Appendix K Rehabilitation Management Plan

Prepared for
Tarong West Project Co Pty Ltd
ABN: 81 679 081 040

AECOM

Rehabilitation Management Plan

Tarong West Wind Farm

22-Aug-2025
Tarong West Wind Farm

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Rehabilitation Management Plan

Tarong West Wind Farm

Client: Tarong West Project Co Pty Ltd

ABN: 81 679 081 040

Prepared by

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22-Aug-2025

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Table of Contents

1.0 Introduction

This Rehabilitation Management Plan (RMP) details how Tarong West Project Co Pty Ltd (the Proponent) will undertake rehabilitation activities required at various stages over the 30-year life of the Tarong West Wind Farm (the Project).

The Project requires approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the assessment approach requires a Public Environment Report (PER) (EPBC 2023/09643) to be prepared. This RMP responds to section 8 of the PER guidelines, which outlines the requirements for environmental management and rehabilitation.

This RMP addresses these guidelines by providing a structured framework for implementing and monitoring rehabilitation efforts, ensuring the restoration of impacted areas to an agreed-upon standard. It includes details on rehabilitation strategy, methodologies, timelines, and performance indicators, demonstrating compliance with the expectations set forth in section 8.

Table 1 RMP content overview

PER Guideline	Rehabilitation requirement	Section of this RMP
8.1.1	Maps showing the areas that will be rehabilitated within the proposed action area and the size in hectares of these areas.	1.2 and 4.0
8.1.2	A summary of the vegetation community/habitat that is being rehabilitated and the dominant species that will be included in the rehabilitation site.	3.0 and 4.0
8.1.3	The details of any rehabilitation activities proposed to be undertaken as required by Commonwealth, State or Territory, and local government legislation.	4.0 and 5.0
8.1.4	Provide details of rehabilitation methods and how they meet best practice standards, including for the restoration of habitat for relevant MNES and avoidance of sedimentation/erosion.	5.0
8.1.5	Information on management of the rehabilitation locations, including, but not limited to, weed and pest management.	Section 5.0 and 5.1.1 (weeds)
8.1.6	Rehabilitation acceptance criteria relevant to MNES and the procedures, including contingency measures, that will be undertaken to achieve them.	4.3
8.1.7	Details of a monitoring program to determine the success of rehabilitation activities implemented by the proponent, including any contingency measures and when they would be triggered.	5.3
8.1.8	Include information on whether any post-construction rehabilitation sites will be subsequently cleared during the decommissioning stage.	4.2

The purpose of this RMP is to provide the framework under which the Proponent will commit to undertaking rehabilitation activities. The RMP provides a central point of reference to confirm rehabilitation requirements and outcomes. It is subject to ongoing review by the Proponent and will be implemented alongside landholder agreements that stipulate the potential mutually agreeable rehabilitation outcomes and other Project management plans (e.g. Environmental Management Plan (AECOM, 2025), Vegetation Management Plan (VMP) (Ecosure, 2025) and Decommissioning Management Plan (AECOM, 2025a)). Mutually agreed rehabilitation outcomes may include conversion of hardstands to grassed paddocks and other grassed areas, rather than reinstatement of all ecosystem strata.

The Proponent has undertaken, and continues to undertake, Project-wide efforts to minimise impacts on the environment. This has included rationalising the footprint of each Project component as part of the design process so that the overall impact was reduced.

The Project has two core phases relating to rehabilitation:

1. post-construction rehabilitation
2. rehabilitation as part of decommissioning the wind farm.

There may be incidental rehabilitation requirements during the Project operational phase, and these works must be undertaken in accordance with this RMP.

The scope of this RMP includes:

- the species composition and density of pre-existing vegetation
- weed management measures for all stages of planting and regrowth
- responsive measures for the characteristics of each area to be rehabilitated
- acknowledgement of the site stabilisation plan-operations
- timing of rehabilitation activities to minimise the unvegetated disturbance time.

The final operational footprint of the project will be less than the area used for construction of the project. As such, some areas of vegetation cleared for Wind Turbine Generator (WTG) pads and infrastructure installation will be progressively rehabilitated.

1.1 Material change of use and operational work approval conditions

The Queensland Government have granted the material change of use and operational work development permits for the Project (reference: 2402-39136-SDA). The approval conditions provide a detailed framework for the Project to manage potential and actual impacts on the environment and community. There are 38 approval conditions and the two conditions replicated in Table 2 specifically require the Proponent to undertake rehabilitation work.

This RMP has been drafted in direct response to the PER guideline and is not intended to satisfy the state planning condition, as the requirements for state conditions will be addressed separately with due consideration for the framework documents in this RMP.

Table 2 Approval conditions specific to rehabilitation in the Queensland Government approval

No.	Conditions of development approval	Condition timing
13	a. Prepare a Rehabilitation Management Plan (RMP) outlining how all areas cleared for construction will be replanted and/or rehabilitated after construction retaining only the minimum footprint required for safe operations, including maintenance, of the wind farm. b. The RMP must: i. be prepared by a suitably qualified professional. ii. reflect the species composition and density of pre-existing vegetation. iii. outline weed management measures throughout stages of planting and regrowth. iv. be responsive to the varying characteristics of areas to be rehabilitated including varying access track cross sections, turbine pads, construction laydown areas, areas for ancillary construction related infrastructure such as accommodation camps, Project offices and car parks, concrete batching plants etc. v. be prepared acknowledging the Site Stabilisation Plan-Operations (SSPO) required in accordance with Condition 19 of this approval. vi. identify proposed timing of rehabilitation activities to minimise the time the disturbed Project footprint is left unvegetated. c. Submit the RMP to:	(a) to (c) Within 12 months after the commencement of construction (d) Within 12 months after the practical completion of the wind farm

No.	Conditions of development approval	Condition timing
	i. The Department of Housing, Local Government, Planning and Public Works (windfarms@dsdilgp.qld.gov.au) d. Implement the measures recommended in the RMP.	
31	a. Prepare an End of Operation Decommissioning Management Plan (EODMP). b. The EODMP must: i. be prepared by a suitably qualified person. ii. demonstrate that all wind turbine componentry and ancillary infrastructure will be reused and/or recycled to the maximum extent possible thereby minimising to the greatest extent possible material destined for land fill. iii. outline all actions to be undertaken to decommission the site including: ▪ deconstruction and removal off-site all above ground structures and infrastructure (including turbines, substations, and above ground cabling). ▪ management of impacts on the transport network arising from removal of materials from the site. ▪ dismantling turbine bases to a depth of 1m below surface level and covering with topsoil. ▪ lightly rip and reseed with native vegetation all hardstand areas (after being cleared of stone and geotextile material). ▪ decontaminate any affected areas in accordance with requirements of the *Environmental Protection Act 1994*. c. Submit the EODMP to the Department of Housing, Local Government, Planning and Public Works (windfarms@dsdilgp.qld.gov.au). d. Decommission the wind farm in accordance with the EODMP. *Note: Suitably qualified person means a person(s) who has professional qualifications, training, skills and/or experience relevant to area of expertise (decommissioning large scale industrial developments).*	(a) to (c) At least 6 months prior to ceasing the operation of the wind farm (d) Within 12 months after the wind farm has ceased operations

As detailed in Table 2, each approval condition has specific timing attached ranging from *prior to the commencement of construction* to *at all times*. The approval conditions deliver certainty to other stakeholders, including DCCEEW, on how the Project will be overseen by the State planning department for the life of the Project. At all times, the Proponent is committed to rehabilitating temporary construction disturbances, maintaining only the minimal footprint necessary for future rehabilitation.

Overall, the approval conditions attached to the State planning department's decision notice are rigorous and stringent. Based on the Queensland Government's approval conditions pertaining to rehabilitation, there is an opportunity for any subsequent approval to avoid duplication of existing approval conditions where there will be no material benefit to the administering authority, the Proponent or the general public.

1.2 Project description

1.2.1 Site details

The Project Site is in the South Burnett Regional Council (SBRC) local government area and is located approximately 30 kilometres (km) west of Kingaroy, 85 km east of Chinchilla and 170 km northwest of Brisbane. The Project Site encompasses approximately 17,500 hectares (ha) of land (including road reserves), with approximately 1,946 ha designated as the Planning Corridor which contains a Clearing Footprint (872 ha) for the proposed wind turbines, access tracks, underground cables, overhead lines and other associated infrastructure.

