

Nursery sustainability – undertaking a lifecycle assessment – NY22001

Created by thinkstep-anz on behalf of Hort Innovation



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Executive summary

Why Hort Innovation commissioned this report

Hort Innovation is a grower-owned, not-for-profit research and development corporation for Australia's horticulture industry. Its role is to invest in research, development, marketing and trade to support a productive, competitive and sustainable future for growers.

To support this role, Hort Innovation engaged thinkstep-anz to undertake a life cycle assessment (LCA) of Australian nursery products and identify their key environmental impacts. The study establishes an industry-level baseline for greenhouse gas emissions and other environmental impact indicators. It also identifies where impacts are greatest across the nursery supply chain. This information is intended to help the nursery industry:

- understand current environmental performance
- identify priority areas for improvement
- track progress over time, particularly as Australia works towards its net zero emissions by 2050 commitment.

The results are designed to inform decision-making within the industry. The results should not be used to make public comparative claims between products, growers or industries.

What we did

We carried out an LCA to assess the environmental impacts of nursery production:

- The study covers 'cradle-to-gate' (see Executive Summary Figure 1), this includes the impacts up to the point the product leaves the nursery. Specifically:
 - **Upstream:** production of raw materials used in nursery growing
 - **Core:** transport of raw materials, growing, packaging and nursery waste disposal
- Results are reported for 1 L of nursery product, based on pot/container size, plus packaging. This is the declared unit used in the study.
- Data was collected for financial year (FY) 2025 from seven growers across five states in Australia.
- This study follows ISO 14040 and ISO 14044, the international standards for LCA.
- The assessed environmental indicators come from the European standard EN 15804+A2.

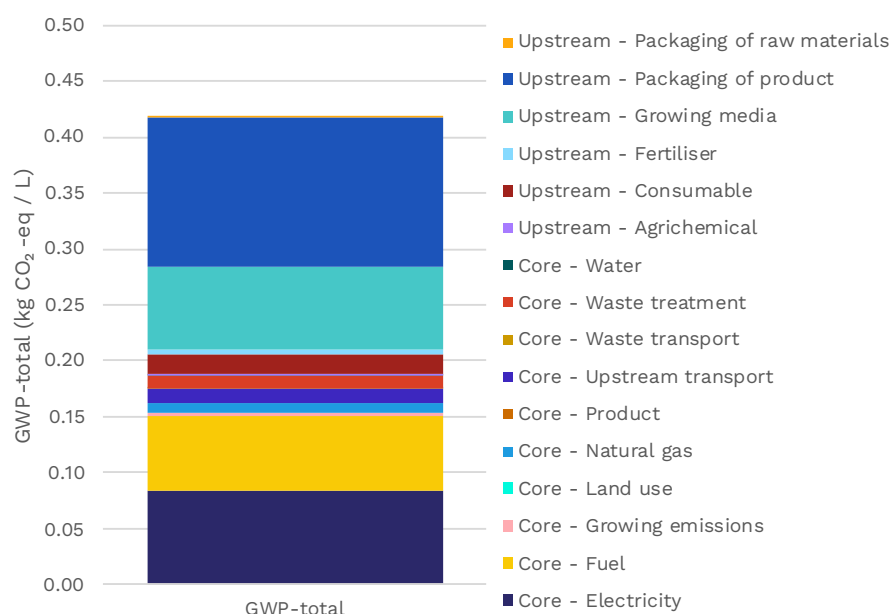


Executive Summary Figure 1: System boundary

What we found

Carbon footprint

The 'cradle-to-gate' carbon footprint of Australian nursery product is 0.42 kg CO₂-eq. per L, based on the pot/container size. This includes plant growth in the nursery, production of upstream raw materials and manufacture of typical pot and container materials, as shown in Executive Summary Figure 2. It excludes the biogenic carbon stored in the plant itself.



Executive Summary Figure 2: Cradle-to-gate carbon footprint of Australian nursery products

Main contributors

The main contributors to the carbon footprint of nursery products were:

- **packaging**, such as polypropylene (PP) pots and polystyrene (PS) plug trays
- **electricity** used in the nursery operation
- **production of growing media**, such as potting mix and peat
- **on-farm fuel** used in nursery operation.

Variation in nurseries

Carbon footprint results vary significantly between nurseries. This is because nurseries differ in their production approaches, plant types, energy use, material use and site conditions.

For example, different plant types can require different amounts of energy, growing media, packaging and time in the nursery. Climate and location can also affect energy use, especially where nurseries need heating or cooling to maintain suitable growing conditions.

What growers are already doing

Despite differences between individual sites, the study identified several practices that can improve environmental performance. These include:

- **Generating renewable electricity on site.** In the study, on-farm solar supplied about 35% of total electricity use.
- **Reusing process materials**, such as plastic trays.
- **Recycling raw material packaging**, such as paper and cardboard.
- **Using biodegradable containers** or collecting discarded plastic pots and trays for recycling, where feasible.

Our recommendations

To reduce environmental impacts, we recommend that the Australian nursery products industry prioritise the following actions:

- **Reduce and improve packaging** by minimising material use, choosing lower-impact pot and tray options and increasing recycled content.
- **Increase renewable electricity use** through on-site solar and purchased renewable energy certificates.
- **Reduce fossil fuel use** by improving energy efficiency and transitioning away from diesel, LPG, petrol and natural gas where feasible.
- **Take a whole-of-life view** when making changes to avoid shifting impacts from one life cycle stage to another.

Abbreviations and glossary

Term	Definition
ADP	Abiotic Depletion Potential
AP	Acidification Potential, Accumulated Exceedance
CEN	European Committee for Standardization
EoL	End-of-Life
EP	Eutrophication Potential
ETP	Potential Comparative Toxic Unit for ecosystems
ff	fossil fuels
fw	fresh water
GHG	Greenhouse Gas
GWP	Global Warming Potential (Climate Change)
HDPE	High-density Polyethylene
HTP	Potential Comparative Toxic Unit for humans
IRP	Potential Human exposure efficiency relative to U235
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LDPE	Low-density Polyethylene
luluc	Land use and land use change
m&m	minerals and metals
NMVOC	Non-Methane Volatile Organic Compound
ODP	Depletion potential of the stratospheric ozone layer
PE	Polyethylene
PM	Potential incidence of disease due to PM emissions
POCP	Formation potential of tropospheric ozone
PP	Polypropylene
PS	Polystyrene
SQP	Soil quality potential
VOC	Volatile Organic Compound
WDP	Water (user) deprivation potential, deprivation-weighted water consumption

Glossary

Life cycle

A view of a product system as “consecutive and interlinked stages ... from raw material acquisition or generation from natural resources to final disposal” (ISO 14040:2006, section 3.1). This includes all material and energy inputs as well as emissions to air, land and water.

Life Cycle Assessment (LCA)

“Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle” (ISO 14040:2006, section 3.2)

Life Cycle Inventory (LCI)

“Phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle” (ISO 14040:2006, section 3.3)

Life Cycle Impact Assessment (LCIA)

“Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product” (ISO 14040:2006, section 3.4)

Life cycle interpretation

“Phase of life cycle assessment in which the findings of either the inventory analysis or the impact assessment, or both, are evaluated in relation to the defined goal and scope in order to reach conclusions and recommendations” (ISO 14040:2006, section 3.5)

Environmental Product Declaration (EPD)

“Independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products.”

Product Category Rule (PCR)

“Defines the rules and requirements for EPDs of a certain product category.”

Functional / Declared unit

“Quantified performance of a product system for use as a reference unit.” (ISO 14040:2006, section 3.20)

Functional unit = LCA/EPD covers entire life cycle “cradle to grave”.

Declared unit = LCA/EPD is not based on a full “cradle to grave” LCA, common in construction product EPDs.

Allocation

“Partitioning the input or output flows of a process or a product system between the product system under study and one or more other product systems” (ISO 14040:2006, section 3.17)

Foreground system

“Those processes of the system that are specific to it ... and/or directly affected by decisions analysed in the study.” (JRC, 2010, 97) This typically includes first-tier suppliers, the manufacturer itself and any downstream life cycle stages where the manufacturer can exert significant influence. As a general rule, specific (primary) data should be used for the foreground system.

Background system

“Those processes, where due to the averaging effect across the suppliers, a homogenous market with average (or equivalent, generic data) can be assumed to appropriately represent the respective process ... and/or those processes that are operated as part of the system but that are not under direct control or decisive influence of the producer of the good....” (JRC, 2010, 97-98) As a general rule, secondary data are appropriate for the background system, particularly where primary data are difficult to collect.

Closed-loop and open-loop allocation of recycled material

“An open-loop allocation procedure applies to open-loop product systems where the material is recycled into other product systems and the material undergoes a change to its inherent properties.”

“A closed-loop allocation procedure applies to closed-loop product systems. It also applies to open-loop product systems where no changes occur in the inherent properties of the recycled material. In such cases, the need for allocation is avoided since the use of secondary material displaces the use of virgin (primary) materials.”

(ISO 14044:2006, section 4.3.4.3.3)

Critical Review

“Process intended to ensure consistency between a life cycle assessment and the principles and requirements of the International Standards on life cycle assessment” (ISO 14044:2006, section 3.45).

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1. Goal of the study

Hort Innovation commissioned this Life Cycle Assessment (LCA) study to assess the environmental impacts of nursery products in Australia. The primary audience is growers. The outcomes of the study will be used to establish a baseline for emissions, to inform growers regarding their current environmental performance, and to help identify areas where environmental impacts can be reduced.

This study follows ISO 14040 (ISO, 2006a) and ISO 14044 (ISO, 2006b), the international standards for LCA. While these standards provide a framework for LCA, they do not provide product-specific rules or a set of environmental impact indicators to apply. As such, this study is also based on two other key documents:

- The calculation rules come from PCR 2020:07 “Arable and vegetable crops” (version 1.0.3), published by the International EPD System (EPD International, 2025). Although arable and vegetable crops represent only a portion of nursery products, this PCR provides the only available product-specific rules.
- The environmental indicators selected come from EN 15804:2012+A2:2019 (EN 15804+A2) (CEN, 2019/2021). While EN 15804 is designed for construction products, its indicator set is comprehensive and is now widely used in LCA studies worldwide, including LCA studies for non-construction products.

Furthermore, this study excludes the use and end-of-life processes for nursery products. This is primarily due to the wide range of plants grown.

The results of this study are not intended to support comparative assertions disclosed to the public, meaning that peer review is not mandatory (ISO, 2006b). As such, no peer review has been undertaken as part of this study.

2. Scope of the study

2.1. Product system

Nursery production involves the following steps: growing media preparation, propagation, potting and growing.

Growing media includes propagation and potting mixes, which are often made of pine bark, coir, perlite, peat moss and fertiliser. Plant seeds or cuttings are sown into seedling trays to propagate. By the end of propagation, some nurseries further transplant these seedlings into plastic pots or containers to grow these plants into desired sizes. Agrichemicals and fertilisers are used throughout the propagation and growing processes.

The Australian nursery industry produced 2.13 billion plants with a value of \$3.49 billion in FY2025 (Watson, 2026). Nurseries from Victoria (VIC) (34%), New South Wales (NSW) (26%) and Queensland (QLD) (24%) collectively accounted for 84% of the total sales value. Perennials, trees and shrubs are the main plant categories sold, which represent around 47% of the total sales value (Watson, 2026). This study collected data from seven growers from VIC, NSW, QLD, South Australia (SA), and Western Australia (WA). A wide range of plants were considered, including shrubs, trees, propagation plants, indoor plants, other perennials, bedding and potted colour, herbs and vegetables, fruit trees, nut trees, vines and other plants.

2.2. Declared unit

PCR 2020:07 defines the declared unit as one kilogram of product. However, nursery products are not measured by weight in practice. In addition, defining a suitable declared unit for the industry benchmark is challenging due to significant variation in plant types and operating modes among nursery growers in Australia. Therefore, this study adopts a declared unit of one litre of nursery products (based on pot/container size), plus packaging. Industry classifications are found in Table 2-1.

This study further explored the potential of using value (per AUD) and number (per sold unit) of plants sold as alternative declared unit. The carbon footprint results based on these different declared units are presented in section 4.4.

Table 2-1: Industry classification

Product	Classification	Code	Category
Nursery products	UN CPC Ver.3	01	Products of agriculture, horticulture and market gardening
	ANZSIC 2006	011	Nursery and Floriculture Production

2.3. Market coverage

This study aims to provide a national baseline for the environmental footprint of nursery products in Australia. The data for this baseline was collected from Australian nursery owners and growers with support from the Greenlife Industry Australia (GIA), the industry association for Australian nurseries. Several iterations of online surveys were developed, which asked growers for data on farm inputs and outputs. These surveys were distributed via digital newsletters and in-person through GIA state extension officers.

