

**Expert Witness Report for the Redbank Power Station
Proposal (SSD-56284960)**

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Barraband Consulting Pty Ltd

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1. Introduction

Barraband Consulting Pty Ltd has been engaged by the Environmental Defenders Office on behalf of the Nature Conservation Council of NSW to prepare an export report on the environmental impacts associated with the Redbank Power Station bioenergy project (SSD-56284960) (Project), focusing on:

- (a) the greenhouse gas (GHG) emissions associated with the Project; and
- (b) The ecological issues associated with 'invasive native species' (INS) and its harvesting for use as feedstock for the Project.

Barraband Consulting provides advisory services related to environmental policy and regulation, ecosystem service markets and environmental accounting, including GHG accounting. It was set up in 2019 and is based in Canberra. The personnel responsible for the preparation of this report are:

- Professor Andrew Macintosh – who is a lawyer and economist with 25 years' experience in environmental policy, environmental accounting and environmental markets, and is a leading authority on land use GHG accounting; and
- Professor Don Butler – who is an ecologist and biogeographer and is one of Australia's leading authorities on vegetation management, environmental policy and environmental accounting.

In preparing this report, we agree to be bound by the Code of Conduct in Schedule 7 of the *Uniform Civil Procedure Rules 2005* (UCPR). We have read, understood and complied with Part 31, Division 2 of the UCPR.

The questions we have been asked are as follows.

Question 1: Based on the proponent's estimated INS biomass fuel usage, what area of land will be required to be cleared for the Project?

Question 2: What impact, if any, will the approval of the Project have on rates of clearing of INS?

Question 3: What ecological and climate change impacts (including in relation to the ability to meet emission targets under the *Climate Change (Net Zero Future) Act 2023* (NSW)) will the INS clearing associated with the Project have?

Question 4: Does the Project properly estimate the GHG emissions based on best practice?

Question 5: Is the Project "near net zero CO₂"?

Question 6: What are the GHG emissions implications of burning biomass (of the type of fuel sources proposed by the Project) for electricity?

Question 7: Is the proponents proposed use of carbon offsetting appropriate (and will it adequately offset the impacts of burning the proposed fuel sources)?

Question 8: Any further observations or opinions concerning the impact of the implementation of the Project on the environment?

The remainder of this report is set out as follows. Section 2 provides the background on the Project and context for the assessment, as we understand them. Section 3 provides our answers to the above questions.

2. The Project and Context

Our understanding of the background and nature of the Project and context for the assessment is outlined below.

2.1 Background

The Redbank Power Station is located at 112 Long Point Road West, Warkworth, in the Singleton Local Government Area (within the Hunter Valley, NSW).

The Redbank Power Station originally operated using beneficiated dewatered coal tailings from the nearby Warkworth coal mine. The plant received its original approval on 15 April 1994 and operated until October 2014, when it was placed in care and maintenance. It has been inactive since this time.

In 2020, Hunter Development Brokerage Pty Limited (HDB) lodged an application for modification of the power plant to enable the use of biomass as fuel. This was deemed refused by Singleton Council, after which HDB brought proceedings in the NSW Land & Environment Court. The NSW Land & Environment Court dismissed the proceedings on 3 June 2022 on the basis that the modification application was not “substantially the same” as the original development.

Verdant Earth Technologies Limited later took over the project and, based on an initial scoping report, sought the Secretary’s Environmental Assessment Requirements (SEARs).

On 10 August 2021, the Department of Planning, Industry and the Environment issued SEARs 1596 for the Project. On 30 August 2023, a revised set of SEARs (SSD-56284960) were issued by the then Department of Planning and Environment (now the Department of Planning, Housing and Infrastructure (DPHI)).

Verdant Earth Technologies Limited has prepared an Environmental Impact Statement (EIS) for the Project based on SSD-56284960.

2.2 Project overview

The Project will generate electricity at the modified power plant using up to 700,000 dry metric tonnes (dmt) of biomass per year (equivalent of ~850,000 dmt yr⁻¹ at 25% moisture content).

The biomass feedstock for the plant will be sourced from “standard fuels” and “eligible waste fuels”, as defined under the Protection of the Environment Operations (Clean Air) Regulation 2022 (standard fuels) and Eligible Waste Fuel Guidelines and NSW Energy from Waste Policy Statement (eligible waste fuels).

Standard fuel is defined for these purposes as “an unused and uncontaminated solid, liquid or gaseous fuel that is ... a wood or wood-derived fuel”. The standard fuels proposed to be used in the Project are purpose-grown short-rotation native trees (*Eucalyptus spp.* and *Acacia spp.*), potentially supplemented with grass (*Cenchrus purpureus* and *Sorghum spp.*) and *Agave spp.* crops.

Eligible waste fuel is defined for these purposes as “waste or waste-derived materials considered by the EPA [NSW Environment Protection Authority] to pose a low risk of harm to the environment and human health due to their origin, low levels of contaminants and consistency over time”. The eligible waste fuels proposed to be used in the Project are:

- (a) biomass with no higher order uses arising from INS control on agricultural land;
- (b) biomass with no higher order uses arising from agricultural waste or residues;

- (c) forestry and sawmilling residues (excluding native forestry residues from logging);
- (d) biomass with no higher order uses from approved land clearing activities (other than INS clearing); and
- (e) other sources of eligible waste fuels with no higher order uses.

A two-staged approach is proposed for the Project, described as follows (Feedstock Supply and Characterisation Study, p 5).

Stage 1: The first stage will involve the start-up of operations using biomass (with no higher order uses) sourced primarily from approved land clearing operations (from existing civil and road works), biomass from invasive native species on agricultural land as approved by Local Land Services NSW and potentially a limited amount of purpose grown biomass.

Stage 2: The second stage will involve the introduction or increased use of purpose grown biomass which will be further increased over a period of two to four years from approval, and, if approved and declared an eligible waste fuel by the NSW EPA, the introduction and use of DBF.

The proposed biomass feedstock sources are summarised in Table 1.

Table 1. Projected feedstock quantities for pre-start, stages 1 and 2 and ongoing operations (Table 4.1 from the Feedstock Supply and Characterisation Study)

Fuel Type		Pre-Start (0-8 months)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6 and onwards
Standard Fuels								
Purpose grown fuel crops	tonnes	-	50,000	100,000	200,000	400,000	490,000	490,000
	%	-	7%	14%	29%	57%	70%	70%
Eligible Waste Fuels								
Biomass from invasive native species control	tonnes	-	500,000	450,000	350,000	180,000	90,000	90,000
	%	-	71%	64%	50%	26%	13%	13%
Biomass from Agricultural wastes	tonnes	-	-	50,000	50,000	50,000	50,000	50,000
	%	-	-	7%	7%	7%	7%	7%
Biomass from approved land clearing works	tonnes	-	150,000	100,000	50,000	20,000	20,000	20,000
	%	-	21%	14%	7%	3%	3%	3%
Domestic Biomass*	tonnes	-	-	-	50,000	50,000	50,000	50,000
	%	-	-	-	7%	7%	7%	7%
TOTAL	tonnes	-	700,000	700,000	700,000	700,000	700,000	700,000

The proponent suggests the standard fuel will be purpose grown biomass, mostly from short-rotation hardwood plantations. From year 5 onward, it is envisaged that these plantations will provide 70% of the biomass feedstock for the power plant (490,000 dmt yr⁻¹). To supply the targeted 490,000 dmt yr⁻¹, the proponent suggests the Project will require a total of 60,000 ha, assuming 4-year rotations and a yield of 35 dmt ha⁻¹ (with the inclusion of an uncertainty buffer). Meeting this target will necessitate 15,000 ha of plantings per year over Stage 1 of the Project.

The proponent suggests the primary eligible waste fuel will be biomass from INS clearing in the Western Local Land Services (LLS) region of NSW, and possibly the Central West LLS.

The Feedstock Supply and Characterisation Study prepared by the proponent states (at p 51):

Verdant have been working with Western LLS and a local business organisation Western Regeneration Pty Ltd, based in Cobar to enter into a supply agreement for up to 500,000 tonnes per annum of biomass from their approved INS clearing. Verdant Earth are also in discussion within the Central West LLS about establishing similar supply agreements with local landowners in their area.

The Higher Order Use Study submitted by the proponent as part of the application states that INS harvesting is likely to yield 25 dmt ha⁻¹ (central estimate). The study notes there is uncertainty around this central estimate, with yields possibly ranging from 5-40 dmt ha⁻¹.

In relation to the proposed biomass feedstock sources and division between short-rotation hardwood plantations and INS, the proponent's Feedstock Supply and Characterisation Study states (at p 39):

Note that these are indicative targets and that actual feedstock mix may vary due to fuel availability fluctuations in market conditions. Other potential sources of eligible waste fuels with no higher order uses will also be considered.

2.3 Estimated greenhouse gas emissions from the Project

The proponent's consultant states that, in assessing the GHG emissions associated with the Project (Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 6):

GHG emissions from the operation of the Proposal were calculated on an annual basis by financial year, and for the estimated 30-year lifetime of the Proposal (from 2025/26 to 2054/55).

The proponent's consultant states that the GHG emission estimates were calculated using the 2023 version of the National Greenhouse Accounts Factors (NGAF) published by the federal Department of Climate Change, Energy, the Environment and Water. The Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan states (at p 10):

The methodologies in the NGAF workbook follow a simplified approach, equivalent the 'Method 1' approach outlined in the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines. The Technical Guidelines are used for the purpose of reporting under the National Greenhouse and Energy Reporting Act 2007 (the NGER Act).

At page 7 of the Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, the proponent's consultant states:

Redbank is not currently operational. Any 'business-as-usual' scenario would therefore have zero emissions. One operational scenario for the Proposal was considered. This scenario involved the operation of Redbank with no measures to avoid or reduce GHG emissions. Emissions were estimated based on the planned maximum operational throughput of biomass (25% moisture content) fuel of 850,000 tpa.

Based on this approach, the proponent's consultant estimates that, at full capacity, the Project will result in:

- Scope 1 emissions of 17,772.8 tonnes of carbon dioxide equivalents (tCO₂-e) yr⁻¹; and
- Scope 3 emissions of 20,641.5 tonnes of CO₂-e yr⁻¹.

Under the method used by the proponent, the Scope 1 emissions from the Project comprised:

- (a) methane (CH₄) and nitrous oxide (N₂O) emissions from the combustion of biomass (modelled as bone dry wood but using the wet fuel mass (850,000 t yr⁻¹ rather than 700,000 dmt yr⁻¹);
- (b) carbon dioxide (CO₂), CH₄ and N₂O emissions from onsite combustion of diesel associated with biomass handling and other operations;
- (c) CO₂, CH₄ and N₂O emissions from onsite combustion of diesel associated with startup; and
- (d) CO₂, CH₄ and N₂O emissions from offsite combustion of diesel associated with harvest and haulage of the biomass.

Notably, the proponent's consultant applied an emission factor for CO₂ from the combustion of biomass of zero. The proponent's consultant justified this approach on the following basis (Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 10):

In accordance with conventions and reporting guidelines (e.g. IPCC 2006, 2019; DCCEEW 2023a), the emission factor for CO₂ from the combustion of biogenic carbon was taken to be zero. The actual direct CO₂ emission at the point of biomass combustion would not be zero. However, there is a simplifying assumption in the guidelines that the amount of CO₂ released during combustion is balanced by the CO₂ taken up by the biomass during its life. These emission and removal mechanisms for CO₂ are therefore accounted for in the land use, land use change and forestry (LULUCF) sector, through an understanding of changes in biomass stock. In this GHG assessment, if the direct CO₂ emissions from burning the biomass had been included in the calculations, then there would effectively been a double counting of emissions in carbon accounting.