The Project Site comprises various freehold properties, state land, stock route reserve (Table 3) and several road reserves (Table 4) that total approximately 17,500 ha.

Table 3 Properties within the Project Site

Lot	Plan	Tenure	Area (ha)	Number of Turbines
4	RP890694	Freehold	922.98	4
5	BO330	Freehold	3,721.19	22
6	BO250	Freehold	2,355.45	14
7	RP890694	Freehold	971.60	4
10	SP168643	Freehold	1,924.15	6
29	BO243	Freehold	1,711.42	19
36	BO236	Freehold	1,982.99	12
43	FTZ37338	Freehold	72.84	0
44	SP345248	Reserve (Stock Route)	14.54	0
60	BO188	Freehold	509.43	2
62	BO188	Freehold	501.89	1
63	BO188	Freehold	507.04	1
64	BO190	Freehold	512.08	4
66	BO190	Freehold	412.34	1
67	BO490	Freehold	493.51	4
68	RP800291	Freehold	511.94	3
100	SP350189	State Land	11.04	0
		TOTAL	**17,136.43**	**97**

Table 4 Road reserves within Project Site (all roads are local roads unless otherwise stated)

Road name	Adjoining lot/plan
Hodges Dip Road	Lot 4 RP890694
Kingaroy Burrandowan Road (State controlled road)	Lot 4 RP890694 and Lot 7 RP890694
Jumma Road	Lot 5 BO330, Lot 44 SP345248, Lot 60 BO188, Lot 62 BO188, Lot 63 BO188, Lot 29 BO243, Lot 10 SP168643
Greystonlea Jumma Road	Lot 7 RP890694, Lot 36 BO236, Lot 5 BO330 and Lot 6 BO250
Boyne River Road	Lot 62 BO188, Lot 63 BO188, Lot 64 BO190, Lot 65 BO190, Lot 66 BO190
Glenrocks Road	Lot 62 BO188
Red Tank Road	Lot 10 SP168643
Unnamed Road	Lot 63 BO188 and Lot 65 BO190
Ironpot Road	Lot 100 SP350189, Lot 6 BO250, Lot 29 BO243, Lot 10 SP168643, Lot 68 RP800291, Lot 66 BO190 and Lot 67 BO490
Total	**Approximately 363 ha**

1.2.2 Project details

The Project seeks to supply up to 436.5 megawatts (MW) of clean and renewable energy to the National Electricity Market (NEM). The Project contains up to 97 wind turbine generators and hardstands, and ancillary infrastructure potentially including (subject to detailed design):

- site access and on-site access tracks, including widening sections of Ironpot Road
- one (1) site compound
- up to four (4) temporary laydown areas / stockpile areas
- two (2) 33kV to 275kV substations
- one (1) switching station to connect to existing 275kV overhead powerlines
- internal electrical reticulation consisting of overhead lines (OHL) and underground (UG) cabling
- one (1) permanent operations and maintenance facility including control centre, offices, workshop, warehouse, water tanks, septic systems and parking
- one (1) batch plant
- washdown areas (as required to comply with site biosecurity)
- up to three (3) borrow pits
- three (3) permanent and four (4) temporary meteorological masts
- helipad.

The proposed Project layout is shown in Figure 1-1.

1.2.3 Project schedule

The indicative Project schedule and delivery program is outlined in Table 5.

Construction is anticipated to take approximately 24 to 30 months, with commencement subject to Project approvals and subsequent agreement between the contractor and the Proponent.

The construction period will remain subject to change depending on factors such as component and materials availability, construction methodologies and weather conditions. Rehabilitation will take place as areas become available (i.e. no longer subject to construction impacts). However the bulk of the first phase of rehabilitation works will occur in conjunction with the Project's transition to the operations phase.

The second phase of rehabilitation will occur as part of the decommissioning work whereby selected hardstand and construction areas will be temporarily reinstated to support the decommissioning activities. When no longer needed and the landowner does not elect to retain the infrastructure, these areas will be rehabilitated.

Table 5 Indicative Project schedule and delivery program

Milestone	Timing
Construction start	Q4 2025
Construction complete	Q2 2028
Commissioning	Q2 2028-Q3 2028
Commencement of use (Practical Completion)	Q4 2028
Operations	Q2 2028 onwards for 30 years (with potential to extend to 40 years)
Decommissioning	Approximately two years upon cessation of operations

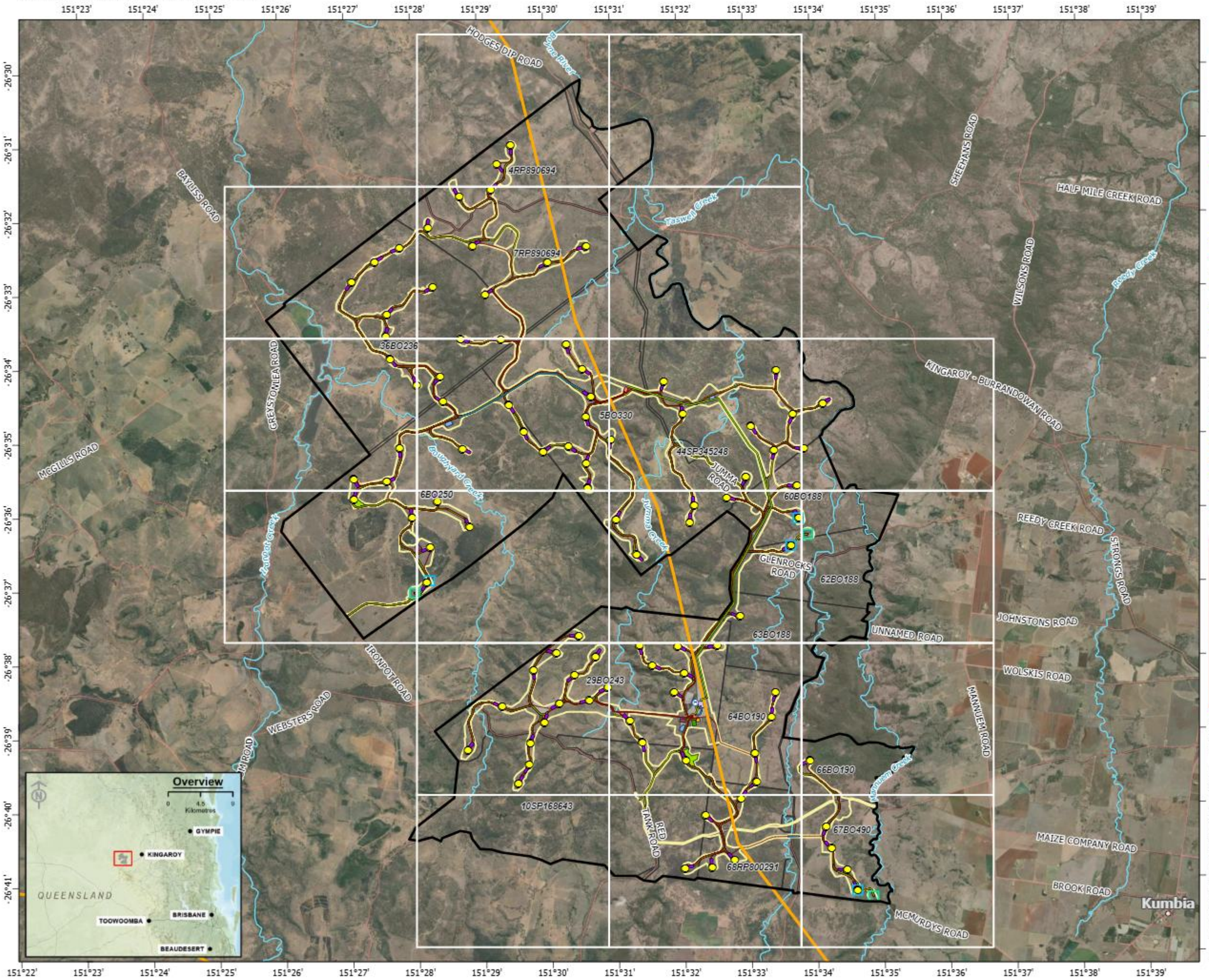
1.2.4 Existing environment

The Project Site is currently used for cattle grazing with areas of cleared paddocks and standing vegetation. The site consists predominantly (90%) of non-remnant vegetation, most of which is grazing land. Field-verified remnant vegetation and high-value regrowth occurs within approximately 8% and 2% of the site respectively. Field-verified vegetation consists mainly of eucalypt woodland, open eucalypt forest, and grassland. Up to 15.5 ha of remnant vegetation, may be cleared for construction and operational works within the Clearing Footprint.