We received ten responses, of which seven responses were used for detailed analysis. Other responses were incomplete and thus the data were not adopted in this study. The seven growers were from New South Wales (NSW), Queensland (QLD), South Australia (SA), Victoria (VIC), and Western Australia (WA). In FY2025, they collectively produced 12 million units of nursery products – approximately 11 million litres of nursery products (based on their pot/container sizes). Only a small share (roughly 0.5%) of the total industry (producing approximately 2.1 billion plants annually) were captured through the survey.

2.4. System boundary

The system boundary of the LCA study is ‘cradle-to-gate’, as shown in Table 2-2. It includes all relevant upstream processes and all core nursery product growing processes. The upstream processes include the production of growing media, packaging and other raw materials. The core processes refer to nursery product growing and supporting activities, including transport of raw materials to the grower, electricity consumption, burning fuels and air emissions during growing.

This study excludes end-of-life processes associated with wasted nursery products over the distribution chain and at the consumer’s home due to high uncertainty in the supply chain and consumer behaviour. Additionally, the use stage of nursery products is excluded from this study due to a lack of a standard scenario for nursery product usage.

Table 2-2: Modules of the production life cycle included in the study

Module	Upstream processes	Core processes	Downstream processes
Included?	Included	Included	Excluded
Life cycle stages	Production of → Electricity and fuel used in upstream processes → Seedlings → Growing media → Fertilisers → Agrichemicals → Packaging → Water → Other raw materials	→ Transport of raw materials to grower’s facility → Production of electricity and fuels used in core processes → Emissions related to the use of fuel, fertiliser and agricultural chemicals during the growing phase → Emissions related to the use of fuels and electricity during the packing phase	→ Distribution → Use phase → End-of-life phase → Waste treatment

The system boundary is presented in Figure 2-1. The nursery production process begins with the preparation of growing media, which involves blending components such as pine bark, perlite, coir, peat moss, and other materials. Seeds and cuttings are then propagated under controlled moisture and temperature conditions to ensure optimal establishment.

Following propagation, plants may either be sold directly or transplanted into pots or containers, where they are cultivated to achieve a range of marketable sizes. During the growing phase, inputs such as fertilisers and agrichemicals (fungicides, herbicides and insecticides) are applied as required to support plant health and development.

The following processes are included within the declared modules:

2.4.1. Upstream processes

- Extraction and processing of raw materials, such as pine bark, coir and perlite.
- Production of fertilisers, agrichemicals and product packaging materials.
- Generation of electricity and fuel from primary energy resources, also including their extraction, refining and transport. This includes energy needed for raw material supply and energy for horticulture in upstream processes.

2.4.2. Core processes

- Transport of raw materials and packaging to grower's facility.
- Emissions from growing.
- Emissions from energy, fertiliser, and agrichemical usage in nursery operations.
- Generation of electricity and fuel from primary energy resources, also including their extraction, refining and transport. This includes energy needed for horticulture in core processes, such as propagation and growing.

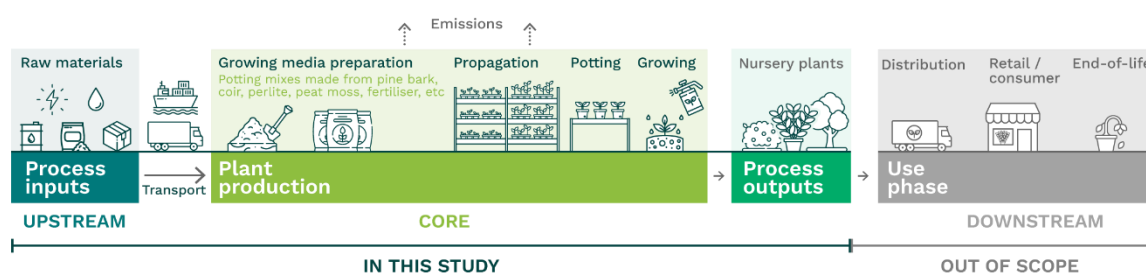


Figure 2-1: High level processes from cradle to gate

Table 2-3: System boundary

Included	Excluded
→ Production of raw materials used in nursery production → Production of packaging of nursery products and raw materials → Transportation of raw materials and packaging to grower's facility → Generation and supply of electricity and water, and their use during growing → Emissions due to growing → Emissions due use of energy, fertiliser and agrichemicals → Treatment of solid waste and wastewater	→ Manufacturing of production equipment, buildings, and other capital goods → Business travel of personnel → Travel to and from work by personnel → Research and development activities → Health and safety equipment → Transport to retail stores → Use phase of nursery products → End-of-life phase of nursery products

2.4.3. Time coverage

This study is based on seven Australian growers' specific data for producing nursery products during FY2025 (2024-07-01 to 2025-06-30). All specific data falls within the mandatory 5-year period required under the PCR.

Data for raw materials, electricity, packaging and transportation are from ecoinvent v3.10 using the "allocation, cut-off, EN15804" system model (Wernet, 2016) and AusLCI v2.45 (ALCAS, 2025). The reference year for the data is 2023 and is within the 10-year limit allowable for generic data under the PCR. Details for data used in the background system are presented in section 3.3.

2.4.4. Technology coverage

This study focuses on the production technologies currently in use at seven nursery sites across multiple Australian states. Processes at each site included growing media preparation, propagation, potting and growing.

2.4.5. Geographical coverage

The study uses specific data from seven growers from NSW, QLD, SA, VIC and WA. The results section presents the weighted average results of nursery products produced by these growers.

Most raw materials are sourced within Australia, such as pine bark, perlite and vermiculite. Some raw materials are sourced globally - for example, peat is from the Netherlands.

All these materials are delivered to growers' facilities for plant production. Supporting background data specific to the country of origin of the raw materials was used whenever possible. When such background data was not available, global or regional datasets were used as proxy. All electricity and water data were regionalised for Australia. The use of background data is further explained in section 3.3.

2.4.6. Boundaries to nature

Processes such as mineral extraction and waste management have been modelled to the elementary flow level, rather than being considered as an open input of resources or an open output of untreated waste. Examples include:

- raw materials such as perlite include mineral extraction from the ground
- emissions from fertiliser application are included as an emission to air and/or water
- emissions to water (after wastewater treatment) are modelled as emissions to water.

Waste to landfill is modelled assuming a 100-year time horizon.

2.4.7. Boundary for personnel processes

Business travel of personnel, travel to and from work by personnel, and research and development activities are excluded from the system boundary. This is *not* regarded as limiting the scope of the inventory or as an incomplete inventory (i.e. a cut-off).

2.4.8. Boundaries for infrastructure and capital goods

In general, the production and end-of-life processes of infrastructure and capital goods used in the product system are not included within the system boundary. All datasets exclude capital goods and infrastructure. An exception is for capital goods for electricity generation, where the capital goods are very important for modelling of changes towards more renewable generation. Capital goods related to electricity generation is included in all electricity datasets used in this study. This is *not* regarded as limiting the scope of the inventory or as an incomplete inventory (i.e. a cut-off).

2.4.9. Boundaries to other product life cycles

Allocation of recycled material is reported in the LCI as an input or output flow when such materials leave or enter the specific product system. The boundary between the current and the next product system is defined by the willingness to pay for the recycled material. This implies that from the moment the user of a secondary material pays for the material, this (secondary) product system will also be responsible for its environmental burdens from that point onward. This is referred to as the Polluter Pays Principle within EN 15804.

For outflow of material to recycling, transport to recycling facilities is included. The material intended for recycling is then an outflow from the product system.

Details on allocation are further described in section 2.5.

2.4.10. Biogenic carbon in product and packaging

Nursery products and growing media contain biogenic carbon. Biogenic carbon is defined as carbon derived from materials of biological origin, excluding material embedded in geological formations (ISO, 2018). The biogenic content of these products and materials varies significantly depending on plant and material types.

This report assumes that the biogenic carbon sequestered in the bio-based materials, such as pine bark and coconut coir, is released as carbon dioxide (CO₂) to the atmosphere when those materials leave the gate of nursery sites. In other words, the biogenic carbon leaves the system boundary being assessed and becomes part of another product's (or material's) system boundary. This assumption is in line with ISO 14067:2018.

The results for upstream and core processes include 'balancing-out reporting' (often referred to as the 'biogenic carbon neutrality assumption') for the biogenic CO₂ of nursery products. This means that the biogenic CO₂ sequestered in nursery products is artificially released in the core process. In addition, the biogenic CO₂ sequestered in nursery plants is assumed to be zero. This approach was adopted due to the significant variability in carbon content across different nursery products (due to plant species, age and growth rate) and because all of this biogenic CO₂ is expected to be re-released to the atmosphere through decomposition at the end of the plant's life.

2.5. Allocation

2.5.1. Multi-output allocation

Multi-output allocation follows the requirements of ISO 14044, section 4.3.4.2 (ISO, 2006b). When allocation becomes necessary during the data collection phase, the allocation rule most suitable for the respective process step is applied and documented along with the process in Chapter 3.

2.5.2. Allocation of background data

Allocation of background data (energy and materials) taken from the ecoinvent and AusLCI databases is documented online at <https://ecoquery.ecoinvent.org/3.10/EN15804/search> and <https://auslci.com.au/>, respectively.

2.5.3. End-of-life allocation

End-of-life allocation follows the requirements of ISO 14044, section 4.3.4.3.

Material recycling (cut-off approach): Any open scrap inputs into product system remain unconnected. The system boundary at end-of-life is drawn after scrap collection to account for the collection rate, which generates an open scrap output for the product system. The processing and recycling of the scrap is associated with the subsequent product system and is not considered in this study.

Landfilling (cut-off approach): The system boundary includes landfilling processes following the polluter-pays-principle. In cases where materials are sent to landfills, they are linked to an inventory that accounts for waste composition, regional leachate rates, landfill gas capture as well as utilisation rates (flaring vs. power production). No credits for power or heat production are assigned.

2.6. Cut-off criteria

In compliance with PCR 2020:07 (EPD International, 2025), the following cut-off criteria were applied during data collection and analysis:

- Data for elementary flows to and from the product system contributing to a minimum of 99% of the declared environmental impacts shall be included (not including processes that are explicitly outside the system boundary as described in PCR 2020:07 section 4.3).
- The application of these cut-off rules was a combination of expert judgment based on experience of similar product systems and a sensitivity analysis in which it is possible to understand how the un-investigated input or output could affect the final results.

Cut-off was applied to packaging of raw materials that are sent for recycling/reuse. The end of waste state for plastic and paper waste is achieved once they reach the waste collection facility. The transport to the collection facility is accounted for. In addition, seed inputs are cut-off due to lack of data, and the production of seeds is of less relevance to the environmental impact of nursery products (Cabot, et al., 2024; Svanes & Johnsen, 2019).

The choice of proxy data is documented in Chapter 3. The influence of these proxy data on the results of the assessment has been carefully analysed and is discussed in chapter 4.4.

2.7. Selection of LCIA methodology and impact categories

The environmental indicators selected come from EN 15804:2012+A2:2019 (EN 15804+A2) (CEN, 2019/2021). While EN 15804 is designed for construction products, its indicator set is comprehensive and is now widely used in LCA studies worldwide, including LCA studies for non-construction products.

2.7.1. Core environmental indicators from EN15804+A2

EN15804+A2 and PCR 2020:07 v1.0.3 (EPD International, 2025) require the Life Cycle Impact Assessment (LCIA) indicators shown in Table 2-4. The characterisation factors from the ecoinvent EN15804 Cumulative database based on EF 3.1 are used. Long-term emissions (>100 years) are not taken into consideration in the impact estimate. The footnotes below the table come from EN15804+A2.