Based on these estimates, the proponent claims the Project will be “near net zero” GHG emissions (Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 3 & Response to Submissions Report, p 41).

The proponent states that “the main mechanism for addressing GHG emissions in the near future will be carbon offsetting. Verdant will use an offsetting agent that is accredited and regulated” (Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p ES.2 & Response to Submissions Report, p 41).

In accordance with this approach, the proponent indicates that it will offset its Scope 1 emissions. For these purposes, the proponent's consultant indicates that it expects that the proponent will “give due regard to the integrity standards set out in the Commonwealth Carbon Credits (Carbon Farming Initiative) Act 2011” and that it will not use carbon credits from avoided deforestation projects (Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 24). The proponent's consultant also states (Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 24):

Moreover, it is noted that NSW prefers proponents to use carbon offsets that conserve, preserve, protect, enhance, and manage the NSW environment. Where appropriate offset projects cannot be identified in NSW, offset projects in other Australian locations may be used.

2.4 Legal context

Our instructions on the legal context for the application and approval decision are as follows.

- The Project is a State significant development (SSD) under Section 4.36(2) of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).
- Owing to the number of objections received in relation to the Project, the Independent Planning Commission (IPC) is the consent authority for the Project under the EP&A Act.
- The IPC can determine the application by granting consent (subject to conditions) or refusing consent.
- When evaluating a SSD application, the IPC must consider, among other things, the likely impacts of the Project, including environmental impacts on both the natural and built environments. This is reflected in section 4.15(1) of the EP&A Act, which provides:

In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application ... (b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.

- In this context, “environmental impact” is defined as “the effects” or “influence” on the environment of the carrying out of the proposed development.
- For these purposes, environmental impact includes climate change impacts. The IPC is required to consider a project’s contribution to climate change and the impacts of climate change globally and in the locality of the project.

3. Response to questions posed

3.1 What area of INS land required to be cleared

The area of INS land required to be cleared to supply the feedstock for the Project is a function of:

- (a) the amount of biomass feedstock sought in a given year or over a prescribed period (in dmt);
- (b) the amount of above-ground biomass removed in relevant INS treatment events (in dmt per hectare); and
- (c) the recovery rate (proportion of above-ground biomass removed that is recovered as feedstock).

Amount of biomass feedstock

The proponent's central estimate of the amount of biomass feedstock sought from INS is provided in Table 1 above, starting at 500 000 dmt in Year 1 and declining to 90,000 dmt by Year 5 as increasing levels of purpose-grown biomass from short-rotation hardwood plantations are used.

We believe the INS feedstock assumptions are conservative and that the plant is likely to have to rely heavily on INS as its primary feedstock for at least 15-20 years, rather than the 1-3 years presented in the proponent's documents. This is because the proponent's feedstock estimates assume highly optimistic levels of substitution with short-rotation hardwood plantations (standard fuel) within 4-5 years of project commencement.

Figures 1 and 2 show the levels of plantation hardwood establishment since 1974-95 across Australia (Figure 1) and in New South Wales (Figure 2). Up until 1990, Australia's plantation hardwood estate covered less than 100,000 ha (most of Australia's plantations until the 1990s were softwoods established in several waves from 1940). The plantation hardwood estate grew rapidly over the 1990s and 2000s, reaching a peak of 991,000 ha in 2009. This unprecedented level of plantation establishment was a product of tax concessions provided via Managed Investment Schemes (MIS). As has been extensively documented,¹ the MIS-plantation system collapsed following the global financial crisis in 2008, leading to considerable losses for investors and others and, ultimately, a major industry restructure and downsizing. Since 2010, the hardwood plantation estate has shrunk to just over 670,000 ha as unviable plantations have been removed and converted back to grazing and cropping land.² In the wake of the collapse, new plantation establishment largely ceased. Since 2010, annual new hardwood plantation establishment has averaged 1,416 ha yr⁻¹ across Australia. In New South Wales, only 15 hectares of new hardwood plantations have been established since 2010; 1 ha yr⁻¹.³ Since 2021, a small number of new plantations have been established with the assistance of carbon credits provided through the Australian carbon credit unit (ACCU) scheme and grants and concessional loans provided by state

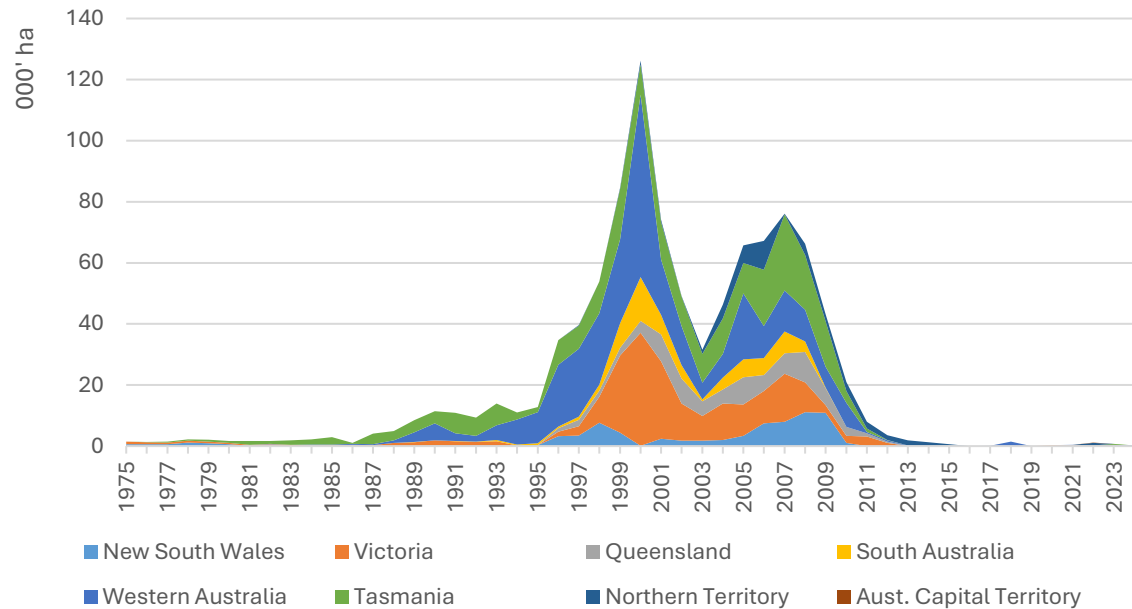
¹ Senate Economics References Committee (2016) Agribusiness managed investment schemes: Bitter harvest. Commonwealth of Australia, Canberra. Available at: https://www.agriculture.gov.au/Parliamentary_Business/Committees/Senate/Economics/MIS/~/_media/Committees/economics_ctte/MIS/Report/report.pdf (15 August 2025).

² ABARES (2025) Australian plantation statistics update 2023-24. Commonwealth of Australia, Canberra. Available at: <https://www.agriculture.gov.au/abares/research-topics/forests/forest-economics/plantations-update#download-the-overview-report-and-datasets> (15 August 2025).

³ ABARES (2025) Australian plantation statistics update 2023-24. Commonwealth of Australia, Canberra. Available at: <https://www.agriculture.gov.au/abares/research-topics/forests/forest-economics/plantations-update#download-the-overview-report-and-datasets> (15 August 2025).

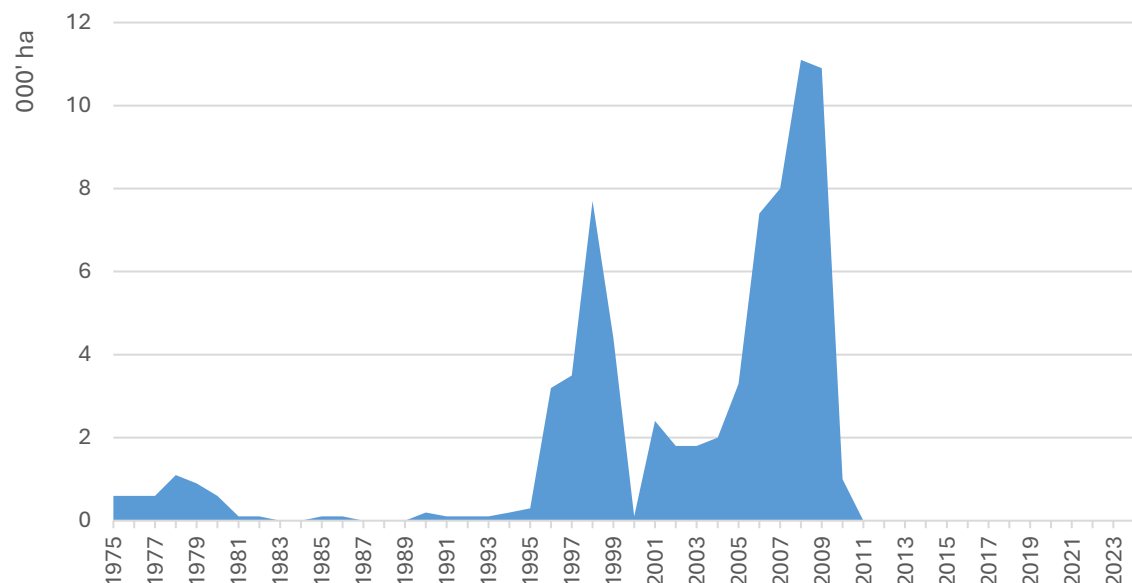
governments, particularly in Victoria and Western Australia. However, as Figures 1 and 2 show, the rates of new establishment remain low, particularly relative to the rates seen in the late 1990s and 2000s.

Figure 1. New hardwood plantations established, by state/territory, 1974-75 to 2023-24 ('000 ha)



Source: ABARES (2025) Australian plantation statistics update 2023-24. Commonwealth of Australia, Canberra. Available at: <https://www.agriculture.gov.au/abares/research-topics/forests/forest-economics/plantations-update#download-the-overview-report-and-datasets> (15 August 2025).

Figure 2. New hardwood plantations established in NSW, 1974-75 to 2023-24 ('000 ha)



Source: ABARES (2025) Australian plantation statistics update 2023-24. Commonwealth of Australia, Canberra. Available at: <https://www.agriculture.gov.au/abares/research-topics/forests/forest-economics/plantations-update#download-the-overview-report-and-datasets> (15 August 2025).

The reason for the low levels of hardwood plantation establishment both since 2010 and prior to 1990 is that plantations struggle to compete with alternative agricultural land uses.

This explains why the overwhelming majority of plantations established in Australia since the early 20th century have been dependent on government support.⁴ The inability of plantations to compete with alternative land uses is because they require considerable upfront capital outlays (including land acquisition) and have material recurrent operating expenses (plantation maintenance and management), while revenues are not realised for 10-40 years, depending on the planting type (rotation length). They are also subject to the risk of losses through fires and other natural disturbances and face strong domestic and international competition, which limits real price increases.

In this case, the proponent is proposing to establish 60,000 ha of short-rotation plantations in reasonable proximity to the power plant (<300 km) over a four-year period. The areas identified for the plantations, within 300km of the plant, consist of areas of moderate to high productive agricultural land, where medium agricultural land values currently range between approximately \$7,000 per ha and \$13,500 per ha.⁵ The main subsidy currently available to support the establishment of these plantations is ACCUs. However, with the proponent aiming for 4-year rotations, the number of credits generated by such projects are likely to be low. Plantation projects under the ACCU scheme also only receive ACCUs for 15-years, after which they are expected to be self-sufficient.