Vegetation surveys included 19 tertiary (detailed) sites and 153 quaternary (observational) sites. Surveys were completed and 113 sites were mapped as remnant and 53 sites were mapped as non-remnant. Five vegetation types/fauna habitats were recorded:

1. remnant eucalypt woodland/forest
2. riparian forest/grassland
3. vine thicket
4. non-remnant woodland
5. cleared grassland.

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



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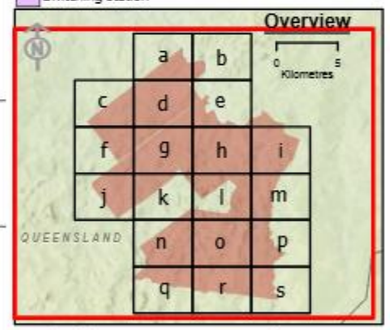
Legend

- Townships
- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
- Existing Powerlink 275kV overhead line
- Site Boundary
- Planning corridor
- Clearing footprint
- Cadastral boundaries

Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



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Units: Metre

TARONG WEST WIND FARM
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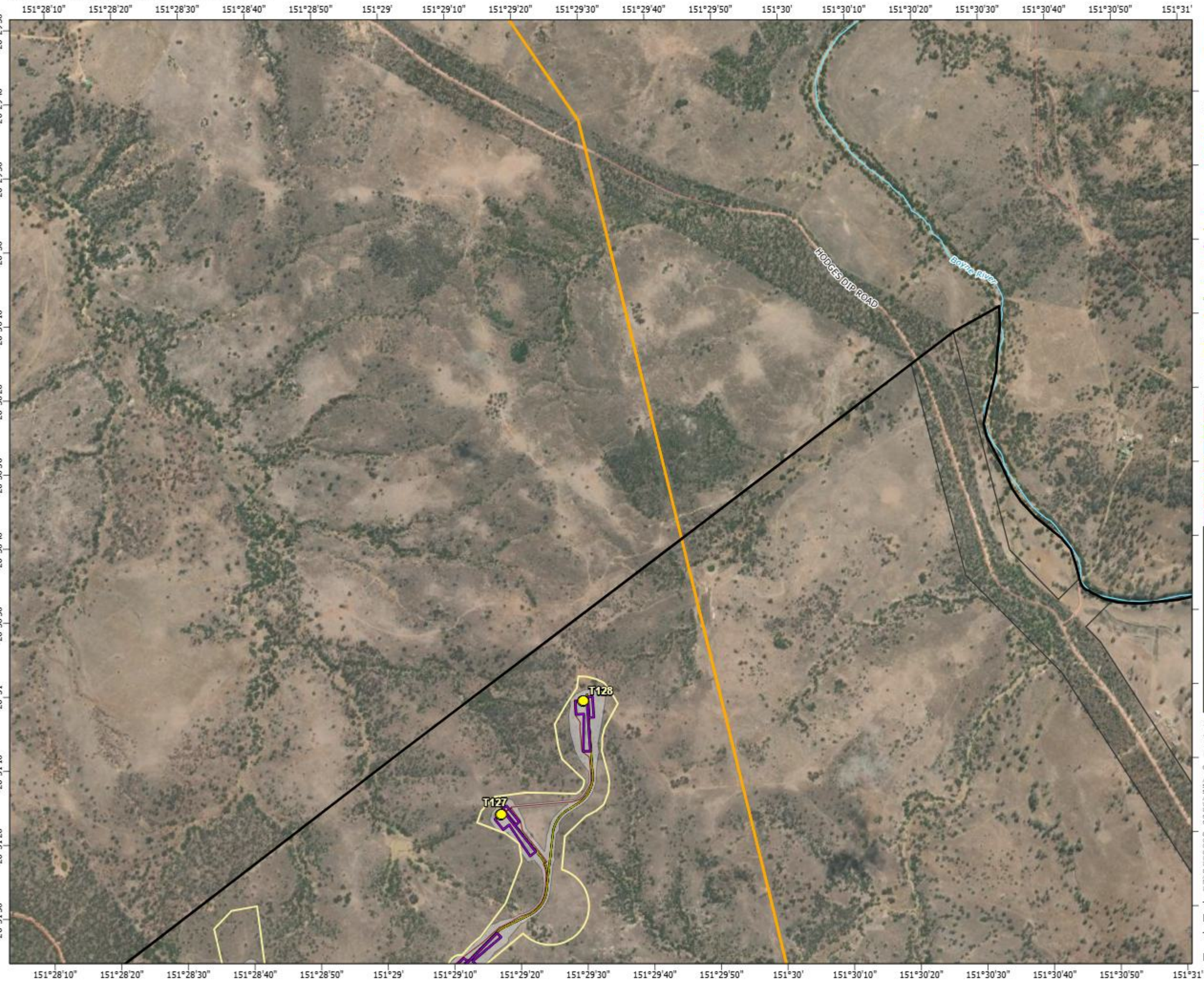
Turbine Layout and Infrastructure

Figure 1-1

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



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Scale: 1:15,000 at A3

Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
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Infrastructure areas

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- Borrow pit
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- Site compound
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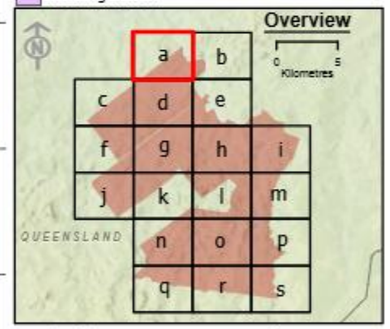
- Switching station



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Turbine Layout and Infrastructure

Figure 1-1a

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure

res AECOM

N

0 275 550 m

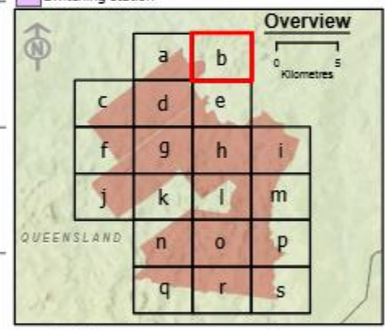
Scale: 1:15,000 at A3

Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
- Existing Powerlink 275kV overhead line
- Site Boundary
- Planning corridor
- Clearing footprint
- Cadastral boundaries

Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



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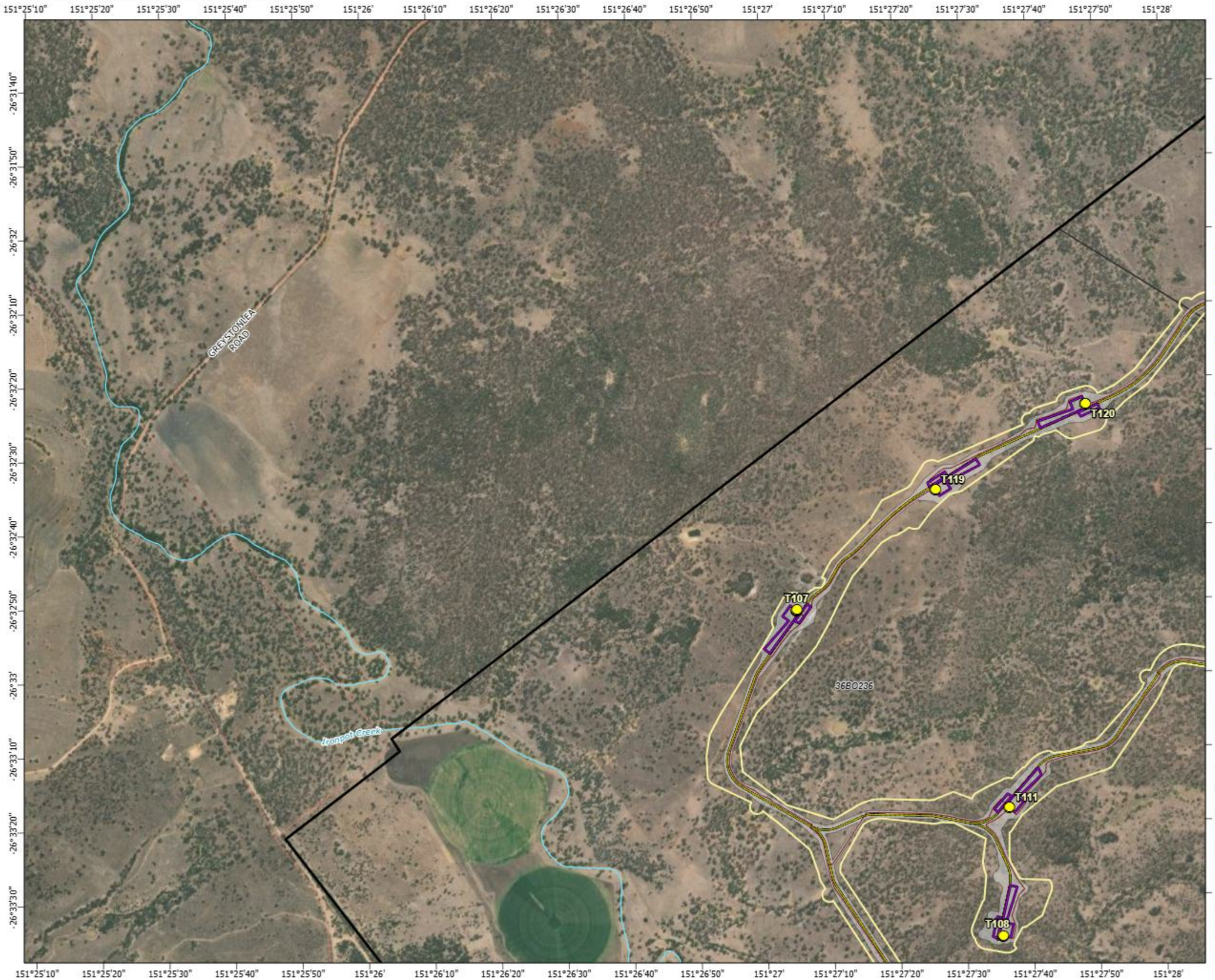
Turbine Layout and Infrastructure