Table 2-4: Core environmental impact indicators (based on EF 3.1)

Impact category	Description	Indicator	Unit	Original reference
Climate change - total	A measure of greenhouse gas emissions, such as CO ₂ and methane. These emissions are causing an increase in the absorption of radiation emitted by the earth, increasing the natural greenhouse effect. This may in turn have adverse impacts on ecosystem health, human health and material welfare	GWP-total	kg CO ₂ -eq.	(IPCC, 2021)
Climate change - fossil		GWP-fossil	kg CO ₂ -eq.	(IPCC, 2021)
Climate change - biogenic		GWP-biogenic	kg CO ₂ -eq.	(IPCC, 2021)
Climate change - land use and land use change		GWP-luluc	kg CO ₂ -eq.	(IPCC, 2021)
Ozone Depletion	A measure of air emissions that contribute to the depletion of the stratospheric ozone layer. Depletion of the ozone leads to higher levels of UVB ultraviolet rays reaching the earth's surface with detrimental effects on humans and plants	ODP	kg CFC11-eq.	(WMO, 2014)
Acidification	A measure of emissions that cause acidifying effects to the environment. The acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H ⁺) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline and the deterioration of building materials.	AP	Mole of H ⁺ eq.	(Seppälä, 2006; Posch, 2008)
Eutrophication aquatic freshwater	Eutrophication covers all potential impacts of excessively high levels of macronutrients, the most important of which nitrogen (N) and phosphorus (P). Nutrient	EP-fw	kg P eq.	(Struijs, 2009)
Eutrophication aquatic marine		EP-m	kg N eq.	(Struijs, 2009)

Impact category	Description	Indicator	Unit	Original reference
Eutrophication terrestrial	enrichment may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. In aquatic ecosystems increased biomass production may lead to depressed oxygen levels, because of the additional consumption of oxygen in biomass decomposition.	EP-tr	Mole of N eq.	(Seppälä, 2006; Posch, 2008)
Photochemical ozone formation	A measure of emissions of precursors that contribute to ground level smog formation (mainly ozone O ₃), produced by the reaction of VOC and carbon monoxide in the presence of nitrogen oxides under the influence of UV light. Ground level ozone may be injurious to human health and ecosystems and may also damage crops.	POCP	kg NMVOC eq.	(van Zelm, 2008)
Depletion of abiotic resources - minerals and metals¹	The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources. Depletion of mineral resources is assessed based on ultimate reserves.	ADP-minerals&metals	kg Sb-eq.	(van Oers, et al., 2002; Guinée, et al., 2002)
Depletion of abiotic resources - fossil fuels¹	The consumption of non-renewable resources leads to a decrease in the future availability of the functions supplied by these resources.	ADP-fossil	MJ	(van Oers, et al., 2002; Guinée, et al., 2002)
Water use¹	Water (user) deprivation potential, deprivation-weighted water consumption (WDP).	WDP	m ³ world equiv.	(Boulay, et al., 2018; UNEP, 2016)

¹ The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

2.7.2. Additional environmental impact indicators from EN15804+A2

EN15804+A2 also requires the calculation and inclusion of additional indicators in the project report, as shown in Table 2-5.

Table 2-5: Additional environmental impact indicators

Impact category	Description	Indicator	Unit	Reference
GWP-GHG²	Total global warming potential, excluding biogenic carbon dioxide	GWP-GHG	kg CO ₂ -eq.	(EPD International, 2024)
Respiratory inorganics	Damage to human health from outdoor and indoor emissions of primary and secondary PM _{2.5} in urban and rural areas	PM	Disease incidences	(Fantke, et al., 2016)
Ionizing radiation - human health³	Impact of low dose ionizing radiation on human health of the nuclear fuel cycle and ionizing radiation from the soil, radon, and some construction materials. Effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities are not considered.	IRP	kBq U235 eq.	(Frischknecht, et al., 2000)
Eco-toxicity – freshwater¹	Toxic effect on aquatic freshwater species in the water column	ETP-fw	Comparative toxic units (CTU _e)	(Rosenbaum, et al., 2008)
Human toxicity, cancer¹	A measure of the impact of chemical emissions on human health	HTPc	Comparative toxic units (CTU _h)	(Rosenbaum, et al., 2008)
Human toxicity, non-cancer¹	A measure of the impact of chemical emissions on human health	HTPnc	Comparative toxic units (CTU _h)	(Rosenbaum, et al., 2008)

² This indicator should be identical to GWP-total except that the CF for biogenic CO₂ is set to zero. It has been included in the EPD following the PCR (EPD International, 2024). In this study it is calculated by subtracting the value of Climate change – biogenic (GWP-biogenic) from the value of Climate change – total (GWP-total) since the ecoinvent Excel LCIA results do not include the indicator.

³ This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Impact category	Description	Indicator	Unit	Reference
Land use related impacts / soil quality¹	This index is the result of the SQP aggregation, performed by JRC, of the 4 indicators provided by LANCA model for assessing impacts due to land use		Dimensionless (Pt), aggregated index of: kg biotic production / (m ² *a) kg soil / (m ² *a)	(Bos, et al., 2016)

It shall be noted that the above impact categories represent impact potentials, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) actually follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. In addition, the inventory only captures that fraction of the total environmental load that corresponds to the functional unit (relative approach). LCIA results are therefore relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks.

2.7.3. Inventory indicators from EN15804+A2

The following environmental parameters are based on the LCI. They describe the use of renewable and non-renewable material resources, renewable and non-renewable primary energy, and water, as shown in Table 2-6.

Table 2-6: Resource use indicators

Parameter	Indicator	Unit
Renewable primary energy as energy carrier	PERE	MJ, net calorific value
Renewable primary energy resources as material utilization	PERM	MJ, net calorific value
Total use of renewable primary energy resources	PERT	MJ, net calorific value
Non-renewable primary energy as energy carrier	PENRE	MJ, net calorific value
Non-renewable primary energy as material utilization	PENRM	MJ, net calorific value
Total use of non-renewable primary energy resources	PENRT	MJ, net calorific value
Use of secondary material	SM	kg
Use of renewable secondary fuels	RSF	MJ, net calorific value
Use of non-renewable secondary fuels	NRSF	MJ, net calorific value
Net use of fresh water	FW	m ³

EN15804+A2 also requires the declaration of waste materials and output flows, such as components for re-use and recycling, as shown in Table 2-7.

Table 2-7: Waste material and output flow indicators

Parameter	Indicator	Unit
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg
Components for re-use	CRU	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported electrical energy	EEE	MJ
Exported thermal energy	EET	MJ

EN15804+A2 requires the declaration of biogenic carbon content of the product and its packaging, as shown in Table 2-8.

Table 2-8: Biogenic carbon content indicators

Parameter	Indicator	Unit
Biogenic carbon content - product	BCC-prod	kg
Biogenic carbon content - packaging	BCC-pack	kg

2.8. Software and database

The LCA was conducted in Microsoft Excel. The LCA utilises life cycle inventory data from ecoinvent database version 3.10 using the “allocation, cut-off, EN15804” system model (Wernet, 2016) for several of the raw and process materials obtained from the background system. In addition, the electricity residual mix is modelled based on AusLCI version 2.45 (ALCAS, 2025). The ecoinvent datasets have not been adapted to Australian conditions as they are provided in Excel and have not been used in conjunction with an LCA software.

2.9. Interpretation to be used

The results of the LCI (Chapter 3) and LCIA (Chapter 4) address the following topics:

- Identification of significant findings, such as the main process step(s), material(s), and/or emission(s) contributing to the overall results.
- Evaluation of completeness, sensitivity, and consistency to justify the exclusion of data from the system boundaries as well as the use of proxy data.
- Conclusions, limitations and recommendations.

2.10. Data quality requirements

The data used to create the inventory model shall be as precise, complete, consistent, and representative as possible with regards to the goal and scope of the study under given time and budget constraints.

- Measured primary data are considered to be of the highest precision, followed by calculated data, literature data, and estimated data. The goal is to model all relevant foreground processes using measured or calculated primary data.
- Completeness is judged based on the completeness of the inputs and outputs per unit process and the completeness of the unit processes themselves. The goal is to capture all relevant data in this regard.
- Consistency refers to modelling choices and data sources. The goal is to ensure that differences in results reflect actual differences between product systems and are not due to inconsistencies in modelling choices, data sources, emission factors, or other artefacts.
- Reproducibility expresses the degree to which third parties would be able to reproduce the results of the study based on the information contained in this report. The goal is to provide enough transparency with this report so that third parties are able to approximate the reported results. This ability may be limited by the exclusion of confidential primary data and access to the same background data sources.
- Representativeness expresses the degree to which the data matches the geographical, temporal, and technological requirements defined in the study's goal and scope. The goal is to use the most representative primary data for all foreground processes and the most representative industry-average data for all background processes. Whenever such data were not available (e.g., no industry-average data available for a certain country), best-available proxy data were employed.

An evaluation of the data quality with regard to these requirements is provided in Chapter 4.4 of this report.

2.11. Type and format of the report

In accordance with the ISO requirements (ISO, 2006b) this document aims to report the results and conclusions of the LCA completely, accurately and without bias to the intended audience. The results, data, methods, assumptions and limitations are presented in a transparent manner and in sufficient detail to convey the complexities, limitations, and trade-offs inherent in the LCA to the reader. This allows the results to be interpreted and used in a manner consistent with the goals of the study.

2.12. Critical review

No critical review was undertaken for this study.

3. Life cycle inventory analysis

3.1. Data collection procedure

3.1.1. Primary data collection

Data collection was a significant challenge in this study. This phase of the LCA required multiple revisions to the approach and timeframe to get sufficient responses from industry. It took more than 24 months to complete and finalise primary data collection from nursery growers.

The study began with a pilot group of six growers. These growers were selected to represent different sectors of the nursery industry. The aim of the pilot group was to do more extensive data collection and then identify hotspots so that we could simplify the data collection questionnaires before surveying the wider nursery industry.

However, participation reduced during the initial data collection phase, leaving only three growers in the pilot group by the end of the project. Growers indicated that the initial Microsoft Excel-based data collection spreadsheet was too extensive and time consuming to complete. To resolve this issue, the data collection process was paused temporarily to revise the approach. Instead of using a detailed questionnaire, we compiled an initial Life Cycle Inventory (LCI) for nurseries based on a literature review. The hotspots identified in the LCI were then used to streamline the questionnaires for growers.

With guidance and review from Greenlife Industry Australia (GIA), a web-based survey was developed to improve usability and reduce the data entry burden (refer to Figure 3-1).

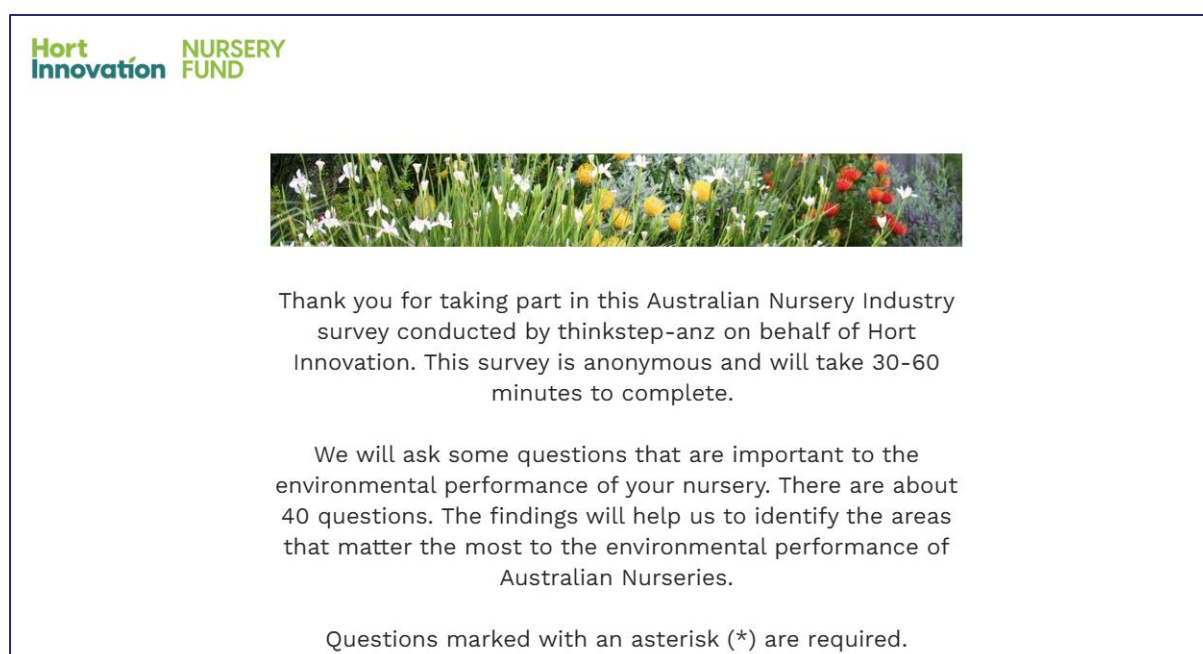


Figure 3-1: The landing page of the web-based survey

The survey was initially sent to the pilot group of three growers. Two growers attempted the survey and provided user feedback, which was then incorporated into the survey before being presented to the GIA for a final review.

Once the web-based survey was complete, our in-house communications team supported in writing copy to summarise the call to action for growers in a concise and eye-catching way. To further incentivise growers, we offered to deliver a tailored snapshot of their own nursery's environmental impact, based on the data they provide in the survey.