Given agricultural land values, competing uses and the modest subsidies available through the ACCU scheme, we believe the proponents scheduled transition to feedstock from short-rotation hardwood plantations is unrealistic. It would require a rate of hardwood plantation establishment that has never been witnessed in New South Wales, and that is commensurate with the levels seen at the height of the MIS period in Victoria, Western Australia and Tasmania, which triggered considerable community opposition and discontent. Moreover, to generate the target levels of biomass, the plantations would need to be established on more productive country, where the yield from the plantations could achieve the levels specified in the Feedstock Supply and Characterisation Study (~8.75 dmt yr⁻¹). This would require the plantations to be established on more productive, higher value land, where the pressure from competing uses is greatest. Moving away from these areas onto more marginal land – which the proponent suggests they will attempt to do (Feedstock Supply and Characterisation Study, p. 44) – would reduce the likelihood of achieving the desired yields. There are also questions regarding the hydrological impacts of the plantations, which are not addressed.

Due to these factors, if the Project is going to proceed, we consider it is highly likely that it will need to rely on INS or other pre-existing feedstocks for a substantially longer period than 4 years. Indeed, it is questionable whether the proposed short-rotation hardwood plantations could supply >200,000-300,000 dmt yr⁻¹ at any time over the 30-year timeframe of the Project, in the absence of significant changes in federal or state policies.

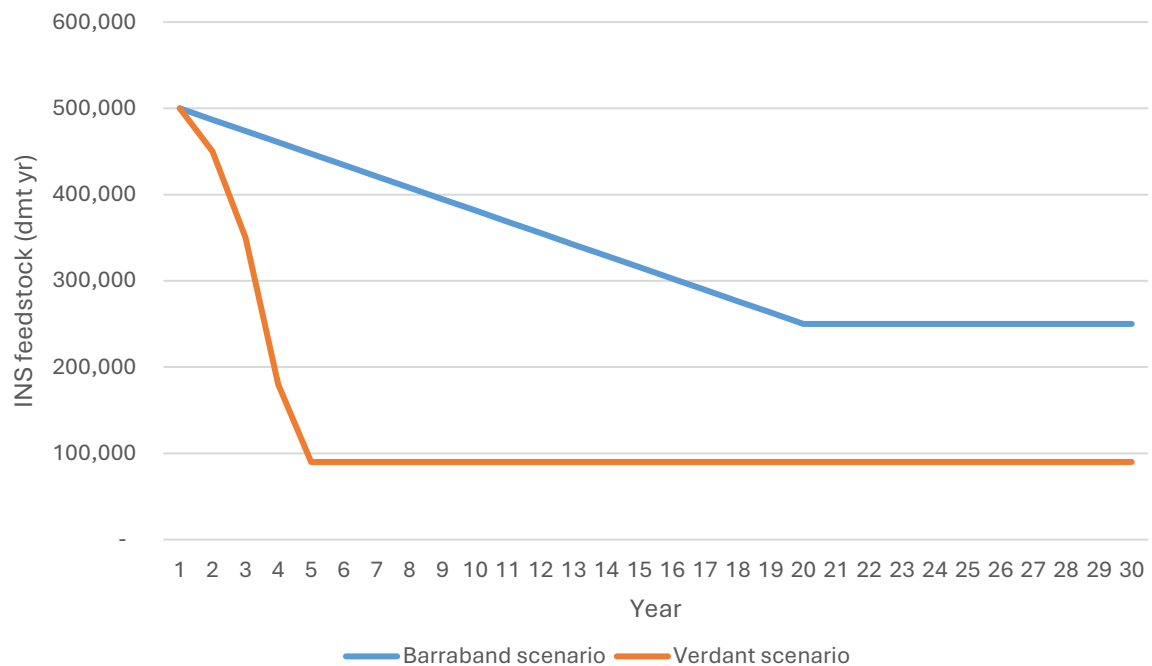
Owing to this, and the proponent's acknowledgment that its estimates are indicative only, we provide two INS feedstock scenarios:

- Scenario 1 – proponent's central estimate (Verdant scenario); and
- Scenario 2 – a more realistic scenario where the amount of biomass feedstock obtained from INS follows the path shown in Figure 3, where it starts at 500,000 dmt yr⁻¹ and declines linearly to 250,000 dmt yr⁻¹ over 20 years (Barraband scenario).

⁴ Dargavel, J. (1995) Fashioning Australia's Forests. OUP Australia and New Zealand.

⁵ Bendigo Bank Agribusiness (2025) Australian Farmland Values: 2025 Report. Bendigo Bank Ltd. Available at: <https://www.bendigobank.com.au/siteassets/business/industries/agribusiness/agriculture-insights/reports/2025-farmland-values-report.pdf> (15 August 2025).

Figure 3. INS biomass feedstock scenarios, Verdant scenario & Barraband scenario (Project years 1 – 30), in dry metric tonnes (dmt)



Amount of above-ground biomass (AGB) removed in INS treatment events

The proponent offers a central yield estimate of 25 dmt ha⁻¹, based on the references provided in the Higher Order Use Study (p 17).

We believe this is too high.

To derive a more realistic estimate, we calculated the average maximum live AGB under native vegetation at the centroids of INS property vegetation plans (INS PVPs) issued in the Western LLS and Central West LLS between 2005 and 2017 using the Australian Government's 'M-layer' (Figure 4). This yielded estimates of potential above ground biomass of 58.8 tonnes of dry matter per hectare (dmt ha⁻¹) in the Western LLS region and 87.5 dmt ha⁻¹ in Central West LLS region.

The proponent focuses on the Western LLS as the primary target for INS feedstock. This is appropriate because most INS clearing occurs in the Western LLS (~90% of the treatment area approved under INS PVPs was in the Western LLS).⁶ On this basis, we assumed a 2/3 to 1/3 division in the source of INS feedstock between the Western LLS and Central West LLS, and weighted the AGB yield estimate on this basis (68.5 dmt ha⁻¹).

Based on the prescriptions for INS treatments, which amongst other things prohibit the removal of large trees (>20-30cm diameter at breast height, depending on species),⁷ we assumed that, on average, INS clearing events result in the removal of 1/3rd of the onsite AGB (per ha). This estimate is based on our experience in biomass assessment in the types of vegetation commonly targeted for INS clearing, as well as data from ten biomass

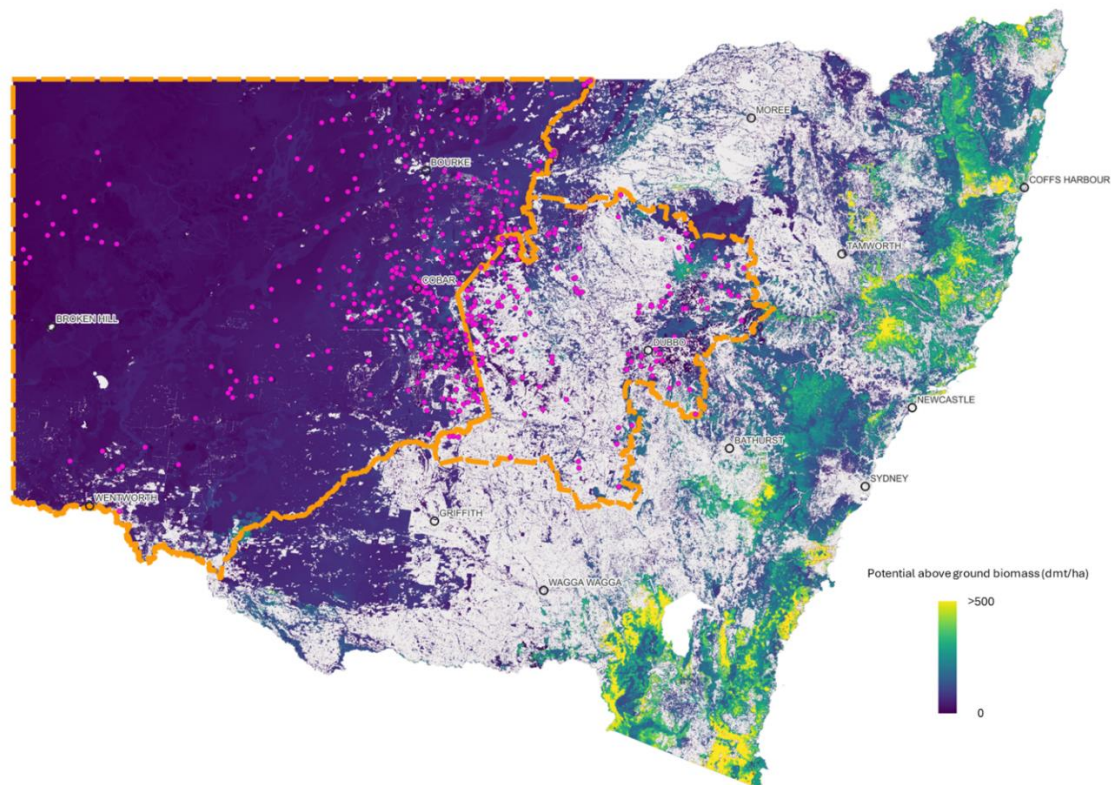
⁶ NSW Department of Climate Change, Energy, the Environment and Water (2025) 'Public Register of PVPs and development consents that approve broadscale clearing and/or specify a date for the definition of regrowth', NSW Government, Sydney. Available at: <https://www.environment.nsw.gov.au/topics/animals-and-plants/native-vegetation/historic-native-vegetation-legislation/native-vegetation-act-2003-public-registers/approved-clearing-pvps-under-the-repealed-native-vegetation-act-2003> (15 August 2025).

⁷ Land Management (Native Vegetation) Code 2018 (NSW), Pt 2. Div 1.

inventory plots available through the “Australian Individual Tree Biomass Library- v4”⁸ from western NSW and southwestern Qld, which showed an average of 32.4% of total above ground biomass from stems less than 20cm dbh.

Applying these assumptions, we arrived at a central estimate of the amount of AGB removed in relevant INS treatment events of 22.8 dmt ha⁻¹.

Figure 4. Locations of INS PVPs (pink dots) sampled to estimate potential above ground biomass. Biomass model (M) shown for areas of native vegetation. Boundaries of the Western and Central West LLS shown with orange dotted lines.



Recovery rate

Live AGB includes all tree and shrub biomass above the roots, including leaves, bark and small twigs and branches. When removing INS, it is unlikely that all AGB will be recovered through the harvesting. A proportion will escape recovery, for practical, economic and other reasons. Due to this, it is necessary to make an assumption about the recovery rate of biomass from cleared areas.

There are no known empirical sources of data on biomass recovery through INS treatment events because it is not done. The biomass cleared in INS treatment events is either burnt onsite or left to decay. However, given the nature of the operations, the vegetation types and the size of the vegetation, we consider a recovery rate of 85% is a reasonable estimate.

Area of INS land required to be cleared

Based on the above assumptions, our estimates of the area of INS land required to be cleared to provide the INS feedstock for the Project are provided in Table 2. The Verdant scenario results were calculated using the Verdant feedstock scenario and the proponent's

⁸ TERN (2025) Australian Individual Tree Biomass Library- v4. Available at: <https://portal.tern.org.au/metadata/TERN/d9f08fc2-28dd-4065-974d-d03f9bf46dbd> (15 August 2025).

biomass yield estimate of 25 dmt ha⁻¹. The Barraband scenario results were calculated using the Barraband feedstock scenario and an INS clearing biomass yield of 22.8 dmt ha⁻¹.

