
To what extent has management of the Project contributed to success?	11. How well managed was the Project? 12. To what extent were the methods for making decisions and managing the Project appropriate and likely to ensure success? 13. What were the associated risks with governance, financial management and project planning and how were these managed?
Opportunities	
To what extent were learnings generated by the Project used and could these be applied differently in hindsight?	14. What were the lessons learned and/or other opportunities related to the Project? 15. What could be done differently?

*Noting that value for money has been assessed qualitatively, with quantitative data included, as available.

Source: ACIL Allen

B Stakeholder engagement

Table B.1 presents the stakeholders consulted for the evaluation.

Table B.1 Stakeholder engagement plan

Stakeholder group	Individuals/organisations of interest	Discussion relevant to:
The Trust	– Leanne Hanvey – Arian Moshefi	Stages 1, 2 and 3
CSIRO	– Louise Morrin – Raghu Sathyamurthy – Ben Gooden	Stages 1, 2 and 3
TRC Members	– Pete Turner (NSW DPI)	Stages 1, 2 and 3
Consortium members	– Hilary Cherry – Andrew McConnachie	Stages 2 and 3
Research partners and/or landowners	– Castlereagh Macquarie County Council – Palm Grove/Ourimbah Creek Landcare – Berry Landcare – Landholder	Stage 3

Source: ACIL Allen

C Target weed and biocontrol agent names

Table C.1 outlines the names of the biocontrol target weeds and agents researched in Stage 2.

Table C.1 Stage 2 biocontrol target weed and agent names (common and scientific)

Target weed		Biocontrol agent(s)	
Common name	Scientific name	Common name	Scientific name
Balloon vine	*Cardiospermum grandiflorum*	Rust fungus and seed-feeding weevil	*Puccinia arechavaletae* and *Cissanthonomous tuberculipennis*
Sea spurge	*Euphorbia paralias*	Foliar blight fungus	*Venturia paralias*
Leaf cactus	*Pereskia aculeata*	Stem-wilter bug	*Catorhintha schaffneri*
Broadleaved pepper tree	*Schinus terebinthifolius*	Leaf-feeding thrips	*Pseudophilothrips ichini*
Yellow bells	*Tecoma stans*	n/a^	n/a^

Source: Stage 2 final report

^ No particular agent researched.