The web-based survey link, along with promotional copy from our communications team, was distributed to nursery growers through numerous channels, including:

- The GIA fortnightly newsletter (at least 3 article entries were published, see Figure 3-2)
- Agriculture Victoria to growers involved in the On-farm Emissions Action Plan Pilot
- GIA extension officers (EOs) through email and phone calls from the GIA's Smart Farming Project Officer

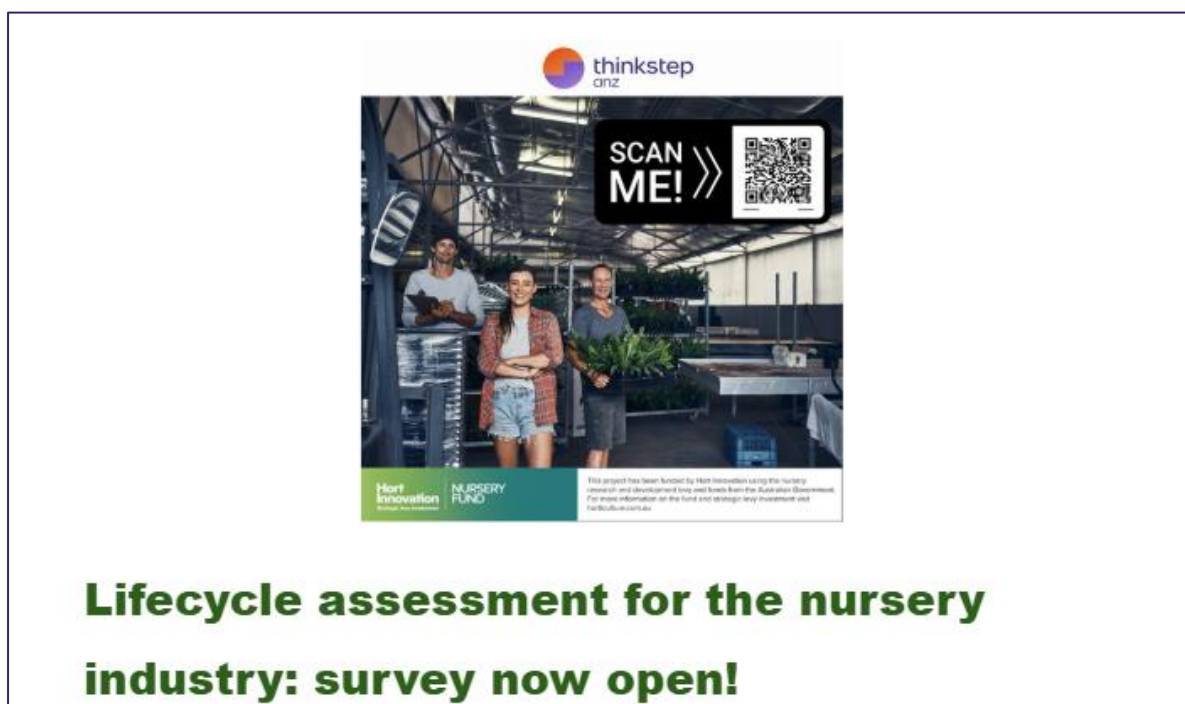


Figure 3-2: A snippet of an article to promote the nursery industry survey (GIA, 2025)

Despite our attempts to engage the industry, only 4 growers had submitted a full response to the web-based survey by the deadline of 30 September 2025. The low participation rate was discussed with Hort Innovation and GIA.

To reduce the barrier to entry even further, the web-based survey was re-formatted and simplified as a Microsoft Word document. This document could either be filled out digitally, or it could be printed by growers to fill out, scan and return. Refer to Annex A for a copy of the survey as distributed to growers. The project deadline was extended from the end of February 2026 to the end of April 2026 to allow for more time to collect data from growers using this new method.

The updated survey and supplementary copy were distributed to growers using similar channels. There were three articles in the GIA's fortnightly newsletter and the Smart Farming Project Officer engaged the extension officers again – via email, phone calls and

in-person site visits – to push the survey to their growers. The survey was also sent to the GIA state associations for distribution to their members, resulting in distribution to growers in Queensland and Western Australia.

By the data collection deadline, we had received responses from ten growers in total. After follow-up to address incomplete data, seven valid responses were obtained. The location and plant types sold for these seven growers are summarised in Table 3-1.

Each response was cross-checked for completeness and plausibility using mass balance as well as internal and external benchmarking. If gaps, outliers, or other inconsistencies occurred, thinkstep-anz engaged with the grower to resolve any open issues.

Wherever feasible, the coefficient of variation was established for the different inputs and outputs, either across different data providers or across the reported time period if a breakdown into smaller increments (e.g., 12 months) was available.

Data was validated through modelling consistency checks, where the results of the model were checked to ensure they matched the expected results across the main impact indicators and LCI data points. In addition, a mass balance was conducted to ensure accuracy across key flows. Energy and material inputs and outputs have been quantified to as much precision as practically possible.

Table 3-1: Location and sold plant type of growers

Grower	Location	Shrubs	Trees	Propagation plants	Indoor plants	Other perennials	Bedding and potted colour	Herbs and vegetables	Fruit trees	Nut trees	Vines	Others
Nursery 1	WA	✓	✓	✓		✓						
Nursery 2	NSW					✓						
Nursery 3	WA	✓	✓				✓	✓	✓			
Nursery 4	SA			✓	✓		✓					
Nursery 5	SA					✓	✓	✓				
Nursery 6	QLD	✓					✓	✓			✓	
Nursery 7	VIC	✓		✓								

3.1.2. Calculation of carbon sequestration, density and moisture content

Stored biogenic carbon in nursery plants was excluded from this study as described in section 2.4.10.

3.1.3. Land use

Land use is split into two components:

- Land transformation
- Occupational land use

Land transformation is modelled in Excel using flows that represent the area of land transformed to and from per unit mass of product, based on the predicted time period of occupation and total production rate for each of growers' sites. The annual production rate for the specified time period for data used in this LCA is assumed to be representative of all years that nursery product growers will occupy each site. Occupational land use accounts for use of the land year-on-year, opposed to the transformation of land due to occupation of the land. Parameters and flow values for land transformation and land occupation of each site are confidential. The industrial average result is calculated based on the weighted average result of land use impacts of all sites.

This modelling applies conservative assumptions, since throughput is expected to increase in future years, due to the likelihood of increased demand for product.

3.1.4. Calculation of PENRM and PERM

The results for upstream and core processes include 'balancing-out reporting' for the PERM and PENRM of nursery products and their packaging. This is because use phase and end-of-life processes of nursery products and packaging are not included in the system boundary for this study.

3.2. Nursery production system

3.2.1. Overview of product system

A high-level overview of the product system is shown in Figure 2-1, and described in section 2.4. The relevant datasets used in modelling can be found in section 3.3.

3.2.2. Product composition

The composition of nursery products is highly dependent on the plant species. They are composed primarily of water, followed by organic compounds forming carbohydrates, proteins, and lipids, and inorganic minerals.

3.2.3. Nursery production

The inputs and outputs of nursery production presented in Table 3-2 are weighted average data of seven growers calculated based on their production outputs. Water and energy usages at the site level are also included. According to the collected data, process

materials, such as plastic trays, are commonly reused on-site. It was assumed that these materials will be reused three times based on the feedback from growers.

Seeds and cuttings inputs are excluded from the table due to a lack of data. Most growers produce cuttings onsite. In addition, the production of seeds is of less relevance to the environmental impact of nursery products (Cabot, et al., 2024; Svanes & Johnsen, 2019). Therefore, material, energy and water consumption of producing seeds and cuttings are assumed to be included in the site level data.

Emissions due to fertilisers and pesticides use are calculated according to the PCR (EPD International, 2025) since no site or region-specific data was available. In addition, data for packaging of growing media, fertilisers and agrichemicals was not available. Therefore, ecoinvent database data was used as proxy to model these processes. Please note that the total may not add up due to rounding.

Table 3-2: Unit process data – nursery production

Type	Flow	Value	Unit	DQI*
Inputs	Electricity - grid	0.0922	kWh	Measured
	Electricity - solar	0.0492	kWh	Measured
	Natural gas	0.108	MJ	Measured
	Diesel	0.00255	L	Measured
	LPG	0.0228	L	Measured
	Petrol	7.76E-04	L	Measured
	Tap water	0.00213	m ³	Measured
	Other water sources	0.0248	m ³	Measured
	Pre-mixed growing media (pine bark, coir, perlite, peat etc)	4.80E-04	m ³	Measured
	Potting mix	4.05E-04	m ³	Measured
	Coir	1.44E-04	m ³	Measured
	Perlite	5.78E-05	m ³	Measured
	Vermiculite	1.39E-05	m ³	Measured
	Pine bark	1.59E-04	m ³	Measured
	Peat	1.35E-04	m ³	Measured
	Wood fibre	1.78E-06	m ³	Measured
	Fertilisers	0.00263	kg	Measured
	Agrichemicals (fungicides/herbicides/insecticides)	1.24E-04	kg	Measured
	Packaging of raw materials (HDPE and PP)	0.00281	kg	Calculated
	Process materials - plastic film (PE)	0.00244	kg	Measured
	Process materials - plastic tray (PS)	0.00409	kg	Measured

Type	Flow	Value	Unit	DQI*
	Process materials - paper and cardboard	9.36E-04	kg	Measured
	Process materials - wood	2.67E-05	kg	Measured
	Process materials - quick plugs (peat moss)	8.91E-05	kg	Measured
Outputs	Nursery product	1.00	L	Measured
	General waste for landfill	7.63E-05	m ³	Measured
	General waste for compost	8.06E-05	m ³	Measured
	General waste for recycling	3.24E-05	m ³	Measured
	NH ₃ emission to air	1.36E-05	kg	Calculated
	NO emission to air	1.32E-05	kg	Calculated
	N ₂ O emission to air	1.34E-05	kg	Calculated
	Nitrates emission to water	1.46E-04	kg	Calculated
	Phosphorus emission to water	2.44E-07	kg	Calculated
	NH ₃ emission to air	1.36E-05	kg	Calculated

* measured / calculated / estimated / literature

3.2.4. Packaging

The inputs and outputs of packaging are presented Table 3-3.

Table 3-3: Unit process data – packaging

Type	Flow	Value	Unit	DQI*
Inputs	Nursery product	1.00	L	Measured
	polypropylene (PP)	0.0140	kg	Measured
	Polystyrene (PS)	0.0127	kg	Measured
	Jiffy pot	3.95E-05	kg	Measured
	Plastic label	6.59E-05	kg	Measured
Outputs	Nursery product	1.00	L	Measured
	Packaging of product	0.0268	kg	Calculated

* measured / calculated / estimated / literature

3.2.5. Water use

Water sources are modelled with AusLCI datasets and are further regionalised by catchment (Bontinck, et al., 2021), as required by EN15804+A2 (CEN, 2019/2021) to allow calculation of water scarcity footprint. These catchments include Swan Coast, South East Coast and river basins on North East Coast other than Burdekin, Fitzroy, Burnett and Brisbane River.

3.3. Background data

The most relevant LCI datasets used in modelling the product systems are detailed below. Australian average datasets were used when available.

Most background datasets were obtained from the ecoinvent database v3.10, EN15804 model, and related documentation can be found at: <https://ecoquery.ecoinvent.org/3.10/EN15804>.

Some background datasets were obtained from the AusLCI database v2.45, and related documentation can be found at: <https://www.auslci.com.au/>.

The proxy column is used to indicate whether a dataset accurately represents the desired material or process; a No* indicates the use of a geographical proxy for a correct dataset where the region of manufacture is expected to have little influence on its environmental profile; and a Yes* indicates the use of a geographical proxy for a correct dataset where the region of manufacture is expected to materially influence its environmental profile.

3.3.1. Fuels and energy

National averages for fuel inputs and electricity grid mixes were obtained from the ecoinvent and AusLCI databases.

Market-based modelling has been used for grid supplied electricity consumed in processes at nursery growers' sites. Location-based grid mix EFs (using the published grid mix) are used in secondary datasets for modelling upstream stage (e.g. for production of raw materials) because the aggregated datasets cannot be modified for electricity supply.

For the seven growers, electricity generated from on-site solar panels accounts for 35% of total electricity consumption. This electricity consumption is modelled with ecoinvent dataset "AU: electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted".

Electricity from the grid accounts for 65% of total electricity consumption. The residual electricity mix on the market is therefore used for modelling electricity from grid. Electricity is modelled using ecoinvent datasets for each generation source in the composition detailed below.

Australia publishes state-specific grid mixes, which vary significantly between states. A national Australian residual mix emission factor (RMF) was published for the first time in 2023 in the National Greenhouse Accounts (NGA) Factors Workbook (DCCEEW, 2023). However, the residual supply mix (i.e. generation by sources) was not published by the Australian Government, nor the state-specific residual supply mixes (RSMs).

To support the PCR requirements for market-based reporting, thinkstep-anz published a whitepaper which provides details of electricity grid RSMs and RMFs for each state in Australia for FY2023 (thinkstep-anz, 2024). The RSMs are calculated by removing the renewable electricity that is considered 'voluntarily surrendered'. The Australian National Life Cycle Inventory Database (AusLCI) has adopted the methodology to publish RMFs. These are included from v2.45 of the database, supported by the methodology paper Life Cycle Inventory of Australian Electricity (Brown & Grant, 2025).