Table 2. Area required to be cleared to supply INS feedstock, Verdant and Barraband scenarios (total hectares and annual average hectares)

Period	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Total
Verdant scenario							
Total area (ha)	73,882	21,176	21,176	21,176	21,176	21,176	179,765
Annual average (ha)	14,776	4,235	4,235	4,235	4,235	4,235	NA
Barraband scenario							
Total area (ha)	122,210	105,236	88,262	71,289	64,499	64,499	515,996
Annual average (ha)	24,442	21,047	17,652	14,258	12,900	12,900	NA

3.2 What impact will the approval of the Project have on INS clearing rates

INS clearing in NSW

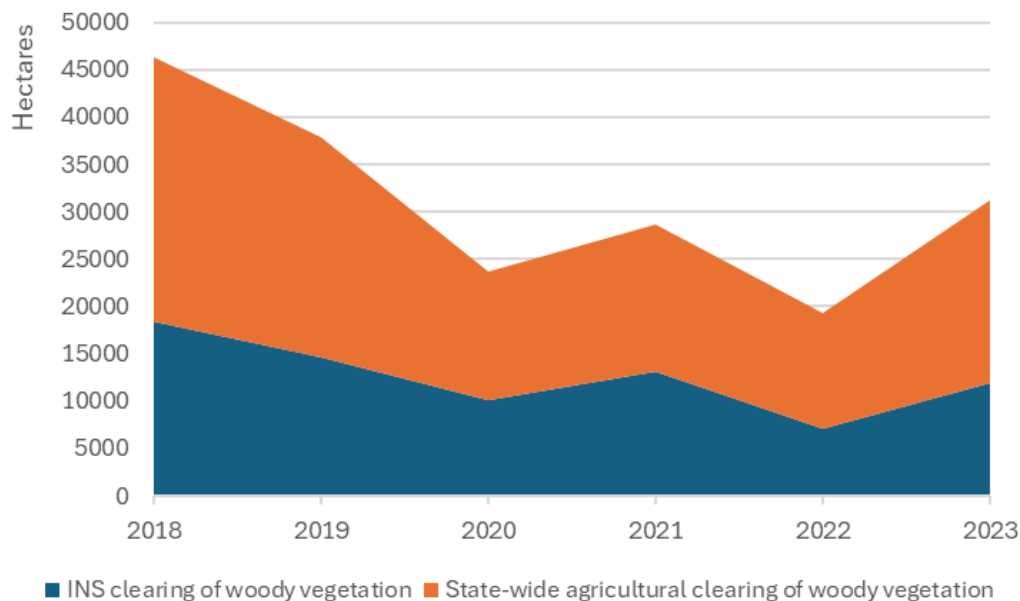
Data on woody vegetation clearing are published by the NSW Department of Climate Change, Energy, the Environment and Water as part of its Statewide Landcover and Tree Study (SLATS). The latest SLATS data were published in July 2025.⁹ Rates of woody vegetation clearing have been estimated using satellite data since 1988. However, three different data sources have been used over this time: 30m resolution Landsat data from 1988 to 2008; 5m SPOT data from 2009 to 2016; and 10m resolution Sentinel-2 data for 2017 onwards.¹⁰ Caution is needed in comparing estimates derived from each of these different data sources. Due to this, the following will focus primarily on the period since 2018, where the estimates have been derived using 10m resolution Sentinel-2 data.

Since 2018, clearing of INS under the *Local Land Services Act 2013* (NSW) (LLS Act) and *Native Vegetation Act 2003* (NSW) (NV Act) has averaged 12,538 ha yr⁻¹, approximately 67% of total statewide agriculture-related clearing of woody vegetation (18,616 ha yr⁻¹) (Figure 5).

⁹ NSW Government (2025) 'Statewide Landcover and Tree Study (SLATS) Dashboard'. Available at: <https://www.seed.nsw.gov.au/slats-dashboard> (15 August 2025).

¹⁰ The estimates for 2015 and 2016 are based on analysis between SPOT-5, SPOT-6 and Sentinel-2 imagery, where the change detection algorithm was run across the 2-year period rather than the individual years.

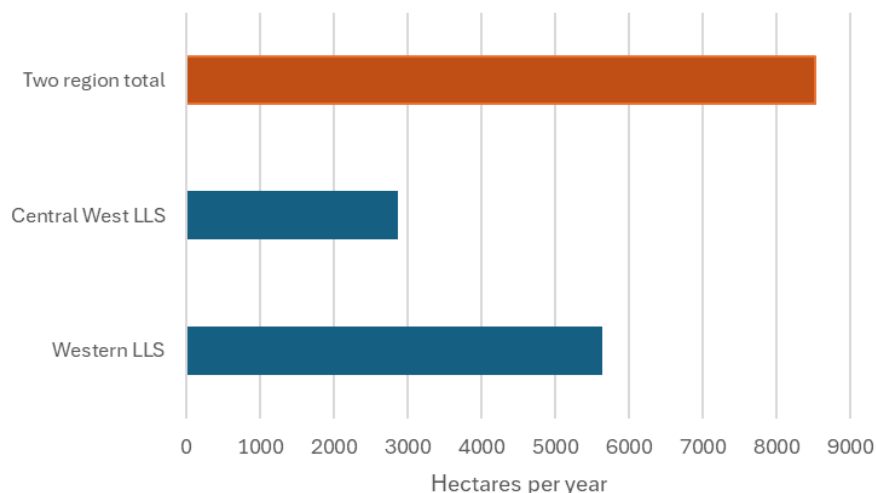
Figure 5. INS clearing under the LLS Act and NV Act & statewide agriculture-related clearing of woody vegetation, 2018 to 2023



Source: NSW Government (2025) 'Statewide Landcover and Tree Study (SLATS) Dashboard'. Available at: <https://www.seed.nsw.gov.au/slats-dashboard> (15 August 2025).

Disaggregated data on INS clearing are not available for LLS regions. However, data are published on agriculture-related clearing of woody vegetation for these regions, including under the LLS Act and NV Act. Over the period 2018-2023, annual agriculture-related woody vegetation clearing under the LLS Act and NV Act averaged 8,515 ha yr⁻¹ across the two regions, with 66% coming from the Western LLS (5,646 ha yr⁻¹) and 34% coming from the Central West LLS (2,869 ha yr⁻¹) (Figure 6). Given the nature of the clearing authorised under these statutes, and the statewide trends, it is reasonable to assume that most (though not all) of this clearing was of INS.

Figure 6. Average annual agriculture-related clearing of woody vegetation under the LLS Act and NV Act, Western LLS and Central West LLS regions, 2018-2023



Source: NSW Government (2025) 'Statewide Landcover and Tree Study (SLATS) Dashboard'. Available at: <https://www.seed.nsw.gov.au/slats-dashboard> (15 August 2025).

Factors that determine Project impact on INS clearing rates

The impact of the Project on INS clearing rates depends on two main factors:

- (a) the INS feedstock demand from the Project; and
- (b) the extent to which the INS feedstock demand can be met from INS clearing that would have occurred anyway (business-as-usual (BAU) INS clearing).

As discussed in section 3.1, we do not regard the Verdant feedstock scenario as credible. The Barraband feedstock scenario provides a more plausible scenario regarding the degree to which the Project will need to rely on INS for feedstock.

Could BAU INS clearing supply the required feedstock?

The rate of INS clearing fluctuates through time depending on a range of economic, social, seasonal and environmental factors. The variability in these factors makes it extremely difficult to devise reliable ex ante forecasts of clearing. Even ex post assessments are subject to high levels of uncertainty.

In this case, a reasonable way of forecasting the likely level of INS clearing in the absence of the project is to extrapolate from the historical averages. Applying this approach, we have assumed that, in the absence of the Project, INS clearing across the Western and Central West LLS regions would average 8,000 ha yr⁻¹, based on the total amount of agriculture-related woody vegetation clearing under the LLS Act and NV Act over the period 2018-2023 (8,515 ha yr⁻¹).

While stressing the caution needed when comparing woody clearing estimates derived from different data sources, the evidence suggests the rates of clearing experienced since 2018 have been relatively high compared to the rates observed over the period 1988-2017. For example, agriculture-related clearing of woody vegetation over the period 2018-2023 averaged 11,705 ha yr⁻¹. By comparison, between 1988 and 2017, agriculture-related clearing of woody vegetation averaged 7,463 ha yr⁻¹. This means the use of average clearing rates from the 2018-2023 period as the basis for analysing the impacts of the Project on INS clearing rates is conservative (i.e. if anything, it is likely to over-estimate clearing in the absence of the Project).

If the BAU INS clearing rate is taken to be 8,000 ha yr⁻¹, it is evident that there is a substantial shortfall between the feedstock required to support the Project and the level of INS clearing that would have occurred anyway. This is shown in Table 3. Under the Barraband INS feedstock scenario, the proponent will need to incentivise substantial additional INS clearing beyond BAU to obtain the required biomass. The extent of the required additional INS clearing depends on the extent to which the INS feedstock can be sourced from BAU INS clearing. If 100% of the BAU INS clearing is able to be utilised, the required additional INS clearing ranges from 16,442 ha yr⁻¹ in years 1-5 down to 4,900 ha yr⁻¹ in years 21-30 (Table 3).

However, it is highly unlikely that the proponent will be able to utilise a substantial proportion of the biomass produced from BAU INS clearing. INS clearing is highly dispersed across a vast area. This is illustrated in Figure 4 above. If the Project relied purely on BAU INS clearing, it would substantially increase the cost and complexity of collecting and hauling the biomass. Accounting for the significant costs of biomass collection and haulage, it is likely the proponent will seek to collect INS biomass from a more concentrated area closer to the power plant. This will reduce the scope for the Project to rely on BAU INS clearing, thereby necessitating additional INS clearing.

We believe a plausible BAU INS utilisation rate is ~25%. Based on this, the required additional INS clearing, above BAU, ranges from 22,442 ha yr⁻¹ in years 1-5 down to 10,900 ha yr⁻¹ in years 21-30 (Table 3).

Table 3. Projected additional INS clearing to supply biomass feedstock, by 5-year Project period (Barraband scenario), in hectares, assuming 100% and 25% utilisation of BAU INS clearing

	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30
Clearing required for feedstock	24,442	21,047	17,652	14,258	12,900	12,900
BAU INS clearing	8,000	8,000	8,000	8,000	8,000	8,000
Additional INS clearing – assuming 100% of BAU clearing utilised	16,442	13,047	9,652	6,258	4,900	4,900
Additional INS clearing – assuming 25% of BAU clearing utilised	22,442	19,047	15,652	12,258	10,900	10,900

3.3 Ecological and climate change impacts of INS clearing associated with the Project

Ecological impacts of INS clearing associated with the Project

INS clearing is described in the information provided by the NSW government as an allowance for landholders to address populations of native plants that have reached unnatural densities and dominate an area. However, the list of species that constitute INS includes most of the widespread woody plants in western NSW, and clearing is not restricted to listed species. Importantly, there is also no requirement for any assessment to determine that areas subjected to INS clearing are actually unnaturally dense.¹¹

The main justification of allowances for INS clearing under the Native Vegetation framework in NSW appears to be the promotion or maintenance of agricultural productivity.¹² The occurrence of dense regeneration of INS is asserted to be a product of grazing and fire suppression, which is used to justify INS clearing on the premise that it restores ecosystem structure.¹³ However, regeneration of most native species, including INS, is often linked to favourable seasonal conditions, particularly successive years with above average rainfall. There are also limits to the extent to which fire can be expected to have maintained vegetation structure in arid environments.¹⁴ As a result, the theorised link between

¹¹ Fensham, R.J. (2008) A protocol for assessing applications to selectively clear vegetation in Australia, Land Use Policy, 25, 249-258. <https://doi.org/10.1016/j.landusepol.2007.07.001>.