Figure 1-1b

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
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- Cadastral boundaries

Infrastructure areas

- Batch plant
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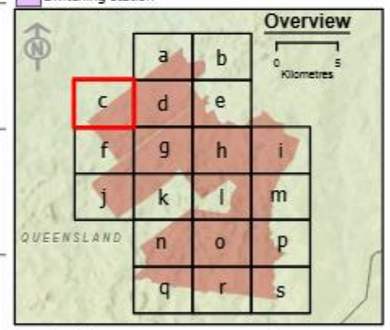

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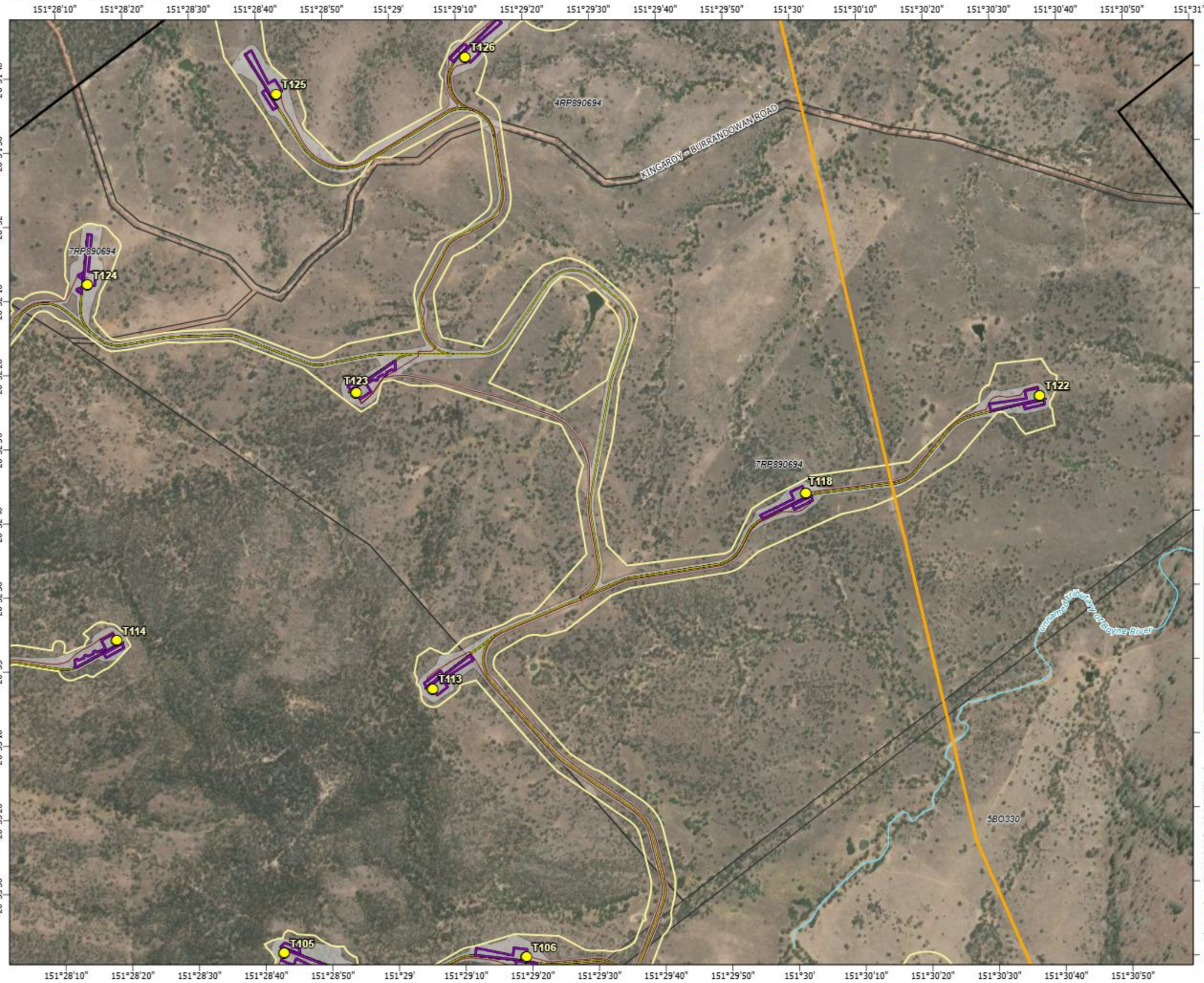
Turbine Layout and Infrastructure

Figure 1-1c

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



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0 275 550 m

Scale: 1:15,000 at A3

Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
- Existing Powerlink 275kV overhead line
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- Cadastral boundaries

Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
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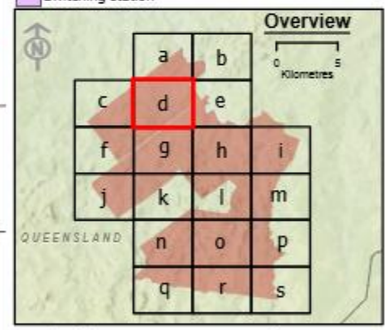