Table 3-4 shows the most relevant electricity datasets. Table 3-5 shows other energy datasets used in modelling the product systems.

Table 3-4: Key electricity datasets used in inventory analysis

Process	Location	Dataset	Data Provider	Reference Year	Proxy?
Electricity	NSW	AU: electricity, low voltage {AU-NSW} market for residual electricity mix, low voltage AusLCI, S	AusLCI	2023	No
Electricity	QLD	AU: electricity, low voltage {AU-QLD} market for residual electricity mix, low voltage AusLCI, S	AusLCI	2023	No
Electricity	SA	AU: electricity, low voltage {AU-SA} market for residual electricity mix, low voltage AusLCI, S	AusLCI	2023	No
Electricity	VIC	AU: electricity, low voltage {AU-VIC} market for residual electricity mix, low voltage AusLCI, S	AusLCI	2023	No
Electricity	WA	AU: electricity, low voltage {AU-WA} market for residual electricity mix, low voltage AusLCI, S	AusLCI	2023	No
Electricity	AU	AU: electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted	ecoinvent	2023	No

Table 3-5: Key energy datasets used in inventory analysis

Energy	Location	Dataset	Data Provider	Reference Year	Proxy?
Diesel	AU	GLO: diesel, burned in building machine	ecoinvent	2023	No
LPG	AU	GLO: propane, burned in building machine	ecoinvent	2023	No
Natural gas	AU	ROW: heat production, natural gas, at boiler condensing modulating <100kW	ecoinvent	2023	No
Petrol	AU	GLO: petrol, unleaded, burned in machinery	ecoinvent	2023	No

3.3.2. Raw materials and processes

Data for upstream and downstream raw materials and unit processes were obtained from the ecoinvent database. Table 3-6 shows most relevant LCI datasets used in modelling the product systems. Documentation for all ecoinvent and AusLCI datasets can be found at <https://ecoquery.ecoinvent.org/3.10/EN15804> and <https://auslci.com.au/>, respectively.

Table 3-6: Key material and process datasets used in inventory analysis

Material/ process	Location	Dataset	Data Provider	Reference Year	Proxy?
Potting mix	AU, GLO	AU: potting mix production and application, for seedlings	AusLCI	2023	No
Coir	AU, GLO	ROW: suction, shavings, softwood	ecoinvent	2023	Yes
Perlite	AU, GLO	ROW: expanded perlite production	ecoinvent	2023	No
Vermiculite	AU, GLO	ROW: expanded vermiculite, at plant	AusLCI	2023	No
Pine bark	AU, GLO	ROW: bark chips production, softwood, at sawmill	ecoinvent	2023	No
Peat	AU, GLO	ROW: peat moss production, horticultural use	ecoinvent	2023	No
Wood fibre	AU, GLO	ROW: suction, shavings, softwood	ecoinvent	2023	No
Sand	AU, GLO	ROW: gravel and sand quarry operation	ecoinvent	2023	No
Fertilisers	AU, GLO	ROW: nutrient supply from NPK (15-15-15) fertiliser	ecoinvent	2023	No
	AU, GLO	ROW: ammonium nitrate production	ecoinvent	2023	No
	AU, GLO	ROW: ammonia production, partial oxidation, liquid	ecoinvent	2023	No
	AU, GLO	ROW: diammonium phosphate production	ecoinvent	2023	No
	AU, GLO	ROW: monoammonium phosphate production	ecoinvent	2023	No
	AU, GLO	ROW: ammonium sulfate production	ecoinvent	2023	No
	AU, GLO	ROW: calcium ammonium nitrate production	ecoinvent	2023	No
	AU, GLO	ROW: urea production	ecoinvent	2023	No

Material/ process	Location	Dataset	Data Provider	Reference Year	Proxy?
	AU, GLO	ROW: sodium nitrate production	ecoinvent	2023	No
	AU, GLO	ROW: treatment of poultry manure, drying, pelleting	ecoinvent	2023	No
Pesticide	AU, GLO	ROW: pesticide, unspecified	ecoinvent	2023	Yes
Inorganic chemical	AU, GLO	GLO: chemical production, inorganic	ecoinvent	2023	Yes
Organic chemical	AU, GLO	GLO: chemical production, organic	ecoinvent	2023	Yes
Paraffinic oil	AU, GLO	ROW: paraffin production	ecoinvent	2023	Yes
Plastic film (PE)	AU, GLO	ROW: polyethylene production, low density, granulate	ecoinvent	2023	No
	AU, GLO	ROW: extrusion, plastic film	ecoinvent	2023	No
Plastic tray (PP)	AU, GLO	ROW: polypropylene production, granulate	ecoinvent	2023	No
	AU, GLO	ROW: injection moulding	ecoinvent	2023	No
Paper and cardboard	AU, GLO	ROW: kraft paper production	ecoinvent	2023	No
Quick plugs (peat moss)	AU, GLO	ROW: peat moss production, horticultural use	ecoinvent	2023	Yes
Packaging of fertiliser	AU, GLO	GLO: packaging production for fertiliser, per kilogram of packed product	ecoinvent	2023	Yes
Packaging of agrichemical	AU, GLO	GLO: packaging production for pesticide, per kilogram of packed product	ecoinvent	2023	Yes
Packaging of growing media	AU, GLO	ROW: polypropylene production, granulate	ecoinvent	2023	Yes
	AU, GLO	ROW: weaving, synthetic fibre	ecoinvent	2023	Yes

3.3.3. Transportation

Average transportation distances and modes of transport are included for the transport of the raw materials, operating materials, and auxiliary materials to production and assembly facilities.

Table 3-7 shows the datasets used to model transportation. Transportation was modelled using the ecoinvent global transportation datasets.

Table 3-7: Transportation and road fuel datasets

Mode / fuels	Location	Dataset	Data Provider	Reference Year	Proxy?
Truck	AU, GLO	GLO: transport, freight, lorry 16-32 metric ton, EURO5	ecoinvent	2023	No
Ship	AU, GLO	GLO: transport, freight, sea, container ship	ecoinvent	2023	No
Train	AU, GLO	GLO: transport, freight train, diesel	ecoinvent	2023	No

3.3.4. Packaging

The datasets used for modelling product packaging materials are provided in Table 3-8.

Table 3-8: Key material and process datasets used in packaging

Material/ process	Location	Dataset	Data Provider	Reference Year	Proxy?
Plastic pot (PP)	AU, GLO	ROW: polypropylene production, granulate	ecoinvent	2023	No
	AU, GLO	ROW: injection moulding	ecoinvent	2023	No
Plastic plug tray (PS)	AU, GLO	ROW: polystyrene production, general purpose	ecoinvent	2023	No
	AU, GLO	ROW: injection moulding	ecoinvent	2023	No
Jiffy pot (peat moss)*	GLO	ROW: peat moss production, horticultural use	ecoinvent	2023	No
Plastic label (PE)	AU, GLO	ROW: polyethylene production, low density, granulate	ecoinvent	2023	No
	AU, GLO	ROW: extrusion, plastic film	ecoinvent	2023	No

*Note: The manufacturing process of jiffy pots was excluded due to a lack of data, which may lead to an underestimation of their environmental impact.

3.3.5. Water processes

The datasets used for modelling water are provided in Table 3-9.

Table 3-9: Water processes

Material	Location	Dataset	Data Provider	Reference Year	Proxy?
Tap water	AU	AU: tap water, at user, Australia	AusLCI	2023	No
Tap water	WA	AU: tap water, at user, Western Australia	AusLCI	2023	No
Tap water	VIC	AU: tap water, at user, Victoria	AusLCI	2023	No
Tap water	NSW	AU: tap water, at user, New South Wales	AusLCI	2023	No
Tap water	SA	AU: tap water, at user, South Australia	AusLCI	2023	No
Tap water	QLD	AU: tap water, at user, South East Queensland	AusLCI	2023	No

3.3.6. Waste and wastewater treatment processes

The datasets used for modelling wastewater treatment are provided in Table 3-10.

Table 3-10: Waste treatment processes

Treatment/ Process	Location	Dataset	Data Provider	Reference Year	Proxy?
General waste for landfill	AU	ROW: treatment of waste plastic, mixture, sanitary landfill	ecoinvent	2023	No
General waste for compost	AU	ROW: treatment of biowaste by anaerobic digestion	ecoinvent	2023	No

4. Life cycle impact assessment

This chapter contains the results for the impact categories and additional metrics defined in section 2.7. It shall be reiterated at this point that the reported impact categories represent impact potentials, i.e., they are approximations of environmental impacts that could occur if the emissions would (a) follow the underlying impact pathway and (b) meet certain conditions in the receiving environment while doing so. In addition, the inventory only captures that fraction of the total environmental load that corresponds to the chosen functional unit (relative approach).

LCIA results are therefore relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks.

4.1. Assessment results

This section provides assessment results for 1 L of nursery products, plus packaging.

Table 4-1 and Table 4-2 present EN15804+A2 core and additional environmental indicators. Table 4-3 to Table 4-5 present the inventory indicators.

The results for upstream and core stages include ‘balancing-out reporting’ for the biogenic CO₂, PERM and PENRM of packaging. This is because the downstream stage is not included in the system boundary for this study.

The results show:

- **Upstream stage** contributes to noticeable impacts of GWP-total, GWP-fossil, ODP, EP-fw and ADP-fossil. It also contributes to all other core environmental indicators.
- **Core stage** generates significant GWP-biogenic, EP-m, EP-tr, ADP-minerals&metals and WDP impacts. It also has an impact on all other core environmental indicators.
- Upstream and core stages have similar impacts on AP and POCP.

Table 4-1: Core environmental indicator results for nursery products, per 1 L (based on pot/container size)

Indicator	Unit	Upstream	Core	Total
GWP-total	kg CO ₂ -eq.	0.231	0.188	0.418
GWP-fossil	kg CO ₂ -eq.	0.230	0.178	0.408
GWP-biogenic	kg CO ₂ -eq.	8.07E-04	0.00870	0.00950
GWP-luluc	kg CO ₂ -eq.	1.48E-04	5.62E-04	7.11E-04
ODP	kg CFC11-eq.	4.36E-09	1.77E-09	6.12E-09
AP	Mole of H ⁺ eq.	0.00107	0.00106	0.00212
EP-fw	kg P eq.	3.82E-05	1.29E-05	5.11E-05
EP-m	kg N eq.	2.21E-04	3.39E-04	5.61E-04
EP-tr	Mole of N eq.	0.00239	0.00293	0.00532
POCP	kg NMVOC eq.	8.89E-04	8.59E-04	0.00175
ADP-minerals&metals¹	kg Sb-eq.	2.51E-07	1.34E-06	1.59E-06
ADP-fossil¹	MJ	7.22	1.32	8.54
WDP¹	m ³ world equiv.	0.137	0.891	1.03

Table 4-2: Additional environmental indicator results for nursery products, per 1 L (based on pot/container size)

Indicator	Unit	Upstream	Core	Total
GWP-GHG²	kg CO ₂ -eq.	0.230	0.177	0.408
PM	Disease incidences	1.01E-08	7.45E-09	1.75E-08
IRP³	kBq U235 eq.	0.00719	0.00301	0.0102
ETP-fw¹	CTUe	0.314	0.730	1.04
HTPc¹	CTUh	1.21E-11	1.54E-11	2.75E-11
HTPnc¹	CTUh	6.40E-10	1.95E-09	2.59E-09
SQP¹	Dimensionless	8.27	15.5	23.7

Table 4-3: Resource use indicator results for nursery products, per 1 L (based on pot/container size)

Indicator	Unit	Upstream	Core	Total
PERE	MJ	1.21	0.320	1.53
PERM	MJ	0	0	0
PERT	MJ	1.21	0.320	1.53
PENRE	MJ	7.22	1.32	8.54
PENRM	MJ	0	0	0
PENRT	MJ	7.22	1.32	8.54
SM	kg	0	0	0
RSF	MJ	0	0	0
NRSF	MJ	0	0	0
FW	m ³	0.00890	0.0288	0.0377

Table 4-4: Waste material and output flow indicator results for nursery products, per 1 L (based on pot/container size)

Indicator	Unit	Upstream	Core	Total
HWD	kg	0.0126	0.00221	0.0148
NHWD	kg	0.323	0.191	0.515
RWD	kg	1.72E-06	2.86E-07	2.01E-06
CRU	kg	0	0	0
MFR	kg	0	0.0109	0.0109
MER	kg	0	0	0
EEE	MJ	0	0	0
EET	MJ	0	0	0

Table 4-5: Biogenic carbon content indicator results for nursery products, per 1 L (based on pot/container size)

Indicator	Unit	Upstream and Core
BCC-prod*	kg	0
BCC-pack	kg	0

*Note: the biogenic carbon content of product was not calculated due to significant variability in carbon content across different nursery products.