¹² NSW Government (2006) Native vegetation management in NSW: Managing invasive native scrub. Info Sheet 9. NSW Government, Sydney; DIPNR Science and Information Board (2004) Clearing/thinning of native vegetation known as invasive scrub under the Native Vegetation Act 2003 – Discussion Paper. NSW Department of Infrastructure, Planning and Natural Resources, Sydney; Science and Information Board (2005) Clearing/thinning of native vegetation known as invasive scrub under the Native Vegetation Act 2003 – Collation of Discussion Paper submissions and responses from the Invasive Native Scrub Team. Department of Natural Resources, Sydney.

¹³ Central West Local Land Services and Western Local Land Services (2014) Managing invasive native scrub to rehabilitate native pastures and open woodlands: A Best Management Practice Guide for the Central West and Western Catchments. NSW Government; DIPNR Science and Information Board (2004) Clearing/thinning of native vegetation known as invasive scrub under the Native Vegetation Act 2003 – Discussion Paper. NSW Department of Infrastructure, Planning and Natural Resources, Sydney.

¹⁴ Silcock, J.L.; Drimer, J.; Fraser, J.; Fensham, R.J. (2017) Inability of fire to control vegetation dynamics in low-productivity mulga (*Acacia aneura*)-dominated communities of eastern Australia. International Journal of Wildland Fire 26(10):896-905.

pastoralism and INS is contested. Even where grazing may have helped INS development, the suggestion that INS represents ecosystem degradation is misleading.¹⁵

INS clearing should not be misconstrued as ecological restoration, or as benefiting native biodiversity. The density of native vegetation can vary over long timescales, primarily in response to inter-annual variation in rainfall. In arid regions, such as western parts of NSW, the density of woody vegetation is naturally spatially patchy and variable through time.

There has been a widespread increase in the vegetation density in western NSW since the mid-twentieth century,¹⁶ but the composition and structure of vegetation is still broadly comparable to that found at European settlement.¹⁷ Importantly, the impact of thickening on biodiversity is complex and far from universally negative. Thinning tends to favour species that are already widespread and abundant, while species in decline in cleared landscapes tend to benefit from the retention of dense patches of vegetation. The increase in INS clearing that would be required to deliver biomass fuel for the Project will negatively impact native biodiversity, including threatened species.

Climate change impacts of INS clearing associated with the Project

Terrestrial ecosystems store carbon in live vegetation, debris (dead biomass) and soils. They also emit carbon to, and remove from, the atmosphere through natural and anthropogenic processes, with the net outcome (source or sink) depending on the magnitude of the respective fluxes.

Clearing of native vegetation reduces the stock of carbon in the ecosystem and liberates the carbon to the atmosphere as CO₂ (or as CH₄ and then to CO₂ when the CH₄ breaks down). The main carbon pools affected by clearing events are:

- (a) live biomass in the trees and shrubs that are cleared, covering above-ground biomass (stems, branches, bark and leaves) and below-ground biomass (coarse and fine roots);
- (b) dead biomass (debris) that is removed in the clearing event (above and below ground, including dead trees); and
- (c) soil organic carbon (carbon in wholly and partially decomposed plant and animal material less than 2mm in size and the microorganisms that feed on those and other organic materials).

The GHG emissions associated with INS clearing depend on

- how much clearing is caused by the Project;
- whether and how any cleared biomass is combusted; and
- how the cleared land is used after the clearing event.

Best practice for assessing the GHG emissions associated with a project involves using consequential life-cycle assessment (LCA), where the impacts of the proposal on net

¹⁵ Eldridge, D., Bowker, M., Maestre, F., Roger, E., Reynolds, J., Whitford, W. (2011). Impacts of shrub encroachment on ecosystem structure and functioning: Towards a global synthesis. *Ecology letters*. 14. 709-22. doi:10.1111/j.1461-0248.2011.01630.x.

¹⁶ Noble, J.C. (1997) *The Delicate and Noxious Scrub: CSIRO Studies on Native Tree and Shrub Proliferation in the Semi-Arid Woodlands of Eastern Australia*. (CSIRO Publishing, Melbourne).

¹⁷ Silcock, J.L., Piddocke, T.P., Fensham, R.J. (2013). Illuminating the dawn of pastoralism: evaluating the record of European explorers to inform landscape change. *Biological Conservation* 159, 321– 331. doi:10.1016/j.biocon.2012.11.030.

emissions are assessed by comparing the emissions and removals from relevant activities under two scenarios:

- (a) a baseline (reference or BAU) scenario, which represents what is likely to occur in the absence of the project; and
- (b) a project scenario, which represents either:
 - i. what is likely to occur if the project is undertaken (ex ante); or
 - ii. what has occurred after the project was undertaken (ex post).

Regardless of whether the analysis is ex ante or ex post, the project is deemed to increase GHG emissions if net emissions in the project scenario exceed those in the baseline scenario, and *vice versa*.

As this description suggests, consequential LCAs assess how net emissions are likely to change, or have changed, in response to a decision or project. For example, in this case, the object is to evaluate how GHG emissions are likely to change if the Project proceeds. The alternative approach is to use attributional LCA, which seeks to assign emissions and removals to a jurisdiction, entity, product or system based on average flows. A key difference between attributional and consequential LCA is that the former tracks and attributes all emissions and removals in the relevant life cycle based on historical averages, assuming a static system. In consequential LCA, the scope (or GHG boundaries) of the analysis is dictated by what changes (or is likely to change) in response to the decision or project.¹⁸ In the current context, where the primary issue of interest is whether the Project will increase GHG emissions, consequential LCA must be used. The use of attributional LCA could provide misleading information,¹⁹ depending on how the analysis is conducted and the information is presented.

Consistent with this, consequential LCA approaches underpin the assessment of abatement in all carbon offset schemes in the world, including the ACCU scheme, Clean Development Mechanism and the Paris Agreement Crediting Mechanism (Article 6).²⁰ Consequential LCA approaches also provide the basis for *The Greenhouse Gas Protocol: The GHG Protocol for Project Accounting*, published by the World Business Council for Sustainable Development and World Resources Institute, and ISO 14064-2:2019

¹⁸ Plevin, R.J. et al. (2014) Using Attributional Life Cycle Assessment to Estimate Climate-Change Mitigation Benefits Misleads Policy Makers. *Journal of Industrial Ecology* 18(1), 73-83; Brander, M. (2015) Transposing lessons between different forms of consequential greenhouse gas accounting: lessons for consequential life cycle assessment, project-level accounting, and policy-level accounting. *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2015.05.101>; Brander, M. (2021) The most important GHG accounting concept you may not have heard of: the attributional-consequential distinction. GHG Management Institute; Bento, A., Klotz, R. (2014) Climate policy decisions require policy-based lifecycle analysis. *Environ. Sci. Technol.* 48, 5379–5387; Macintosh, A. et al. (2016) Reply to ‘Policy institutions and forest carbon’. *Nature Climate Change* 6, 805–806.

¹⁹ Plevin, R.J. et al. (2014) Using Attributional Life Cycle Assessment to Estimate Climate-Change Mitigation Benefits Misleads Policy Makers. *Journal of Industrial Ecology* 18(1), 73-83; Brander, M. (2021) The most important GHG accounting concept you may not have heard of: the attributional-consequential distinction. GHG Management Institute.

²⁰ Brander, M. (2015) Transposing lessons between different forms of consequential greenhouse gas accounting: lessons for consequential life cycle assessment, project-level accounting, and policy-level accounting. *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2015.05.101>; Integrity Council for the Voluntary Carbon Market (2024) Core Carbon Principles Assessment Framework and Procedure. Available at: <https://icvcm.org/assessment-framework/> (15 August 2025).

*(Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements).*²¹

In this case, evaluating the “climate change impacts” of the INS clearing associated with the Project requires a comparison between the BAU INS clearing rate (baseline scenario) and the total rate necessary to supply the INS feedstock for the Project (project scenario).

As detailed above, a reasonable forecast of BAU INS clearing is 8,000 ha yr⁻¹, based on the total amount of agriculture-related woody vegetation clearing under the LLS Act and NV Act over the period 2018-2023 (8,515 ha yr⁻¹). We have used this as the baseline (reference) scenario for the analysis.

The project scenario represents the total INS clearing needed to supply the INS feedstock for the Project. This depends on the proportion of BAU INS clearing that is able to be utilised for feedstock. As detailed above, we believe a plausible rate is ~25%. In the results below (Table 4), we provide estimates based on a 25% and 100% BAU INS utilisation rate.

Following a consequential approach, the GHG emissions associated with the INS clearing caused by the project is calculated based on the difference between the INS clearing rate in the project scenario and the BAU INS clearing rate. The GHG emissions associated with BAU INS clearing are assumed to occur anyway, regardless of whether the Project proceeds. Due to this, they are excluded from the analysis.

The ‘additional’ GHG emissions associated with this clearing were calculated using an 8-step method.

Step 1: Determine how much AGB per ha is removed in INS treatment events. Here, 22.8 dmt ha⁻¹.

Step 2: Determine how much of the AGB is recovered as feedstock and how much is left onsite. Here, 85% is recovered, meaning 19.4 dmt ha⁻¹ is recovered and 3.4 dmt ha⁻¹ is left on site.

Step 3: Calculate the below-ground biomass (coarse and fine roots) that is lost in INS clearing events and left on site. Based on the literature in relevant vegetation types, and accounting for the relatively small size of the woody vegetation, we assume a root:shoot ratio of 1:4 (mass of the roots is 25% of live AGB). This provides an average total live below-ground biomass that is lost in relevant INS clearing events of 5.7 dmt ha⁻¹.

Step 4: Calculate how much dead biomass (debris) is lost in INS clearing events. The debris pool in relevant vegetation communities in western NSW is typically 5-15% of live tree and shrub biomass. For these purposes, we conservatively assume lost debris is 5% of total live AGB, meaning lost dead biomass is 1.4 dmt ha⁻¹.

Step 5: Calculate how much soil organic carbon is lost in INS clearing events. This is subject to a high degree of uncertainty, with the science suggesting soil organic carbon losses could range from negligible to significant, depending on the soil type and subsequent land use (e.g. losses are likely to be significant if the land is converted to cropping, but may be negligible if the land is used for grazing).²² Here we have assumed the INS clearing does not result in any loss of soil organic carbon.

²¹ World Business Council for Sustainable Development and World Resources Institute (2003) The Greenhouse Gas Protocol: The GHG Protocol for Project Accounting. Available at: https://ghgprotocol.org/sites/default/files/standards/ghg_project_accounting.pdf (15 August 2025).

²² See, for example, Dalal, R.C. et al (2021) Long-term land use change in Australia from native forest decreases all fractions of soil organic carbon, including resistant organic carbon, for cropping but not sown pasture. Agriculture, Ecosystems and Environment 311, 107326.