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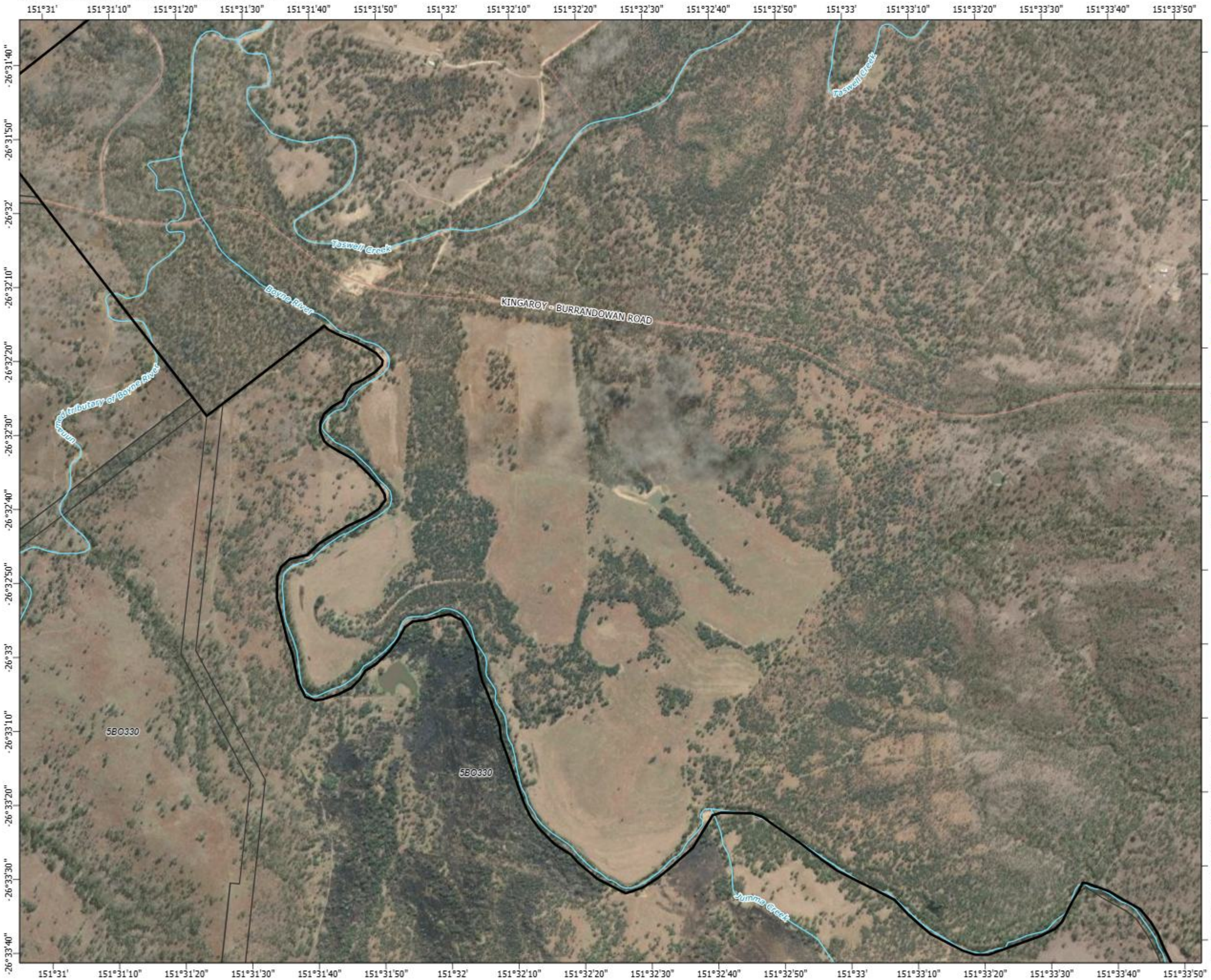
Turbine Layout and Infrastructure

Figure 1-1d

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



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0 275 550 m

Scale: 1:15,000 at A3

Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
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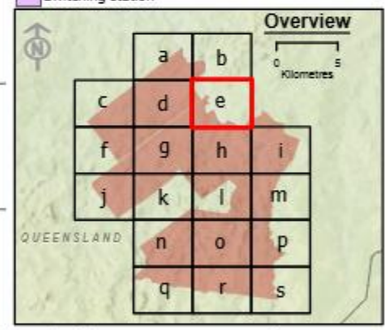

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TARONG WEST WIND FARM
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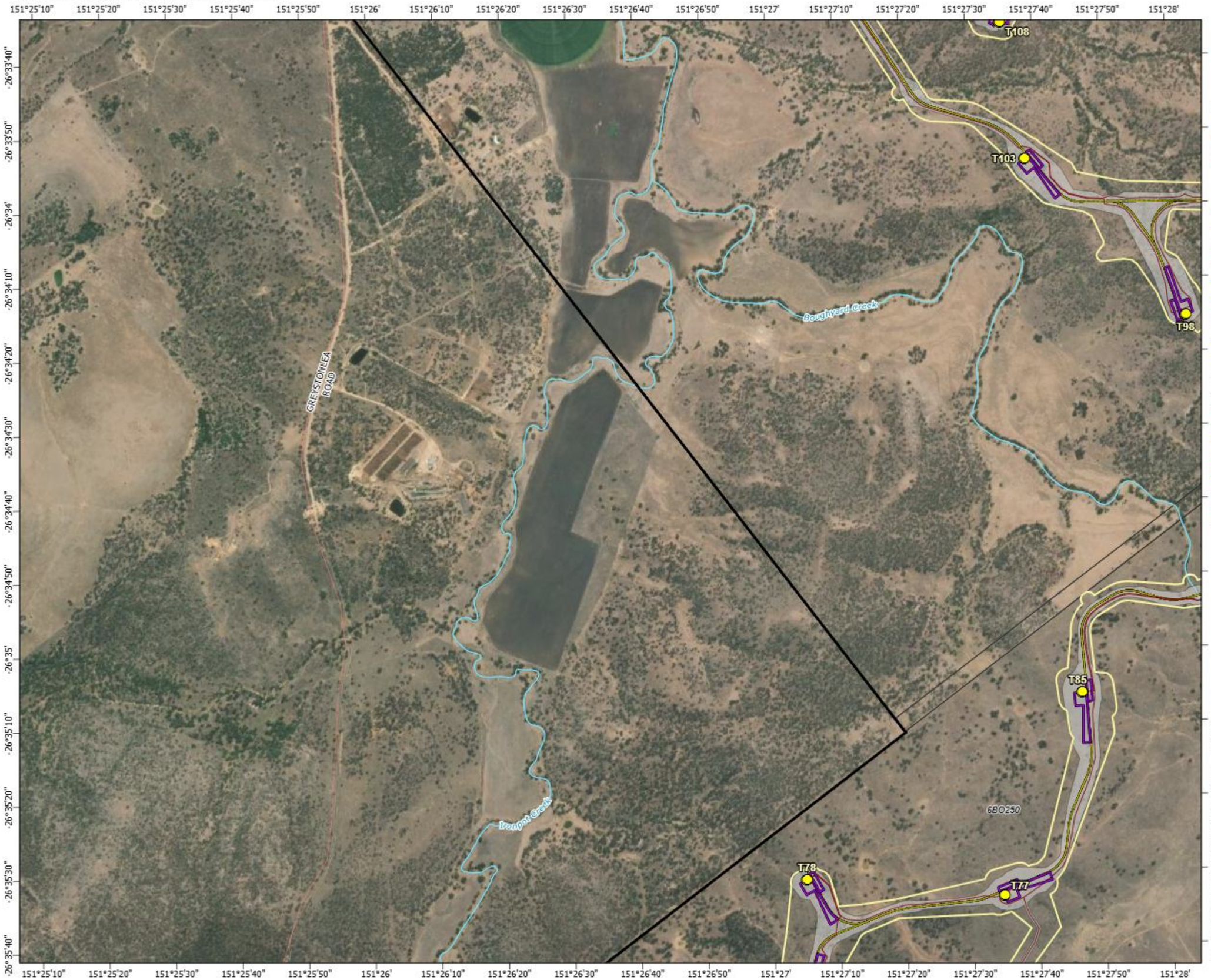
Turbine Layout and Infrastructure

Figure 1-1e

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



Legend

- Wind turbine generator
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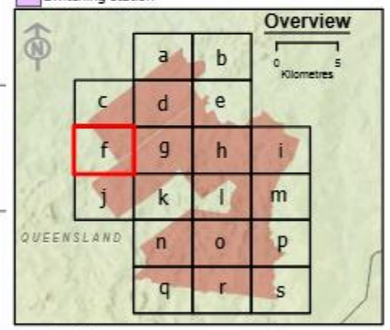