4.2. Comparison across products

The locations and plant types sold by seven growers are summarised in Table 3-1. The GWP-total results for all products from growers are presented in Figure 4-1. The comparison is provided to support identification of relevant findings and is not intended to be used for comparative assertions.

The comparison shows:

- GWP-total results vary significantly between growers.
- The location of growers has an impact on their GWP-total results. Growers in Southern Australia, where the climate is colder, often use more energy to maintain suitable temperatures for plant growth.
- The type of plants sold also has an impact on GWP-total results. The production of propagation plants, bedding and potted colour, and herbs and vegetables in general consumes more energy and materials.
- The intensive use of potting mix by one grower has significantly increased the contribution of growing media to the industry's average carbon footprint.

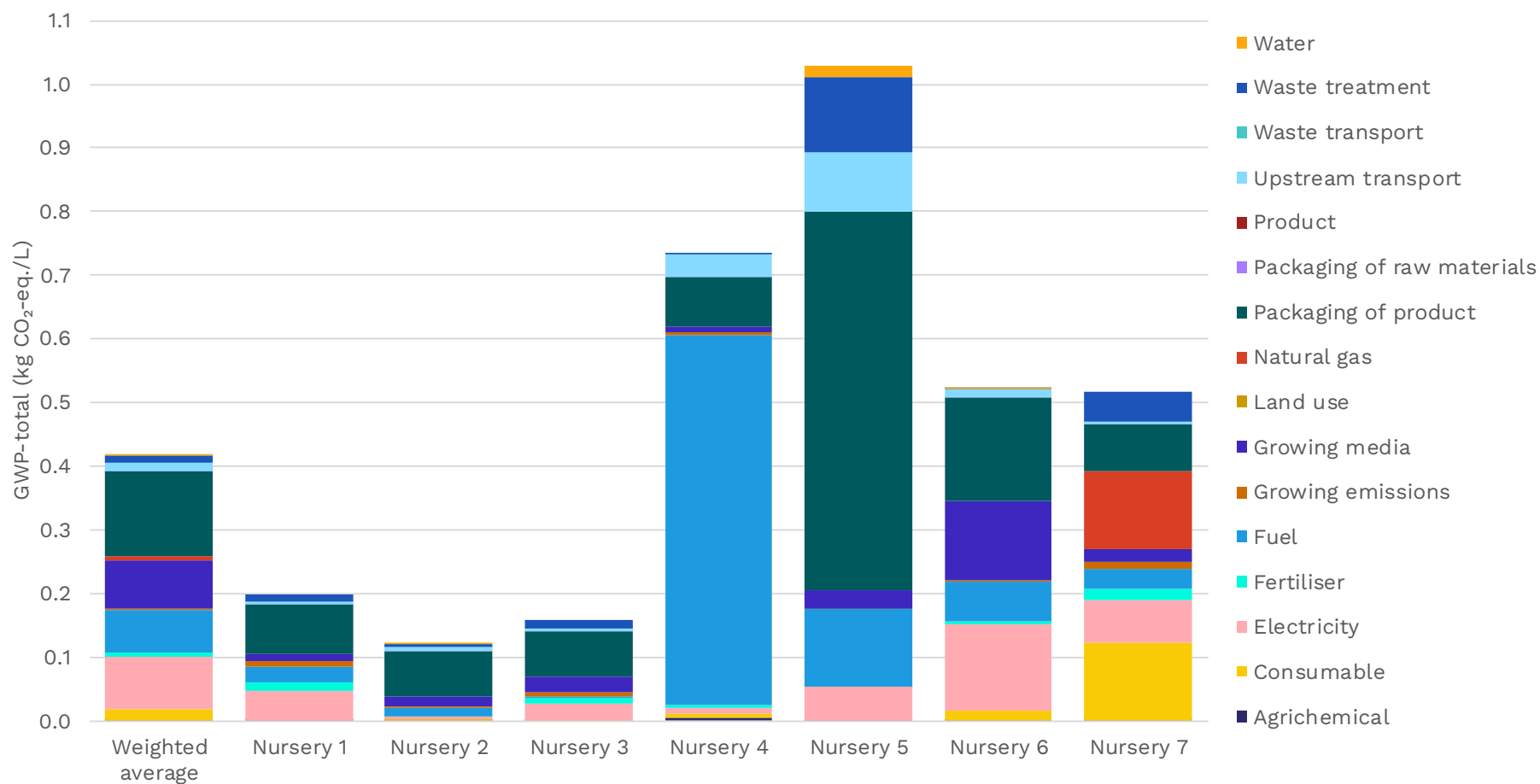


Figure 4-1: Comparison of GWP-total results of nursery products, per 1 L (based on pot/container size)

4.3. Hotspot analysis

Hotspot analysis has been conducted for the EN 15804+A2 core environmental impact indicators as well as for additional environmental indicators.

Hotspot analysis examines the percentage contribution of each process to the total impact. Therefore, products with lower overall upstream and core impact will show higher percentage contributions from each process. Percentage contributions should therefore be understood within the context of the relative impact per product and not assumed to imply that the impacts from that process are higher for a particular product.

4.3.1. Hotspot analysis – Core environmental impact indicators

GWP-luluc is of less relevance to GWP-total results. Therefore, the hotspots of GWP-luluc are not analysed in this report.

The hotspots of core environmental indicators are presented in Figure 4-2. The hotspot analysis of nursery products shows:

- **Packaging of nursery products** has the highest impact on GWP-total and GWP-fossil. It is also a hotspot for ODP, AP, EP-fw, POCP and ADP-fossil impacts. It also contributes to GWP-biogenic, EP-m, EP-tr and WDP impacts.
- **Electricity consumption** is a hotspot for GWP-total and GWP-fossil. It has the highest impact on ADP-minerals&metals. It is also a hotspot for GWP-biogenic, AP, EP-fw, EP-m, EP-tr and POCP. In addition, it contributes to ODP and WDP impacts. It is worth noting that electricity distribution infrastructure contributes to most of ADP-minerals&metals impact of electricity.
- **Production of growing media** is a hotspot for all core environmental impact indicators, except for GWP-biogenic. It has the highest impact on ADP-fossil. This is due to the use of potting mix.
- **On farm fuel use** is another hotspot for all core environmental impact indicators, exceptions are GWP-biogenic and WDP.
- **Consumables** contribute to many indicators, such as GWP-total, GWP-fossil, ODP, AP, EP-fw, EP-m, EP-tr, POCP and ADP-fossil. It is also a key hotspot for ODP and EP-fw.
- **Upstream transport of raw materials** contributes to many indicators, such as GWP-total, GWP-fossil, ODP, AP, EP-m, EP-tr, POCP and ADP-fossil.
- **Waste treatment** has the highest impact on GWP-biogenic and is a hotspot for EP-m. It also contributes to GWP-total impact.
- **Agrichemicals** contribute to ODP significantly.
- **Operational emissions** due to the application of fertilisers and agrichemicals contribute to EP-m and EP-tr noticeably.
- **On-farm water use** has the highest impact for WDP.

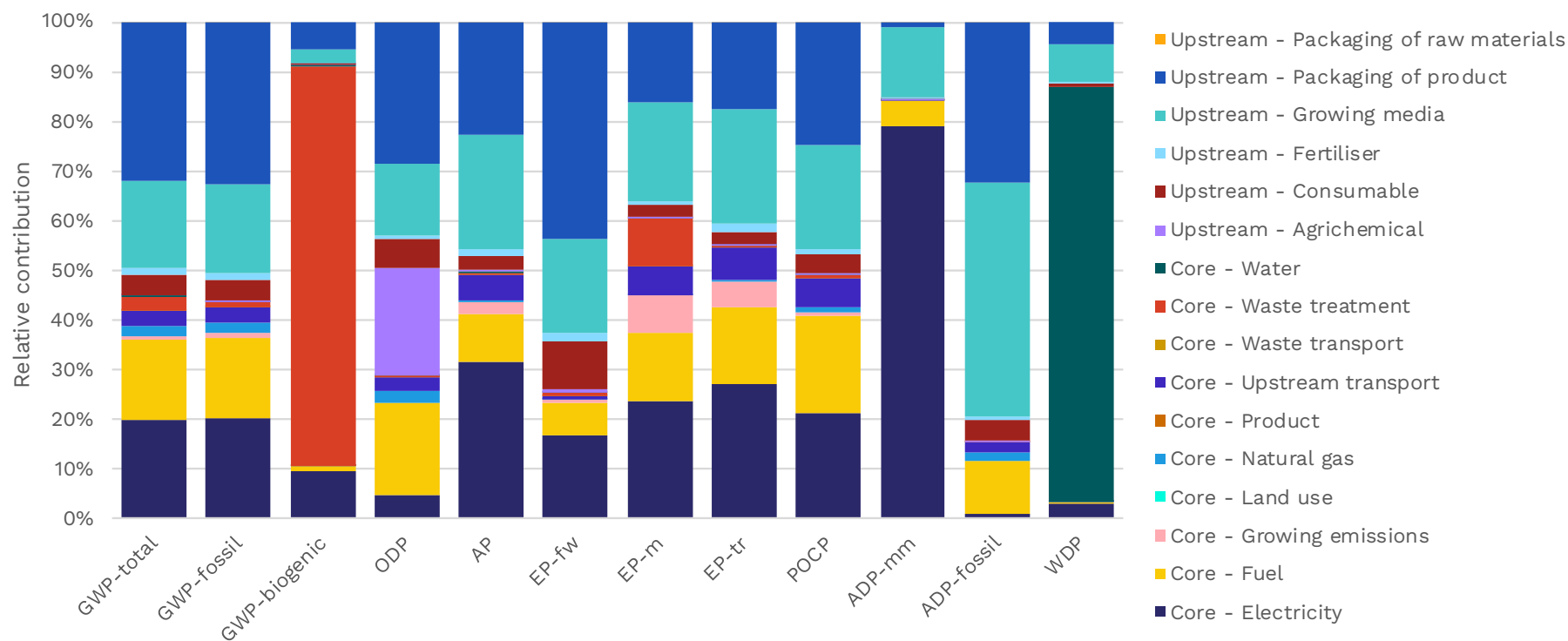


Figure 4-2: Main contributors to core environmental indicators for nursery products from cradle-to-gate

4.3.2. Hotspot analysis – Additional environmental impact indicators

The hotspots of GWP-GHG impact are similar to that of GWP-total. Therefore, the hotspot analysis of GWP-GHG is not repeated.

The hotspots of additional environmental indicators are presented in Figure 4-3. The hotspot analysis of nursery products shows:

- **Packaging of nursery products** has the highest impact on PM and IRP. It also contributes to ETP-fw, HTPc and HTPnc.
- **Electricity consumption** has the highest impact on HTPc and HTPnc and is a major hotspot for PM. It also contributes to IRP and ETP-fw.
- **Production of growing media** is a hotspot for all additional environmental impact indicators.
- **Fuel consumption** is another hotspot for all additional environmental impact indicators, with the exception of SQP.
- **Consumables** contribute to all additional environmental impact indicators. It is a hotspot for IRP impact.
- **Upstream transport of raw materials** contributes to many indicators, such as PM, HTPc and HTPnc.
- **Waste treatment** is a hotspot for ETP-fw. It also contributes to HTPnc impact.
- **Agrichemicals** contribute to ETP-fw impact.
- **Operational emissions due to the application of fertilisers and agrichemicals** have the highest impact on ETP-fw and contribute to noticeable impacts of IRP. It also contributes to HTPnc impact.
- **Land use due to site operation** has the highest impact on SQP.