Step 6: Determine how much of the lost biomass is burnt and how much decays aerobically. Here, we conservatively assume that only the biomass that is used as feedstock for the power plant is combusted.

Step 7: Calculate the CO₂ emissions from the biomass that decays aerobically. This was done assuming 50% of the biomass is carbon and then converting C to CO₂ using the atomic mass ratio, 44/12.

Step 8: Calculate the CO₂, CH₄ and N₂O emissions, in tCO₂-e, from the biomass that is combusted in the power plant. CO₂ emissions were calculated assuming carbon content of 50% and then converting C to CO₂ using 44/12. CH₄ emissions were calculated assuming an energy content factor for dry biomass of 16.2 gigajoules (GJ) per dmt and a CH₄ emissions factor of 0.1 kg CO₂-e per GJ. N₂O emissions were calculated assuming the same energy content factor and a N₂O emissions factor of 1.1 kg CO₂-e per GJ. The energy content factor and emissions factors are from the 2024 Australian National Greenhouse Accounts Factors.

Note, we have conservatively assumed that the additional vegetation that is cleared in the project scenario has reached a mature, quasi-equilibrium state, meaning that, if it was left uncleared, it would not sequester any additional carbon. In reality, in the absence of clearing, the vegetation is likely to continue to grow and remove carbon from the atmosphere. The extent to which this occurs will depend on several factors, including the condition of the relevant land and the extent to which it is at or near its maximum biomass potential (i.e. carbon carrying capacity).

The results are presented in Table 4 below. In our preferred scenario, with a 25% BAU INS utilisation rate, the additional INS clearing above BAU initially results in GHG emissions of 1.24 MtCO₂-e yr⁻¹, falling to 0.6 MtCO₂-e yr⁻¹ after year 20. Total cumulative emissions over the 30-year project life under this scenario are estimated at 25.2 MtCO₂-e. If 100% BAU INS utilisation is assumed, the Project results in additional GHG emissions from INS clearing of 0.91 MtCO₂-e yr⁻¹, falling to 0.27 MtCO₂-e yr⁻¹ after year 20, with total cumulative emissions over the 30-years estimated at 15.3 MtCO₂-e.

Table 4. GHG emissions from additional INS clearing, above what is likely to occur without the Project, annual average (tCO₂-e yr⁻¹) and 30-year total (tCO₂-e)

	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Total
100% BAU INS utilisation							
Combusted at plant	590,982	468,963	346,945	224,927	176,120	176,120	9,920,288
Decay on site	318,190	252,494	186,798	121,103	94,825	94,825	5,341,168
Total	909,171	721,457	533,744	346,030	270,944	270,944	15,261,455
25% BAU INS utilisation							
Combusted at plant	806,643	684,625	562,607	440,589	391,782	391,782	16,390,137
Decay on site	434,304	368,608	302,912	237,217	210,939	210,939	8,824,590
Total	1,240,947	1,053,233	865,519	677,806	602,720	602,720	25,214,727

To put these estimates in context, total GHG emissions in NSW are currently ~115 MtCO₂-e yr⁻¹.²³ A useful reference point is that GHG emissions from cars currently account for ~11.5 MtCO₂-e yr⁻¹. Hence, the GHG emissions from additional INS clearing associated with the Project will initially equate to approximately 8-10% of the current emissions from cars in the state.

We note that the GHG emission estimates provided above differ from those provided by Professor Macintosh in his statement to the Independent Planning Commission. These changes follow more extensive modelling undertaken after the statement to ensure full coverage of GHG emissions over the 30-year project period.

Note also that, due to time restrictions, we were unable to do an analysis on the implications of the Project for the state's ability to meet the emission targets under the *Climate Change (Net Zero Future) Act 2023* (NSW). As the above results demonstrate, the Project is likely to result in a significant increase in INS-related emissions over the Project period. Section 3.7 discusses the appropriateness of the proponent's proposed use of offsets as a way of mitigating these emissions.

3.4 Does the Project properly estimate the GHG emissions based on best practice?

No.

As detailed above, the GHG emissions impacts associated with a project or development should be assessed using a consequential LCA approach, where the net increase or decrease in emissions and removals attributable to the project is calculated by comparing the outcomes from a baseline scenario that represents what is likely to occur in the absence of the project and a project scenario that represents what is likely to occur if the project is undertaken. The proponent has not done this, instead applying an attributional approach that should largely be reserved for application in jurisdictional accounts.

The nature and flaws in the approach used to estimate the GHG emissions associated with the Project are most evident in the treatment of biomass and INS clearing. Three issues illustrate the deficiencies in the approach.

1. **Use of CO₂ emission factor of zero for the combustion of biomass.** This choice is justified on the basis that:
 - a. it accords with international standards governing the development of national greenhouse gas accounts, where CO₂ fluxes associated with the harvesting of biomass are accounted for in the land use, land use change and forestry (LULUCF) sector (rather than the energy sector); and
 - b. if direct CO₂ emissions from biomass burning were included, it would result in "double counting" (Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 10).

Excluding CO₂ emissions from biomass burning from estimates of emissions from energy generation is logical in the context of national (and provincial) greenhouse gas accounts, where the object is to estimate all emissions and removals that occur within the relevant jurisdiction. A production 'production approach' (otherwise known as a 'territorial approach') is used for these purposes, meaning the relevant

²³ Department of Climate Change, Energy, the Environment and Water (2025) Australia's National Greenhouse Accounts: Paris Agreement inventory. Commonwealth of Australia, Canberra. Available at: <https://www.greenhouseaccounts.climatechange.gov.au/> (15 August 2025).

countries (or states/territories) are only responsible for emissions that occur within their sovereign territory.²⁴ Emissions are then estimated from all sources within the jurisdiction and reported across five sectors: energy, industrial processes and product use, agriculture, waste, and LULUCF.²⁵ Removals into sinks are also recorded but only in LULUCF. In this context, the exclusion of CO₂ emissions from biomass burning from the energy subaccount does not affect the estimates of the jurisdiction's total net emissions because the relevant emissions are accounted for as part of LULUCF. The same does not apply to project-level accounting. Here, the proponent has chosen not to report CO₂ emissions from biomass burning on the basis it will result in double counting, even though it does not separately estimate emissions and removals associated with the production and harvesting of biomass. That is, there is no double counting; only one-sided accounting where a significant source is omitted from the analysis. This conflicts with basic principles governing consequential emissions analysis, which require the boundaries of the analysis to be governed by what is likely to change in response to the project. Even if an attributional approach was used, CO₂ fluxes associated with the production, harvesting and combustion of biomass should still be reported, only without accounting for what is likely to occur in the absence of the project.

2. ***Treatment of INS clearing as rotational harvesting.*** Implied in the proponent's approach to CO₂ emissions from biomass combustion is the assumption that "CO₂ released during combustion is balanced by the CO₂ taken up by the biomass during its life" (Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 10). The use of this approach could be justified for the proposed short-rotation hardwood plantations, where non-forest lands are proposed to be planted and harvest on repeated short-rotation cycles. In this case, the removals associated with the planting and growth period will largely equal the removals associated with harvesting, save for the CH₄ and N₂O emissions that arise through biomass burning. However, the adoption of this assumption for INS clearing is illogical and contrary to accepted practice because the clearing involves the permanent (or long-term) removal of woody vegetation to facilitate grazing and cropping. In other words, the woody vegetation that is removed is not intended to be replaced through plantings or natural regeneration. Consequently, over the relevant "cycle", the CO₂ released through the clearing is not balanced by subsequent sequestration through replanting or regeneration. The only way the proponent could claim there is a balance over the cycle is if it was allowed to claim credit for prior sequestration in the cleared vegetation, which would be nonsensical. It would be the equivalent of allowing a coal generator to claim credit for the sequestration in the coal it combusts.
3. ***Ignoring increase in INS clearing required to supply biomass feedstock.*** The proponent does not engage with the question of whether, and the extent to which, the Project will necessitate an increase in INS clearing to supply the required

²⁴ This is subject to some exceptions, including emissions from road vehicles (they assumed to occur where the fuel is loaded into the vehicle). See Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change (IPCC) (1996) *IPCC Guidelines for National Greenhouse Gas Inventories*. IPCC, Geneva, Switzerland; Houghton, J. et al. (eds), *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. UK Meteorological Office, England; and Eggleston, S. et al. (eds) (2006) *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Institute for Global Environmental Strategies, Hayama, Japan.

²⁵ The agriculture and LULUCF sectors are often combined into agriculture, forestry and other land use (AFOLU). The approach used here aligns with how Australia prepares its National Inventory Report. The added advantage of separating LULUCF from agriculture is it emphasises the unique nature of LULUCF, as the only sector with anthropogenic emissions and removals.

feedstock. On page 7 of the Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, the proponent's consultants state that "any 'business-as-usual' scenario would therefore have zero emissions", based on the fact that the power plant is not currently operational. However, there is no attempt to evaluate the levels of INS clearing required to supply the feedstock, or the extent to which these levels align with the expected level of clearing in the absence of the Project. This is confusing because the proponent's Feedstock Supply and Characterisation Study provides details of historic agricultural-related clearing rates in the Western LLS region and cites a study that demonstrated the large disparity between approved and actual levels of clearing in western NSW (see pp 50-51). Despite presenting this information, the proponent's GHG assessment implicitly assumes the levels of INS clearing that are required to supply the INS feedstock would occur in the absence of the Project. This assumption is false. As detailed above, INS clearing would need to increase substantially to provide the required INS feedstock.

3.5 Is the Project "near net zero CO₂"?

No.

As the analysis presented in section 3.3 shows, the Project is likely to result in a substantial increase in GHG emissions due to the level of INS clearing required to supply feedstock for the plant.

A further factor that should be accounted for in the GHG analysis is the diesel and petrol consumption associated with the additional INS clearing (above BAU INS clearing). While relatively small in comparison to the direct emissions associated with the clearing of the biomass, these emissions should be included in a comprehensive analysis of the GHG emissions associated with the Project.

We also question the off-site diesel use assumptions, particularly the use of a return distance of 600 km and the resulting payload and truck movement (20,000 per yr⁻¹) assumptions. It is almost 600km from Cobar to Warkworth. Even if the Project can rely heavily on biomass generated from BAU INS clearing, sourcing the biomass from relevant properties across the Western LLS and Central West LLS regions will result in substantial additional GHG emissions that would not otherwise occur. Further, a substantial proportion of the biomass will be transported while it is green (i.e. significant moisture content), implying average payloads of around 40 t per truck movement. While possible, we recommend further analysis be done to test the proponent's assumptions and results concerning GHG emission from off-site diesel use.

3.6 GHG emissions implications of burning biomass for electricity?

Burning biomass for electricity results in CO₂, CH₄ and N₂O emissions.