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TARONG WEST WIND FARM
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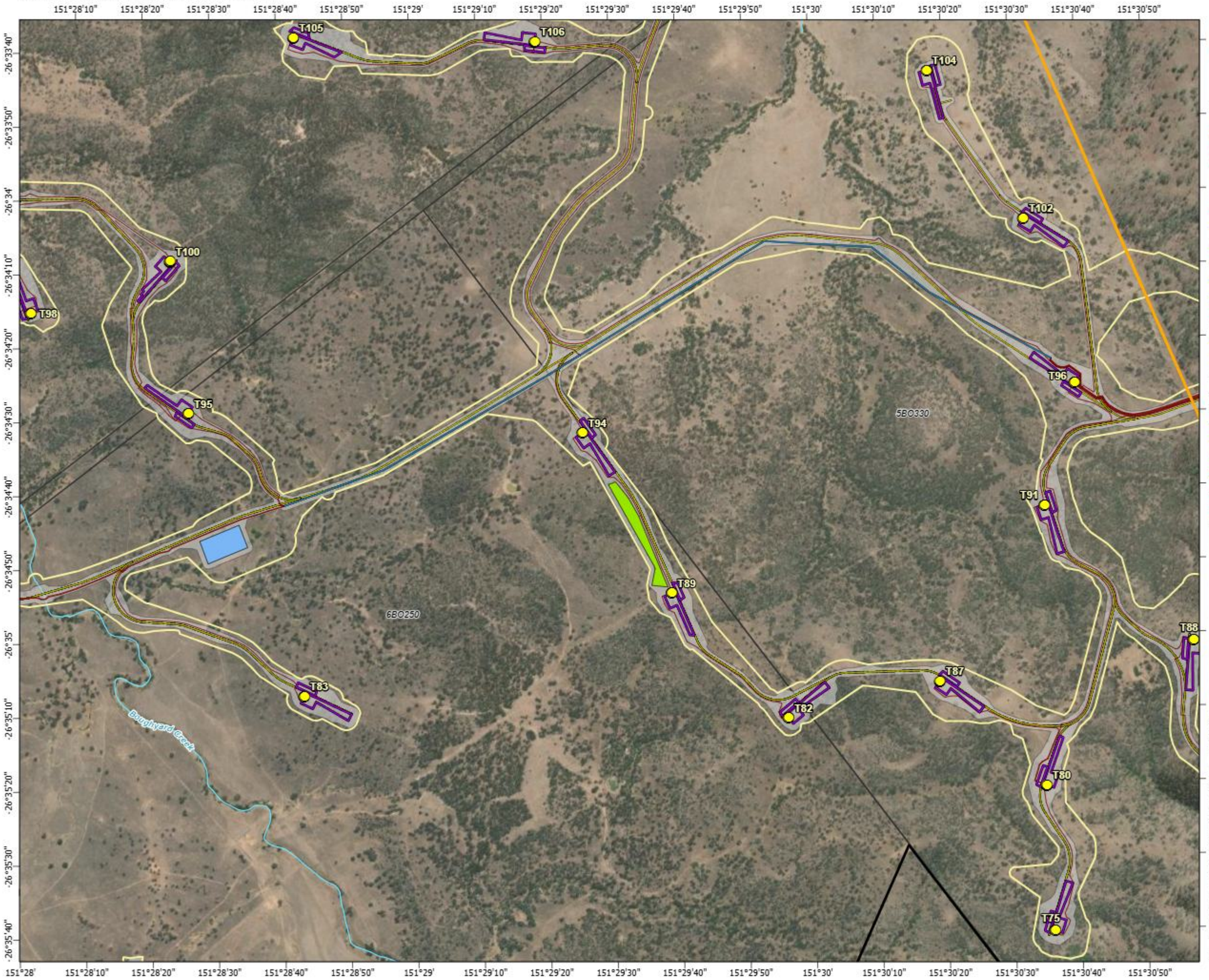
Turbine Layout and Infrastructure

Figure 1-1f

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



Legend

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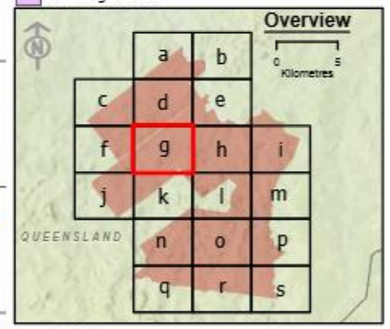

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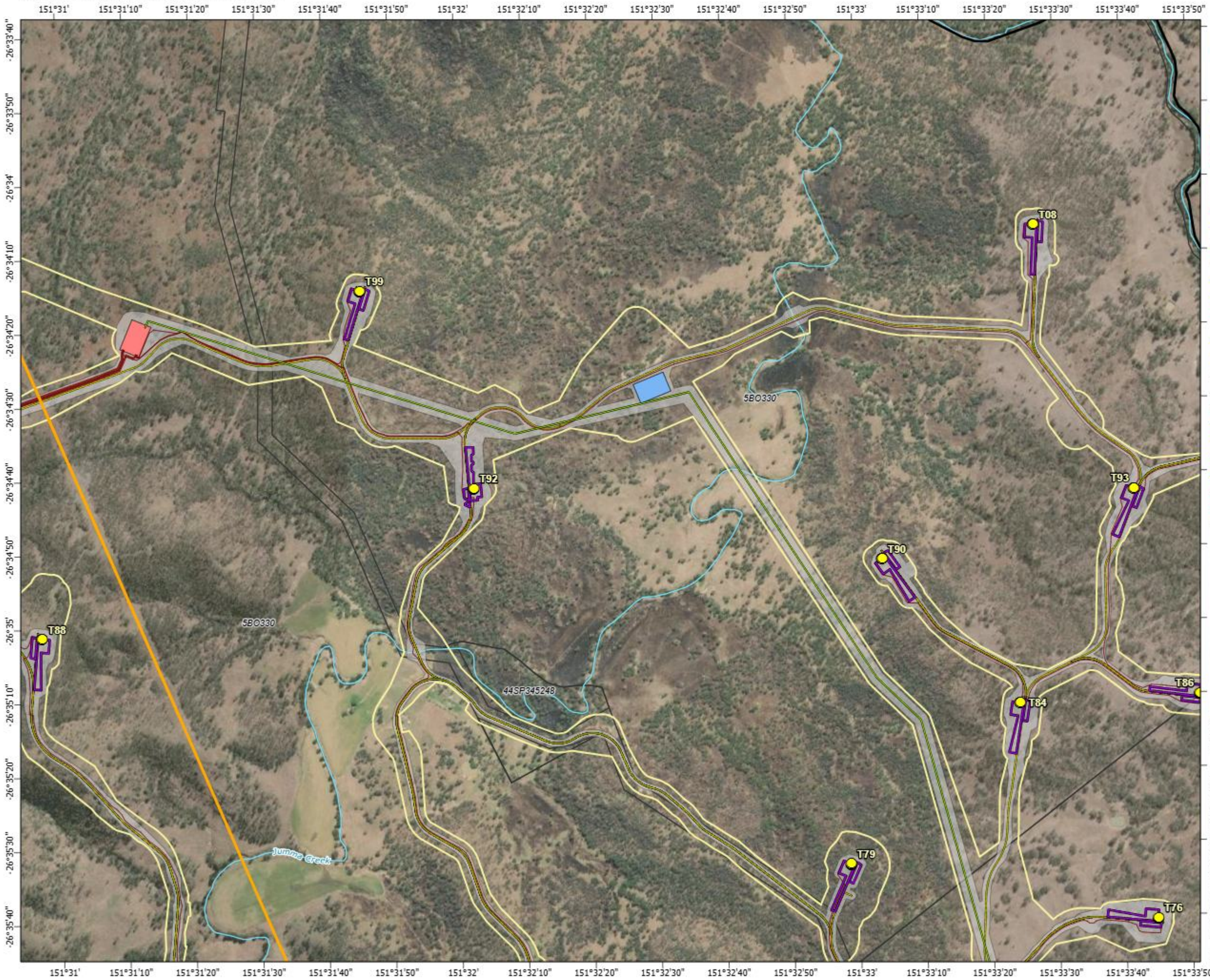
Turbine Layout and Infrastructure

Figure 1-1g

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure

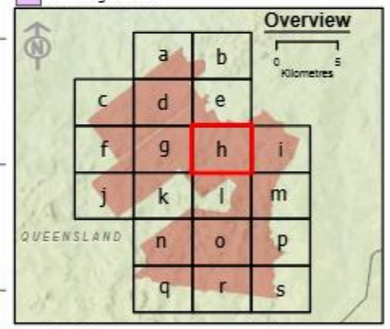


Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
- Existing Powerlink 275kV overhead line
- Site Boundary
- Planning corridor
- Clearing footprint
- Cadastral boundaries

Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



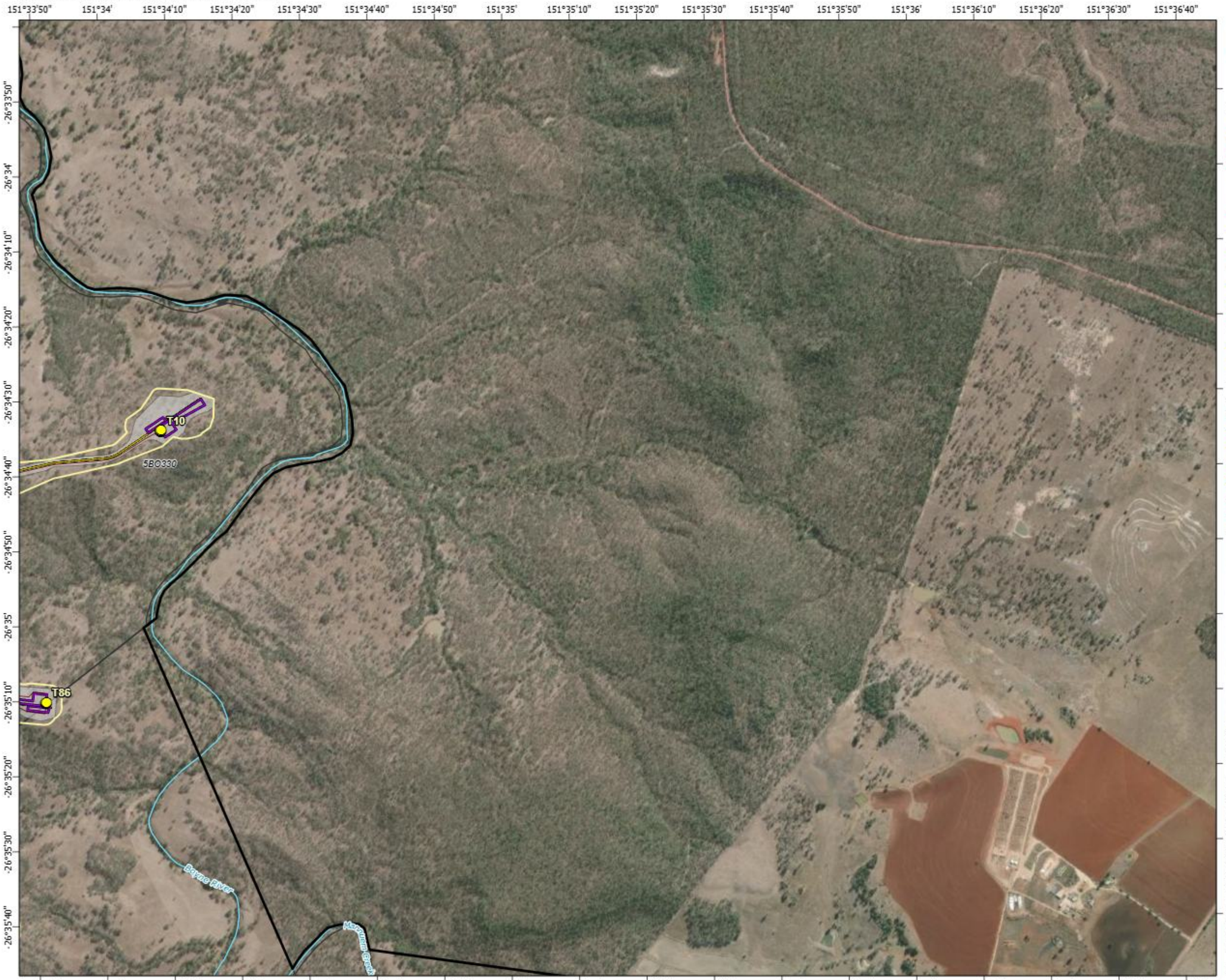
Spatial Reference: Geocentric Datum of Australia 1994 Map Grid of Australia Zone 56
Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1h

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
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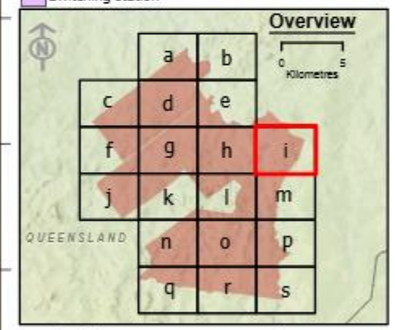
- Planning corridor
- Clearing footprint
- Cadastral boundaries

Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



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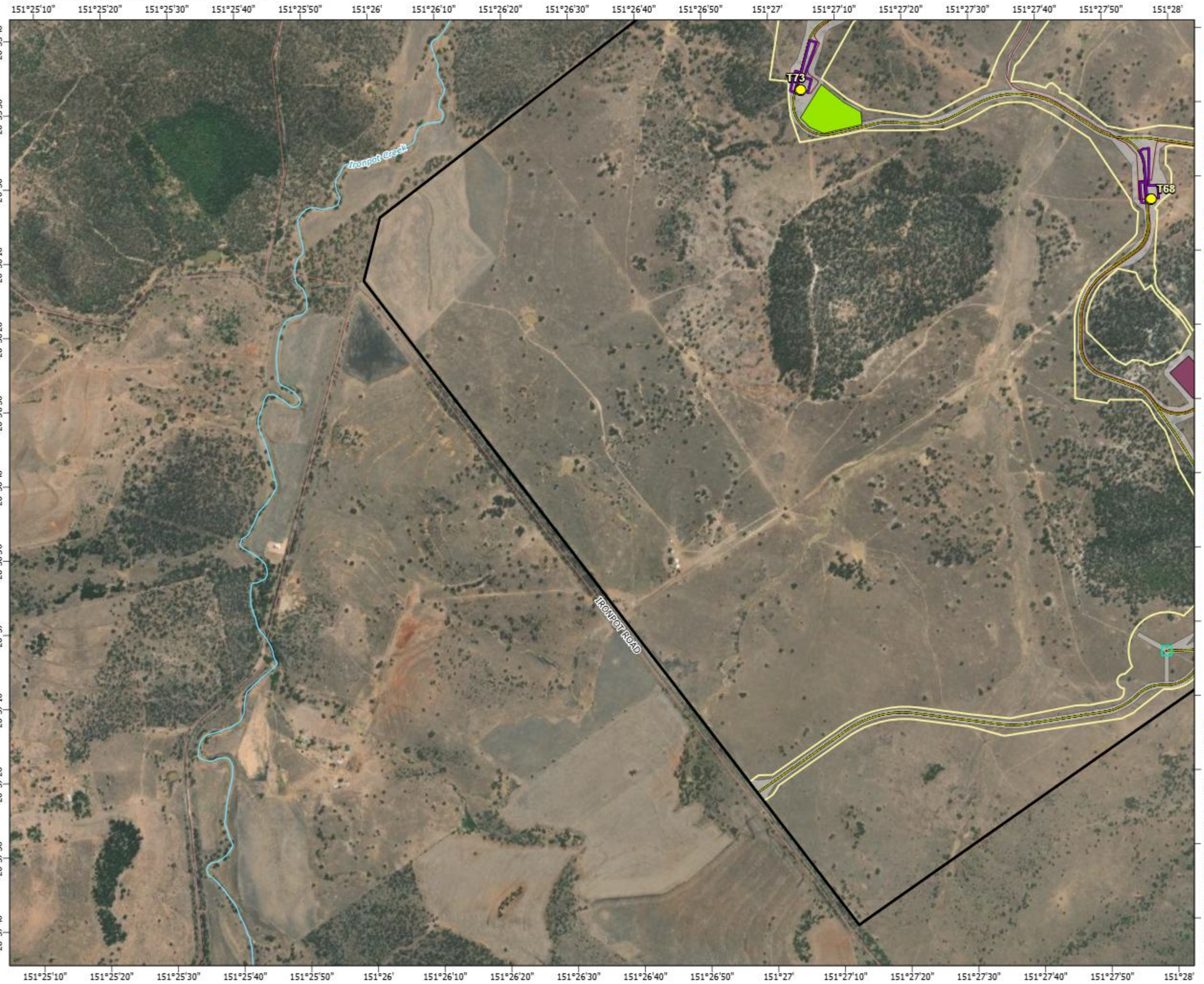
Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1i

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



res AECOM

N

0 275 550 m

Scale: 1:15,000 at A3

Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
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- Cadastral boundaries

Infrastructure areas

- Batch plant
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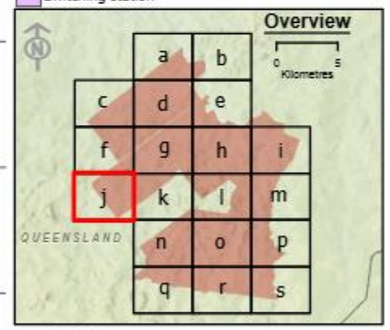
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