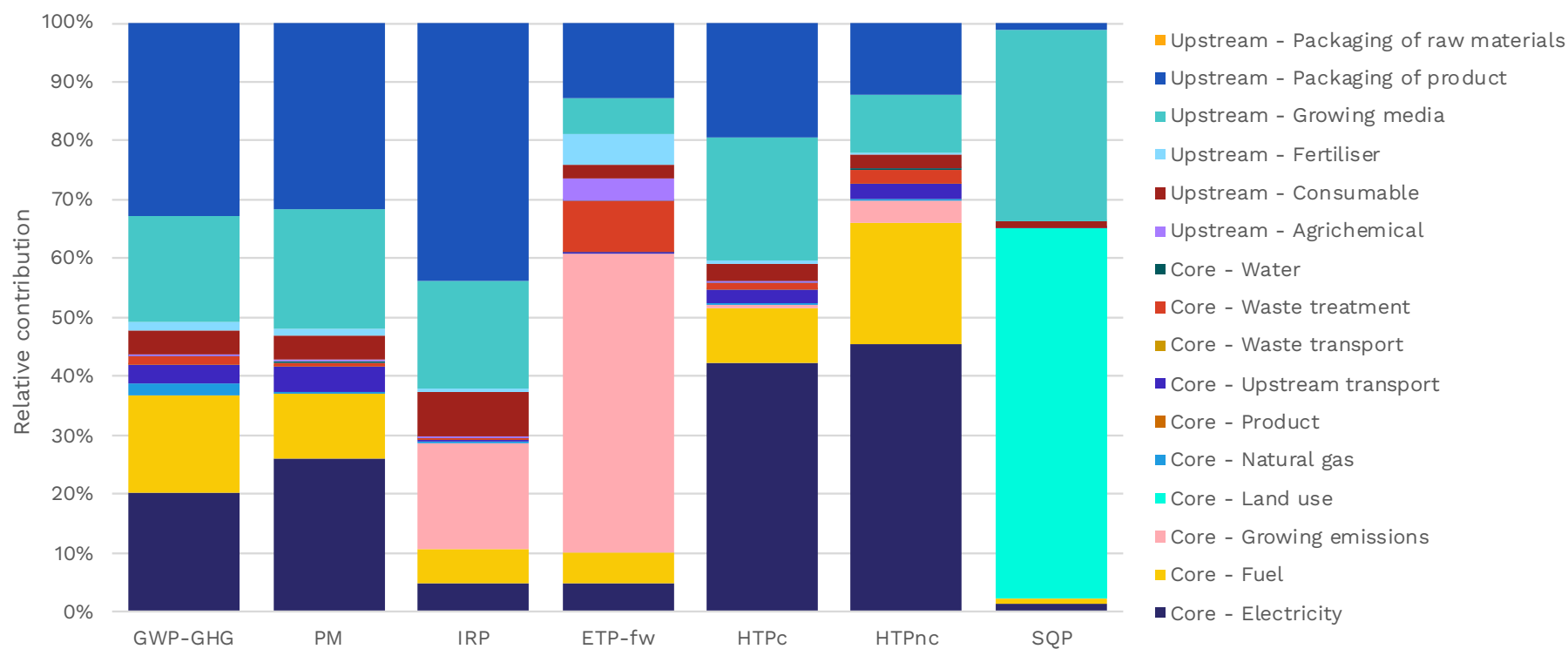


Figure 4-3: Main contributors to additional environmental indicators for nursery products in upstream and core stages

4.4. Additional scenario analysis

This section calculates the carbon footprint (GWP-total) results based on value (per AUD) and number (per sold unit) of plants sold. GWP-total results per AUD and per sold plant are presented in Figure 4-4 and Figure 4-5, respectively. In these charts, the nurseries have been reordered and relabelled to protect confidentiality.

The results show:

- The GWP-total results vary significantly between growers.
- The average GWP-total result per AUD of plants sold is 0.083 kg CO₂-eq/AUD.
- The average GWP-total result per sold plant is 0.39 kg CO₂-eq/plant.

According to the analysis, the declared unit can significantly affect the environmental indicator results for nursery products. It is necessary to develop a consistent declared unit for the LCA of nursery products.

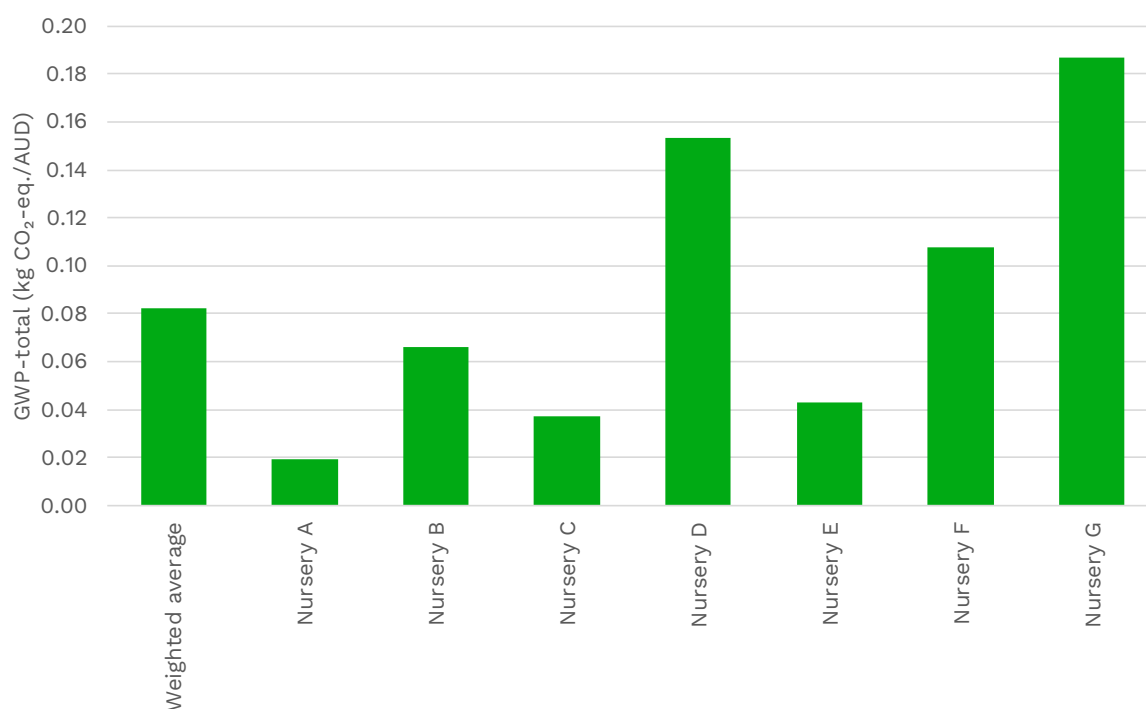


Figure 4-4: GWP-total results based on value of plants sold, per AUD.

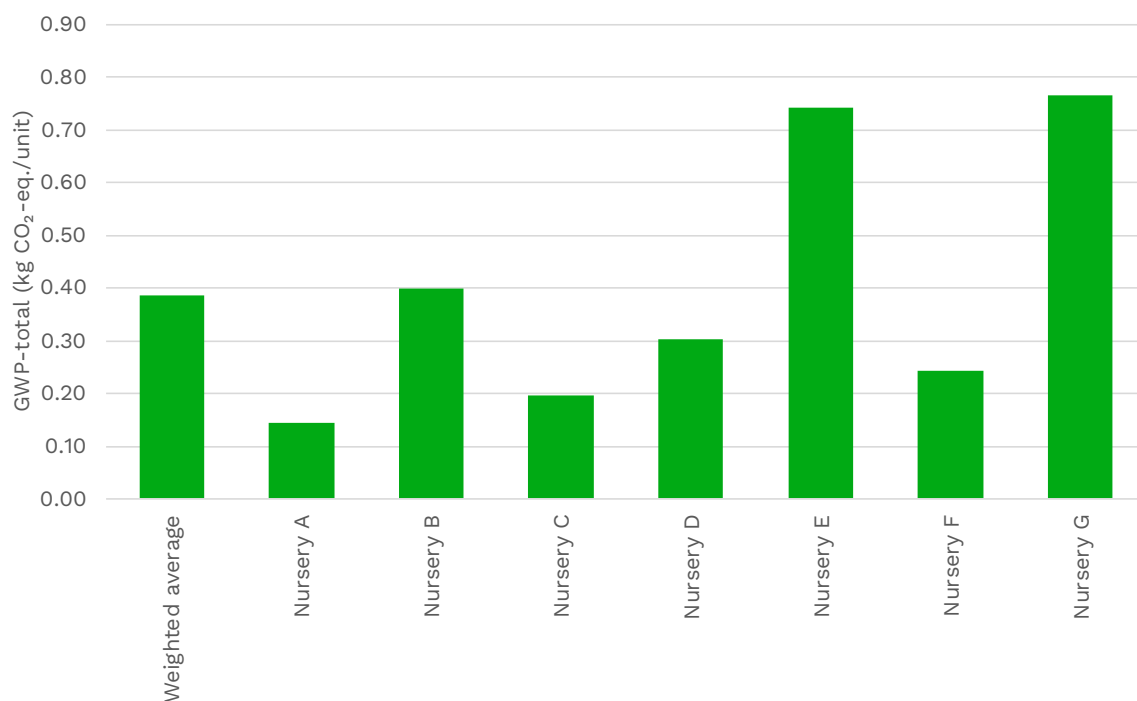


Figure 4-5: GWP-total results based on number of plants sold, per plant

5. Data quality assessment

Inventory data quality is judged by its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied) and representativeness (geographical, temporal, and technological).

To cover these requirements and to ensure reliable results, first-hand industry data in combination with consistent background LCA information from the ecoinvent and AusLCI databases were used. The LCI datasets from the ecoinvent and AusLCI databases are widely distributed and used with the MS Excel. The datasets have been used in LCA models worldwide in industrial and scientific applications in internal as well as in many critically reviewed and published studies. In the process of providing these datasets they are cross-checked with other databases and values from industry and science.

5.1. Representativeness

The data quality assessment according to the EN15804 Annex E is provided in Table 5-1 with more details provided below.

- **Temporal:** All primary data were collected for the financial year 2025. All secondary data come from the ecoinvent and AusLCI databases and are representative of the years 2023. As the study intended to compare the product systems for the reference year 2025, temporal representativeness is considered to be very good.
- **Geographical:** All primary data are for Australian. Much of the secondary data is also for Australia. Where country-specific or region-specific data were unavailable, proxy data were used. Geographical representativeness is considered to be good.
- **Technological:** All primary and secondary data were modelled to be specific to the technologies or technology mixes under study. Where technology-specific data were unavailable, proxy data were used. Technological representativeness is considered to be good.

Table 5-1: Data quality assessment

Process	Geographical representativeness	Technical representativeness	Time representativeness
Production of growing media	Good	Good	Very Good
Production of fertiliser	Good	Good	Very Good
Production of agrichemical	Good	Fair	Very Good
Production of pot and tray	Good	Good	Very Good
Generation and combustion of fuel used in nursery processes	Good	Very Good	Very Good
Generation of electricity used in nursery processes	Very Good	Very Good	Very Good
Generation of water in nursery processes	Very Good	Very Good	Very Good
Waste and wastewater treatment	Good	Good	Very Good
Transport of raw materials to growers' sites	Good	Good	Very Good
Production of other raw materials	Good	Good	Very Good

5.2. Precision and completeness

- **Precision:** As the majority of the relevant foreground data are measured data or calculated based on primary information sources of the owner of the technology, precision is considered to be high. Seasonal variations and variations across different nurseries were balanced out by using yearly averages and weighted averages, respectively. All background data are sourced from ecoinvent and AusLCI databases with the documented precision.
- **Completeness:** Each foreground process was checked for mass balance and completeness of the emission inventory. No data were knowingly omitted. Completeness of foreground unit process data is considered to be high. All background data are sourced from ecoinvent and AusLCI databases with the documented completeness.

5.3. Consistency and reproducibility

- **Consistency:** To ensure data consistency, all primary data were collected with the same level of detail, while all background data were sourced from the ecoinvent and AusLCI databases.
- **Reproducibility:** Reproducibility is supported as much as possible through the disclosure of input-output data, dataset choices, and modelling approaches in this report. Based on this information, any third party should be able to approximate the results of this study using the same data and modelling approaches.

5.4. Model completeness and consistency

5.4.1. Completeness

All relevant process steps for each product system were considered and modelled to represent each specific situation. The process chain is considered sufficiently complete and detailed with regards to the goal and scope of this study.

5.4.2. Consistency

All assumptions, methods and data are consistent with each other and with the study's goal and scope. Differences in background data quality were minimised by exclusively using LCI data from the ecoinvent and AusLCI databases. System boundaries, allocation rules, and impact assessment methods have been applied consistently throughout the study.

6. Interpretation

6.1. Conclusions

The cradle-to-gate carbon footprint of 1 L of Australian nursery products (plus packaging) in FY2025 was found to be 0.42 kg CO₂-eq. Many other environmental indicators were also assessed in this study alongside carbon footprint, including eutrophication, water use and air pollution.