Based on the assumption that the Project will combust 700,000 dmt of biomass each year, the direct GHG emissions from this will be approximately 1,296,941 t CO₂-e yr⁻¹, calculated using the following assumptions:

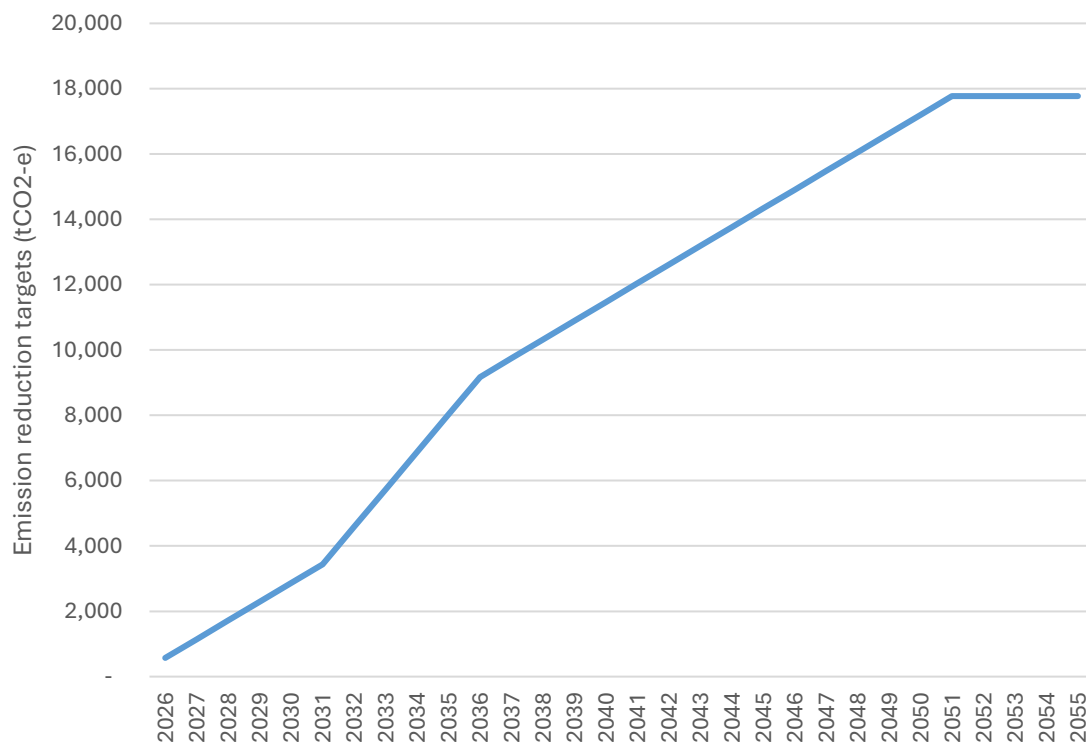
- Carbon content of dry biomass = 50%
- C to CO₂ atomic mass ratio = 44/12
- Energy content factor for dry biomass = 16.2 GJ per dmt
- Combined emission factor for CH₄ and N₂O = 1.2 kg CO₂-e per GJ.

However, as detailed above, in evaluating the environmental impacts of the Project, the GHG emission implications should be evaluated relative to what would otherwise occur.

3.7 Is the proponent's proposed use of carbon offsetting appropriate?

The aim of the proponent's offset strategy is seemingly to align the Project with the NSW Government's net zero by 2050 target. The revised mitigation targets put forward by the proponent are provided in Figure 7. The documents indicate the proponent's plan for meeting these targets involves the purchase and surrender of ACCUs.

Figure 7. Project mitigation targets, 2025-26 to 2054-55



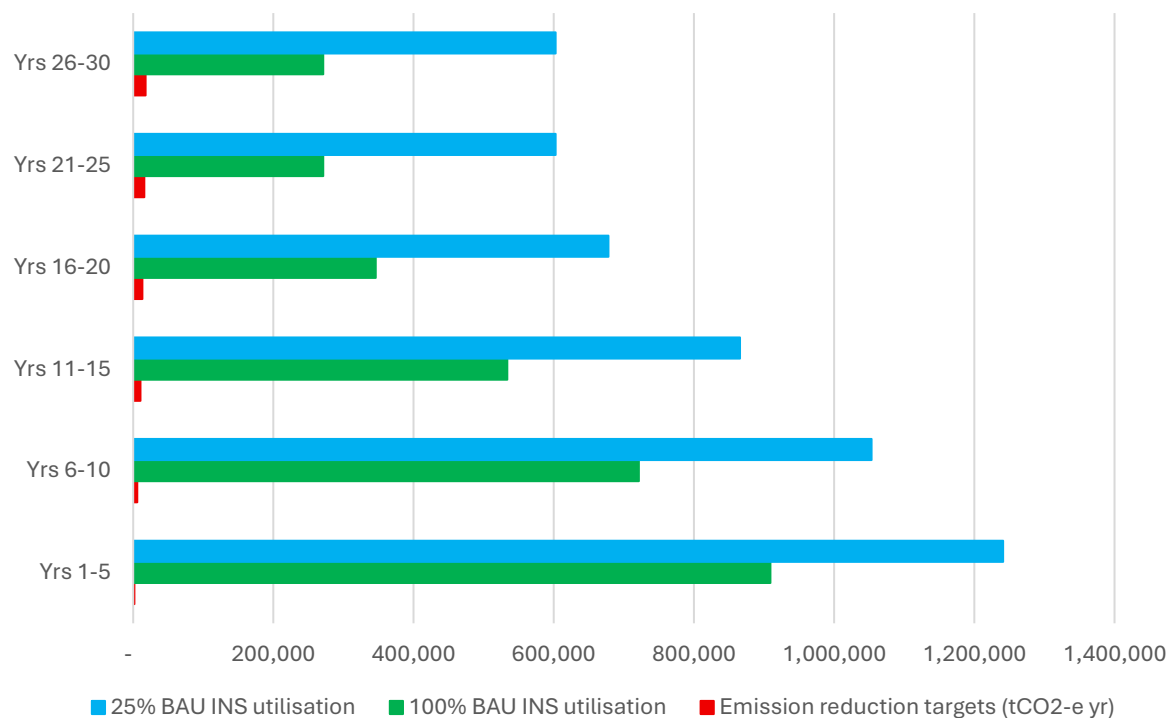
Source: Response to Submissions Report, p 41; Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 21.

The 'appropriateness' of the proponent's planned use of offsets (ACCUs) depends on two factors:

- (a) the number of offsets that the proponent proposes to surrender; and
- (b) the integrity (quality) of the ACCUs that are used for these purposes.

The revised mitigation targets do not align with the likely emissions associated with the Project. This is shown in Figure 8, which compares the mitigation targets to the GHG emissions associated with the additional INS clearing that is likely to be needed to provide the feedstock for the plant. A more comprehensive analysis of the GHG impacts of the Project is likely to make this comparison worse (see section 3.5 for details of recommended areas for further analysis). For the offset strategy to be credible, the mitigation targets would need to be increased substantially.

Figure 8. Mitigation targets vs GHG emissions associated with the additional INS clearing (25% and 100% BAU INS utilisation scenarios)



Even if the mitigation targets were substantially increased, the surrender of ACCUs to meet these targets will not mitigate the warming effects of the Project's emissions unless the surrendered credits have 'integrity'. For offsets to have 'integrity', the credits must represent abatement that is real (i.e. the credited emission reductions or sequestration must have actually occurred), additional (i.e. the credited abatement would not have happened in the absence of the incentive provided by the scheme) and permanent (i.e. any credited sequestration must persist in the relevant sink).²⁶

A large and growing body of scientific research has found that offsets rarely deliver real, additional or permanent abatement. A recent meta-analysis published in 2024 that evaluated over 2,300 offset projects – representing around one-fifth of all issued credits – found that less than 16% achieved the credited emissions reductions.²⁷ In-depth evaluations of the world's large offset types, including REDD+,²⁸ renewable energy²⁹, clean cooking stove projects³⁰ and improved forest management³¹ have all found persisting problems, including a lack of additionality and impermanence.

²⁶ Macintosh, A., Butler, D. et al. (2024) Australian human-induced native forest regeneration carbon offset projects have limited impact on changes in woody vegetation cover and carbon removals. *Communications Earth & Environment* 5, 149.

²⁷ Probst, B.S. et al. (2024) Systematic assessment of the achieved emission reductions of carbon crediting projects. *Nature Communications* 15, 9562.

²⁸ West, T.A.P. et al. (2023) Action needed to make carbon offsets from forest conservation work for climate change mitigation. *Science* 381, 873–877.

²⁹ Calel, R. et al. (2025) Do Carbon Offsets Offset Carbon? *American Economic Journal: Applied Economics* 17(1), 1–40.

³⁰ Gill-Wiehl, A. et al. (2024) Pervasive over-crediting from cookstove offset methodologies. *Nature Sustainability* 7, 191–202

³¹ Stapp, J. et al. (2023) Little evidence of management change in California's forest offset program. *Communications Earth & Environment* 4, 331 (2023); Badgley, G. et al. (2022) California's forest carbon offsets

Independent analyses on the credits issued under the ACCU scheme have found similar problems, both in terms of the nature and magnitude of the integrity failings. Three peer-reviewed studies have found glaring integrity and legal problems with the ACCU scheme's largest project type: human-induced regeneration of even-aged native forest projects (HIR projects).³² HIR projects account for more than 30% of the ACCUs issued under scheme. The science on these projects suggests that most of the ACCUs issued to these projects do not represent real or additional abatement.

The second largest offset projects under the ACCU scheme are landfill gas projects, which earn credits by capturing and combusting the CH₄ emitted in biogas, using either electricity generators or flares. Similar to HIR projects, they account for almost 30% of issued ACCUs. Analysis published in 2022 exposed deficiencies in the additionality of the generation-based projects (i.e. those that combust CH₄ using electricity generators), which account for almost 80% of the credits issued to landfill gas projects.³³ Inexplicably, the landfill gas methods provide the largest, most profitable and most highly regulated landfill projects (i.e. those with generators) with the lowest baselines (typically 0% and 24%), significantly below what is meant to be the minimum of 30%. These baselines are meant to represent the level of CH₄ that would be captured and combusted at these sites in the absence of the incentive provided by the ACCU scheme. The methods' assumptions infer that, in the absence of ACCUs, these large landfills with electricity generators would capture no or very little CH₄, even though they are required to under state and territory environment laws and they also generate revenues through the sale of electricity and Large-scale Generation Certificates under the Australian Government's Renewable Energy Target scheme.

From 2022 until June 2025, the Australian Government and various government agencies and committees denied there were integrity problems with landfill gas projects.³⁴ This was despite 90% of the landfill gas industry publicly acknowledged the baselines were too low.³⁵ In June 2025, the federal Department of Climate Change, Energy, the Environment and Water released a proposal to vary the method, which finally acknowledged that the

buffer pool is severely undercapitalized. *Frontiers in Forests and Global Change* 5, 930426; Cullenward, D., Burtraw, B. (2025). Carbon offsets. Chapter 7 in Fowlie, M. et al. (2025) 2024 Annual Report of the Independent Emissions Market Advisory Committee. California Environmental Protection Agency, California. Available at: <https://calepa.ca.gov/2024-iemac-annual-report/> (15 August 2025).

³² Macintosh, A., Butler, D. et al. (2024) Australian human-induced native forest regeneration carbon offset projects have limited impact on changes in woody vegetation cover and carbon removals. *Communications Earth & Environment* 5, 149; Macintosh, A., Evans, M. et al. (2024) Non-compliance and under-performance in Australian human-induced regeneration projects. *The Rangeland Journal* 46, RJ24024; Beare, S., Chambers, R. (2021) Human induced regeneration: A spatiotemporal study. Report for the Clean Energy Regulator. AnalytEcon Pty Ltd, Berry, NSW. See also Macintosh, A. et al. (2022) The ERF's Human-induced Regeneration (HIR): What the Beare and Chambers Report Really Found and a Critique of its Method. The Australian National University, Canberra.

³³ Macintosh, A. (2022) The Emissions Reduction Fund's Landfill Gas Method: An Assessment of its Integrity. The Australian National University, Canberra.

³⁴ ERAC statement regarding Landfill Gas (Generation) Method. Available at: <https://cer.gov.au/news-and-media/news/2022/april/erac-statement-regarding-landfill-gas-generation-method> (15 August 2025); Emissions Reduction Assurance Committee (2022) Emissions Reduction Assurance Committee Findings on the Emissions Reduction Fund's Landfill Gas Generation method. Clean Energy Regulator, Canberra. Available at: <https://www.dcceew.gov.au/sites/default/files/documents/erac-findings-erf-landfill-gas-generation-method.docx> (15 August 2025).

³⁵ Slezak, M. (2022) 'Industry bosses making money from carbon credits say system needs to change'. ABC, 6 September. Available at: <https://www.abc.net.au/news/2022-09-06/companies-making-money-from-carbon-credits-speak-out/101400566> (15 August 2025); Macintosh, A., Butler, D., Evans, M. C., Waschka, M. & Ansell, D. (2023) Tortured recommendations, incomplete and unsubstantiated findings: an analysis of the report of the Independent Review of Australian Carbon Credit Units, The Australian National University, Canberra.

baselines were inadequate, meaning the projects have been credited for a substantial amount of non-additional abatement. The Department's proposal states (at p 2):³⁶

Baselines for some existing projects do not appropriately represent what would happen in the absence of the Scheme. Baselines have been 'grandfathered' for projects as they transitioned between schemes and methods, and some assume 0% methane capture in the absence of the ACCU Scheme. ... Projects that transitioned to the [CFI] in 2012 have not had their baselines adjusted. As such, their baselines do not represent what would happen in the absence of the Scheme. These 51 projects are also at the largest landfills, and account for around 76.4% of ACCUs issued under the landfill gas methods in financial year 2023/2024.

The third largest project type under the ACCU scheme is avoided deforestation projects, which receive credits for the avoidance of INS clearing in western NSW. To date, they account for almost 20% of issued ACCUs. A study published in 2021 revealed substantial integrity flaws in the method, focused on the additionality of the credited abatement.³⁷ The data suggest that, in a substantial proportion of cases, the forests protected by the projects would not have been cleared anyway. The proponent of the Redbank Project acknowledges the integrity problems with these projects and has indicated it will not rely on ACCUs from these projects.³⁸

The fourth largest project type under the ACCU scheme is savanna burning. These projects generate abatement by undertaking early dry season prescribed burns, with the intent of reducing late dry season wildfires. They account for almost 10% of issued ACCUs. A study published in 2024 raised questions about the integrity of the credits issued to these projects, with data indicating they may have been materially over-credited, partly due to climate change.³⁹ There is also evidence that the model used to estimate abatement in the 2015 savanna burning method was manipulated to deliberately over-estimate abatement.⁴⁰

Material integrity flaws have also been found with soil carbon projects, which now number in excess of 750.⁴¹

In summary, there is a large body of scientific evidence that shows the majority of the credits issued under the ACCU scheme are of low integrity. If the Project relies on these credits to offset its emissions, it will have little to no effect on reducing climate change or in helping NSW or Australia meet their mitigation targets. ACCUs have no direct link to the Australian or NSW greenhouse gas accounts. They only contribute to climate change mitigation targets if the credits represent real and additional abatement. Consequentially, if the proponent buys and surrenders low integrity ACCUs, it is merely transferring funds to the offset provider, with no public gain.

³⁶ Department of Climate Change, Energy, the Environment and Water (2025) ACCU Scheme landfill gas method reforms – exposure draft supplementary material. Commonwealth of Australia, Canberra. Available at: <https://consult.dccceew.gov.au/accu-scheme-landfill-gas-exposure-draft-method> (15 August 2025).

³⁷ Hemming P., Merzian R., Schoo, A. (2021) Questionable integrity: Non-additionality in the Emissions Reduction Fund's Avoided Deforestation Method. Australian Conservation Foundation, Melbourne. Available at: <https://australiainstitute.org.au/report/questionable-integrity-non-additionality-in-the-emissions-reduction-funds-avoided-deforestation-method/> (15 August 2025).

³⁸ Greenhouse Gas Mitigation Plan and Climate Change Adaptation Plan, p 24.

³⁹ Bowman, D. et al. (2024) Climate change must be factored into savanna carbon- management projects to avoid maladaptation: the case of worsening air pollution in western Top End of the Northern Territory, Australia. The Rangeland Journal 46, RJ23049 <https://doi.org/10.1071/RJ23049>.

⁴⁰ Carbon Credits (Carbon Farming Initiative—Emissions Abatement through Savanna Fire Management) Methodology Determination 2015, Schedule 2, Table P.

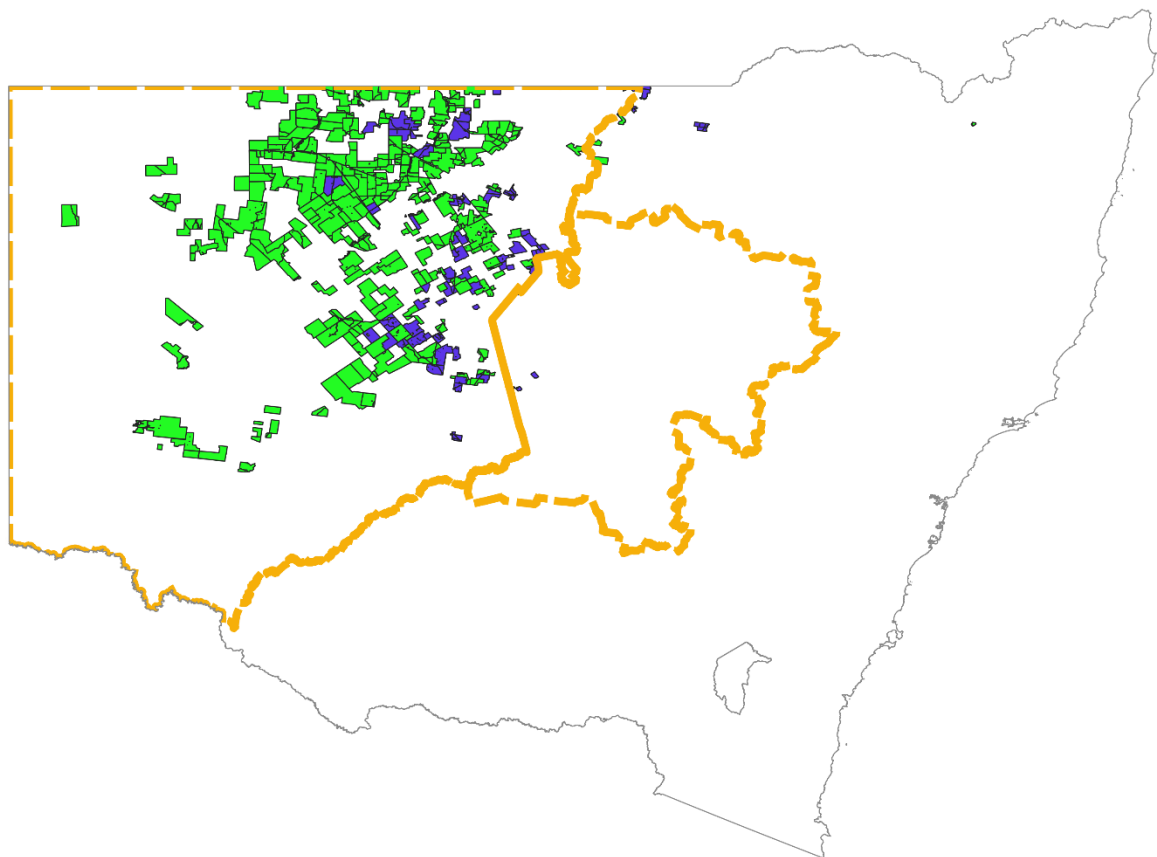
⁴¹ Mitchell, E. et al (2024) Making soil carbon credits work for climate change mitigation. Carbon Management 15(1), 243078. <https://doi.org/10.1080/17583004.2024.2430780>.

To address this issue, we recommend the proponent be required to surrender ACCUs from projects with impeccable integrity credentials. At present, the only project type that meets this criterion is environmental plantings.

3.8 Further observations and opinions concerning environmental impacts

Western NSW is now covered by a large number of HIR and avoided deforestation projects (Figure 9). As at July 2025, the credited areas of HIR projects in NSW spanned approximately 3.4 million ha, while the credited areas of avoided deforestation projects stretched across more than 350,000 ha. As Figure 9 shows, the vast majority of these projects are located in the Western LLS.

Figure 9. Human-induced regeneration of even-aged native forest (HIR) project areas (in green) and avoided deforestation project areas (in blue), NSW, with boundaries of Western LLS and Central West LLS regions (as at July 2025)



Source: Clean Energy Regulator (2025) ACCU project register. Available at: <https://cer.gov.au/markets/reports-and-data/accu-project-and-contract-register> (15 August 2025).

The existence and extent of these projects raises three material issues for the Project.

1. The avoided deforestation projects involve the protection of INS that was subject to an INS property vegetation plan (PVP) issued between 2005 and 30 June 2010 that authorised the clearing of native forest and permanent conversion to grazing or cropping land. As discussed, the issuance of INV PVPs is premised on the assumption that grazing and associated changes in fire regimes have resulted in 'unnatural woody thickening', and that the clearing of this thickened woody

vegetation will ‘improve or maintain’ relevant environmental conditions. Prior to the creation of the avoided deforestation projects, the NSW Government had to consent to the establishment of the projects on Crown land (pastoral leasehold land) under the ACCU legislation. The fact the NSW Government was willing to consent to the establishment of these projects supports the notion that INS is not a form of land degradation.

2. The HIR projects are based on the opposite scientific premise to avoided deforestation regarding the impact of grazing and altered fire regimes. These projects involve the control of grazing pressure, based on the premise that past grazing has substantially reduced woody cover across vast areas of western NSW and other parts of Australia’s rangelands. Decades of research in Australia’s rangelands, and the rangelands in other countries, has demonstrated that grazing generally does not materially reduce woody cover in these areas. Grazing can and frequently does have a material impact on ground and low shrub cover. However, its impacts on tree cover – which contains the majority of the biomass – tend to be marginal, particularly relative to the effects of rainfall. The primary determinant of woody cover in rangeland areas is rainfall and associated fluctuations in plant water availability result in variability in cover, over short and long-time scales. The premise of the HIR projects runs directly counter to the science that underpins NSW’s land management laws concerning the management of INS. Despite this, again, the NSW Government consented to the establishment of these projects. Moreover, it has established its own HIR projects on uncleared rangelands and even runs a program that encourages NSW drivers to offset their vehicle emissions using ACCUs from HIR projects.⁴² The approach to the effects of grazing in uncleared rangelands associated with HIR projects is incongruous with its approach to INS under the LLS Act and NV Act.
3. The establishment of avoided deforestation and HIR projects across such a large expanse of the Western LLS will limit the ability of the proponent to access INS feedstock. Under the ACCU legislation, credited carbon stocks cannot be cleared or otherwise degraded, unless the proponent surrenders ACCUs equivalent to the lost stocks. The extent of the area and need to surrender ACCUs will materially limit the proponent’s ability to access INS feedstock from the Western LLS region, raising questions about the Project’s viability.

■

⁴² Vehicle emissions offset scheme (VEOS). See: <https://www.energy.nsw.gov.au/households/rebates-grants-and-schemes/vehicle-emissions-offset-scheme-veos> (15 August 2025).