The results show that many factors contribute to the overall environmental impacts of nursery products from ‘cradle-to-gate’:

- **Upstream stage** has a higher impact on total carbon footprint, carbon emissions (fossil), ozone depletion, eutrophication (freshwater) and resource use (fossil).
- **Core stage** has higher impact on carbon emissions (biogenic), eutrophication (marine and terrestrial), resource use (minerals and metals) and water depletion.
- **Upstream and core stages** have a similar impact on acidification and smog formation.
- **Packaging of nursery products** has the highest impact on the carbon footprint of nursery plants. It is also a major contributor to many indicators, including ozone depletion, acidification, eutrophication (freshwater), smog formation and resource use (fossil). It also contributes to eutrophication (marine and terrestrial) and water depletion. This is due to the use of polypropylene pots and polystyrene trays.
- **Electricity consumption** is a hotspot for many indicators, including carbon footprint, acidification, eutrophication and smog formation. It also contributes to ozone depletion and water depletion.
- **Production of growing media**, particularly potting mix, has significant impacts on most indicators, including carbon footprint, eutrophication, resource use and water depletion.
- **On-farm fuel use** is another hotspot for most indicators. Exceptions are biogenic carbon emissions and water depletion.
- **Consumables and upstream transport of all raw materials** contribute to many indicators, such as carbon footprint, ozone depletion, acidification, eutrophication, smog formation and resource use (fossil).
- **Waste treatment** has the highest impact on biogenic carbon emissions and is a hotspot for eutrophication (marine).
- **Agrichemicals** contribute to noticeable impacts of ozone depletion.
- **Operational emissions due to the application of fertilisers and agrichemicals** contribute to noticeable impacts of eutrophication (marine and terrestrial).
- **On-farm water use** has the highest impact on water depletion.
- Other processes, such as production of fertilisers, packaging of raw materials and transport of waste, have lesser impacts on the environmental indicators considered in this study.

According to the additional scenario analysis, the average carbon footprint of Australian nursery products is 0.0825 kg CO₂-eq/AUD and 0.387 kg CO₂-eq/plant.

Overall, this study presents a baseline environmental footprint for Australian nursery products. This baseline can be used as a starting point from which to measure progress as the nursery industry tries to reduce its environmental impacts over time. These results are not intended to support direct comparative claims made against other industries.

6.2. What growers are already doing to improve their environmental performance

Variations were observed in material and energy consumption across different sites. However, there are some common practices adopted by different growers to improve the environmental performance of their nursery operations:

- Renewable electricity from on-site solar panels accounted for 35% of total electricity usage.
- Most consumables, such as plastic plug trays, are reused multiple times on-site.
- Packaging of raw materials, such as paper and cardboard, is recycled.
- Some growers recycled used plastic pots/trays and composted used biodegradable pots/trays.

6.3. Options available to improve environmental performance

To reduce the environmental footprint of Australian nursery products, we recommend that the Australian nursery industry:

- **Reduce and improve packaging** by minimising material use and requesting lower impact options (such as those with increased recycled content) from packaging suppliers. While this won't reduce your on-site emissions, it will reduce your emissions in your supply chain.
- **Increase renewable electricity use** through on-site solar and purchased renewable energy certificates.
- **Reduce fossil fuel use** by improving energy efficiency and transitioning away from diesel, LPG, petrol and natural gas where feasible.
- **Take a whole-of-life view** when making changes to avoid shifting impacts from one life cycle stage to another.

6.4. Data collection guidance for growers

We recommend that nursery growers adopt a suitable process for collecting data for their own operations moving forward. This will prepare them for future life cycle assessments, and for any future emissions data requests from third-parties such as the Australian government. As a starting point, we recommend that growers undertake audits of their own nurseries to better understand their energy use and waste treatment.

An LCA relies on 12 consecutive months of data. This data is typically gathered from central management systems (i.e. accounting). Where this information is not centrally recorded, it typically needs to be compiled from monthly invoices.

The types of data we recommend growers collect includes:

- Energy (electricity, thermal energy, fuels)
- Raw materials (by type and mass/volume)
- Water (both municipal and rainwater collection)
- Packaging (by material and mass)
- Waste (by type of waste and treatment type)

For a full list of required data types, please refer to Annex A.

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Applicability and limitations

Restrictions and intended purpose

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If you have any suggestions, complaints, or any other feedback, please contact us at: feedback@thinkstep-anz.com

Legal interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Annex A Data collection survey

The following survey was distributed to nursery growers to collect data for the LCA. We recommend that growers continue to collect data for their operations using a similar format.

Basic data	
Where is your business located?	Click here to enter state. Click here to enter suburb.
Please provide the start date of the reference year.	dd/mm/yyyy
Energy	
How much electricity from grid was used on-site?	Value here kWh
How much electricity from renewables was used on-site	Value here kWh
How much natural gas was used on-site?	Value here MJ
How much diesel was used on-site?	Value here Litres
How much LPG was used on-site?	Value here Litres
How much petrol was used on-site (Excluding staff transport and product distribution etc.)?	Value here Litres
Water	
Total amount of water used?	Value here kLitres
Share of municipal water (town water)?	Value here %
Share of dam water?	Value here %
Share of bore water?	Value here %
Share of rainwater?	Value here %
Share of creek or river water?	Value here %

Fertiliser/growing media

Select materials used for propagation/growing media

Materials	Tick if used	Quantity	Unit of measure (e.g. kg, m ³)	Cost	Manufacturer location if known	Transport distance from manufacturing site if known	Transport mode from manufacturing site if known (road/rail/sea/air)
Arrives pre-mixed (bulk)	☐	number only	unit only	value AUD	answer here	value km	answer here
What materials does the media contain and in what proportions, such as peat and fertiliser? list options here, include proportions as % value here							
Potting mix (bags)	☐	number only	unit only	value AUD	answer here	value km	answer here
If sourcing your own individual ingredients rather than pre-mixed (i.e. on-site blend), please fill out the questions below							
Coir	☐	number only	unit only	value AUD	answer here	value km	answer here
Perlite	☐	number only	unit only	value AUD	answer here	value km	answer here
Vermiculite	☐	number only	unit only	value AUD	answer here	value km	answer here
Pine bark	☐	number only	unit only	value AUD	answer here	value km	answer here
Peat	☐	number only	unit only	value AUD	answer here	value km	answer here
Solid fertilizer (blended into the growing media)	☐	number only	unit only	value AUD	answer here	value km	answer here
For "solid fertiliser": NPK ingredient (in %)? For example, N%-P%-K%		N value here % P value here % K value here %					

Fertiliser/growing media

Other fertiliser/growing media

Others	☐						
Name other material		number only	unit only	value AUD	answer here	value km	answer here
Name other material		number only	unit only	value AUD	answer here	value km	answer here
Name other material		number only	unit only	value AUD	answer here	value km	answer here
Name other material		number only	unit only	value AUD	answer here	value km	answer here

What other types of fertilisers were used in the reference year (as applied after potting?)

For the solid and/or liquid fertiliser (if applicable)

Materials	Tick if used	Quantity	Unit of measure (e.g. kg, m ³)	Cost	Manufacturer location if known	Transport distance from manufacturing site if known	Transport mode from manufacturing site if known (road/rail/sea/air)
Solid fertiliser name	☐	number only	unit only	value AUD	answer here	value km	answer here
For "solid fertiliser": NPK ingredient (in %)? For example, N%-P%-K%	N value here % P value here % K value here %						
Liquid fertiliser name	☐	number only	unit only	value AUD	answer here	value km	answer here
For "solid fertiliser": NPK ingredient (in %)? For example, N%-P%-K%	N value here % P value here % K value here %						

Agrichemicals

What type of agrichemicals (fungicide/insecticide/herbicide/disinfectant) were used in the reference year?							
Top 5 agrichemicals	Solid	Liquid	Quantity	Cost	Manufacturer location if known	Transport distance from manufacturing site if known	Transport mode from manufacturing site if known (road/rail/sea/air)
Brand name agrichemical	☐	☐	number only kg	value AUD	answer here	value km	answer here
Brand name agrichemical	☐	☐	number only kg	value AUD	answer here	value km	answer here
Brand name agrichemical	☐	☐	number only kg	value AUD	answer here	value km	answer here
Brand name agrichemical	☐	☐	number only kg	value AUD	answer here	value km	answer here
Brand name agrichemical	☐	☐	number only kg	value AUD	answer here	value km	answer here
What share of your total agrichemical use do these 5 agrichemicals make up?			Value here %				
Total amount of spend on all agrichemicals combined?			value AUD				
Main manufacturer location if known?			answer here				
Transport distance (in km) from main manufacturer to site if known?			value km				
Transport mode (road/rail/sea/air) from main manufacturer to site if known?			answer here				

Pots/Containers

How many different types of pots/containers do you sell plants in?

Types of Pot	Pot/container name	Number purchased for sale	Number of throw-outs	Cost	Material type	Pot diameter	Tray cell number? Enter "1" if a pot or bag.	Volume	Manufacturing location if known	Transport distance from manufacturing site if known	Transport mode from manufacturing site if known (road/rail/sea/air)
Type 1	Pot/container name	number only	number only	value AUD	answer here	number only mm	number only	value Litres	answer here	value km	answer here
Type 2	Pot/container name	number only	number only	value AUD	answer here	number only mm	number only	value Litres	answer here	value km	answer here
Type 3	Pot/container name	number only	number only	value AUD	answer here	number only mm	number only	value Litres	answer here	value km	answer here
Type 4	Pot/container name	number only	number only	value AUD	answer here	number only mm	number only	value Litres	answer here	value km	answer here
Type 5	Pot/container name	number only	number only	value AUD	answer here	number only mm	number only	value Litres	answer here	value km	answer here
Type 6	Pot/container name	number only	number only	value AUD	answer here	number only mm	number only	value Litres	answer here	value km	answer here

Pots/Containers												
What are the main types of plant you sell in these pot/container types?												
Types of Pot	Shrubs	Trees	Propagation plants	Indoor plants	Other perennials	Bedding and potted colour	Herbs and vegetables	Fruit trees	Nut trees	Vines	Others	Total plant sales in this pot/container size?
Type 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	answer here	value AUD
Type 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	answer here	value AUD
Type 3	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	answer here	value AUD
Type 4	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	answer here	value AUD
Type 5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	answer here	value AUD
Type 6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	answer here	value AUD

Other packaging materials		
Material	Amount	Cost
Plastic packaging (such as wrapping film) usage	value kg	value AUD
Paper and cardboard (such as label) usage	value kg	value AUD
Metal (such as stake) usage	value kg	value AUD
Wood (such as pallet) usage	value kg	value AUD
Are there other process materials used in nursery operations?	☐ Yes	☐ No
If yes, provide the following information:		
Process material name?	answer here	
Quantity?	number only	
Unit of measure (such as kg, tonne, L)?	unit only	
Amount of spend?	value AUD	
Manufacturer location if known?	answer here	
Transport distance from manufacturing site if known	value km	
Transport mode from manufacturing site if known (road/rail/sea/air)	answer here	
Waste		
Waste for landfill	value m ³	
Waste for compost	value m ³	
Waste for recycling	value m ³	
Do you have a water dam? If yes, please provide:	☐ Yes	☐ No
Your total dam volume	value ML	
Surface area	value m ²	
Average depth	value m	
How many overflow events have you experienced over the last five years that have led to significant nutrient loss from your dam? Please enter "n/a" if not relevant to your site.	answer here	

About thinkstep-anz

We're an independent and award winning sustainability firm with offices in Australia and Aotearoa New Zealand – and a global reach.

Our team works with you to put sustainability at the heart of your business, to set you up to succeed and inspire you to keep achieving more.

We focus on what matters and use data to understand organisations and their impact. We provide practical resources and ideas that move you ahead.

We create value for organisations like yours, bringing our technical expertise and business know-how to help you tell your story. It's what we've been doing since 2006.

Our services cover:



LCA and EPD services

Measure environmental impacts to support informed decision-making.

- Life Cycle Assessment (LCA)
- Environmental Product Declarations (EPD)
- Product carbon footprinting
- Critical review



Carbon footprint services

Calculate your carbon footprint, develop net zero strategies and targets.

- Carbon footprint: Scope 1 & 2
- Scope 3
- Carbon reduction strategy
- Net zero targets



Circular economy services

Identify opportunities to improve resource efficiency and reduce waste.

- Material Circularity Indicator
- Circular economy workshops
- Circular economy strategy
- Circularity declaration



Sustainability strategy

Turn sustainability priorities into practical roadmaps and targets.

- Materiality assessment
- Double materiality
- Sustainability strategy
- ESG policies



ESG and climate reporting

Prepare reports and disclosures supported by robust data and practical implementation.

- Climate related disclosures
- Disclosurekit
- GRI and sustainability reports
- Greenwashing risk review



Communications and design services

We turn complex data into graphics, summary reports and presentations.

- Sustainability reports
- Summary reports
- Board presentations
- Case studies
- Infographics



Software, data and tools

- LCA calculators
- LCA software
- Material Circularity Indicator
- Spend based emission factors
- Residual grid mix factors
- LCA data
- Carbon reporting software



Upskilling and training

- LCA training
- Carbon workshops
- Supplier workshops
- Training for industry associations
- Tailored in-house workshops
- Greenwash risk training



Succeed sustainably

www.thinkstep-anz.com

We don't just talk
about sustainability
– we practise it too



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