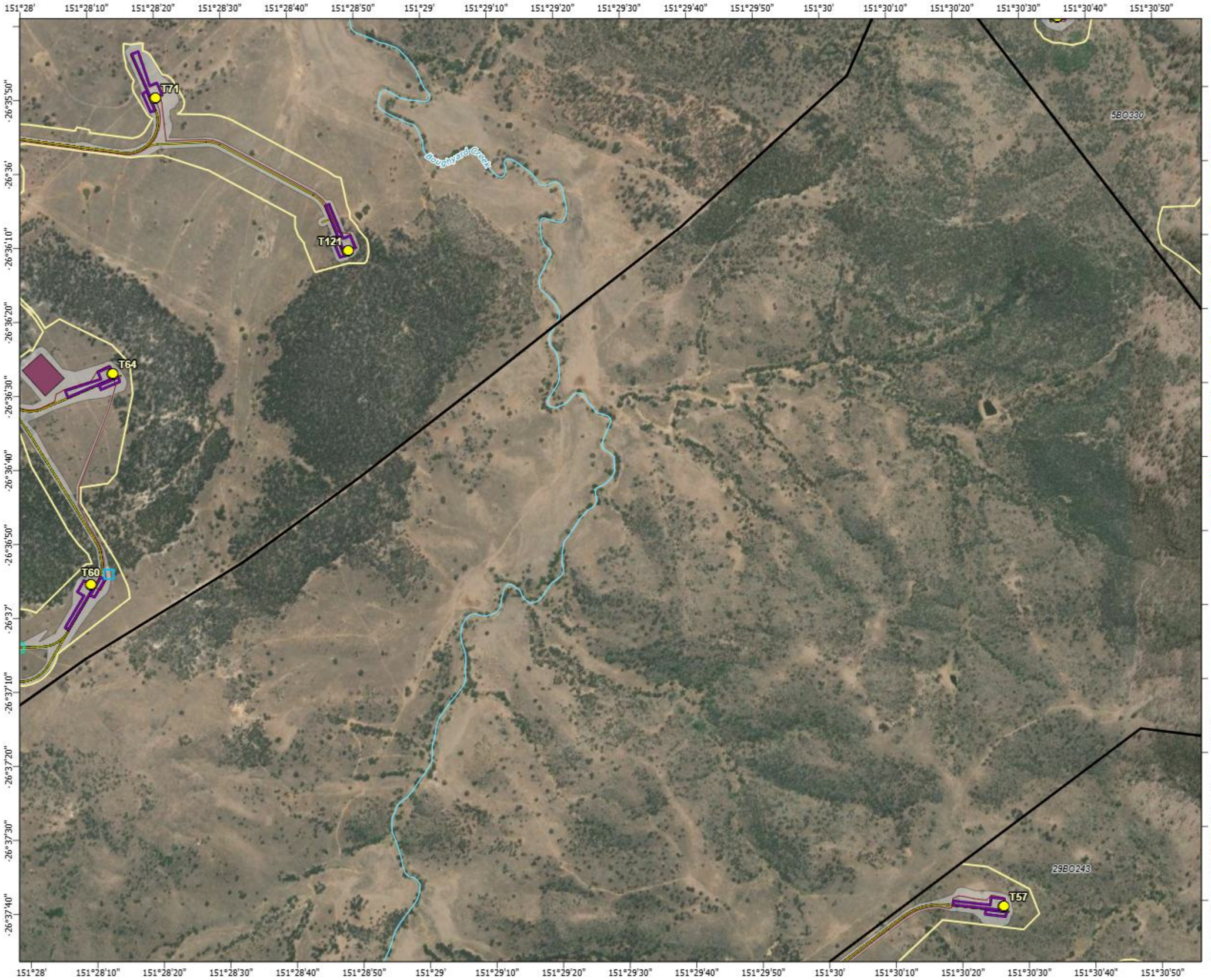
Spatial Reference: Geocentric Datum of Australia 1994 Map Grid of Australia Zone 56
Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1j

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



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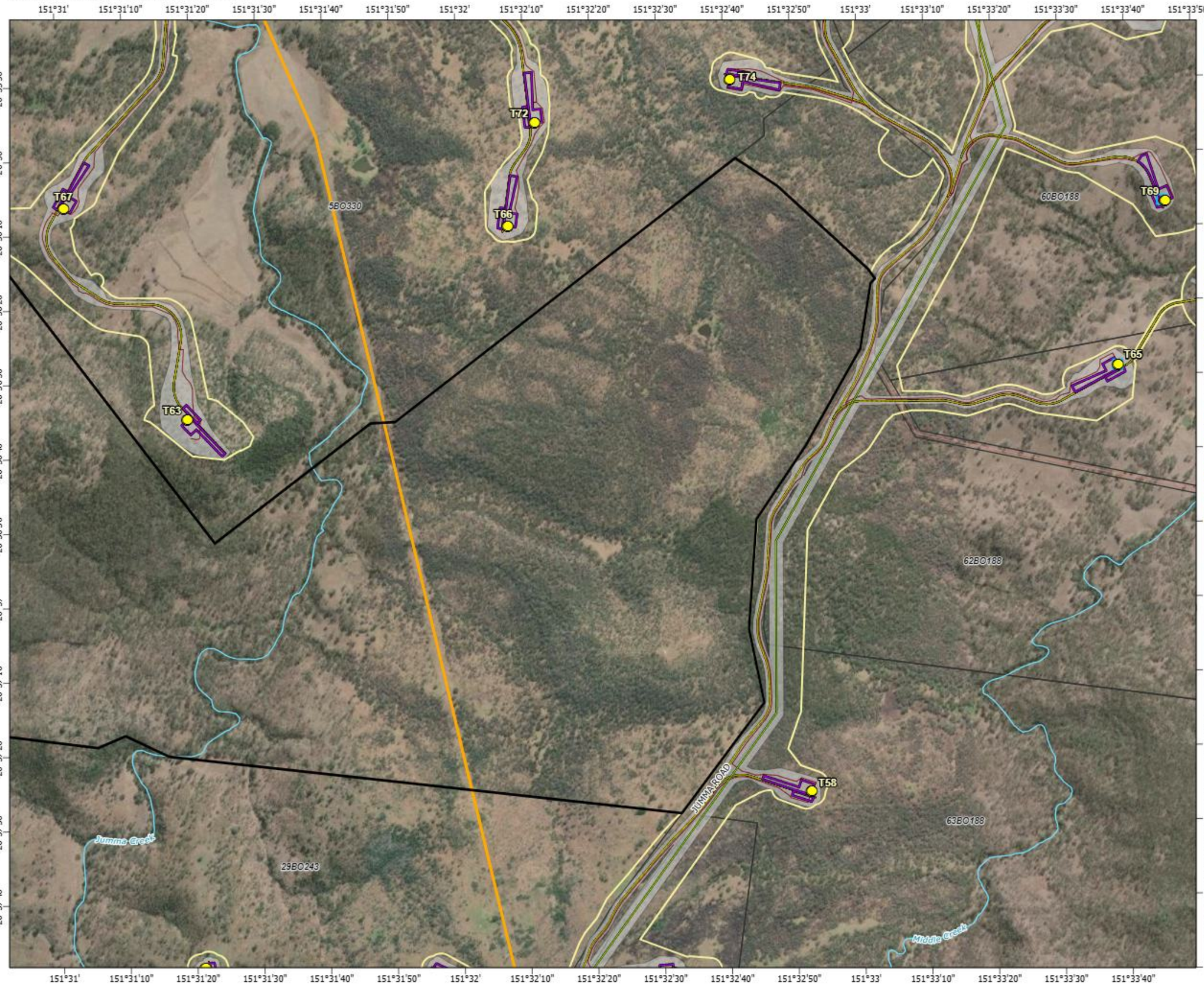
Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1k

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



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Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1l

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure

N

0 275 550 m

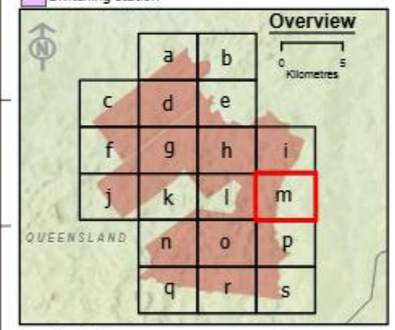
Scale: 1:15,000 at A3

Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
- Existing Powerlink 275kV overhead line
- Site Boundary
- Planning corridor
- Clearing footprint
- Cadastral boundaries

Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



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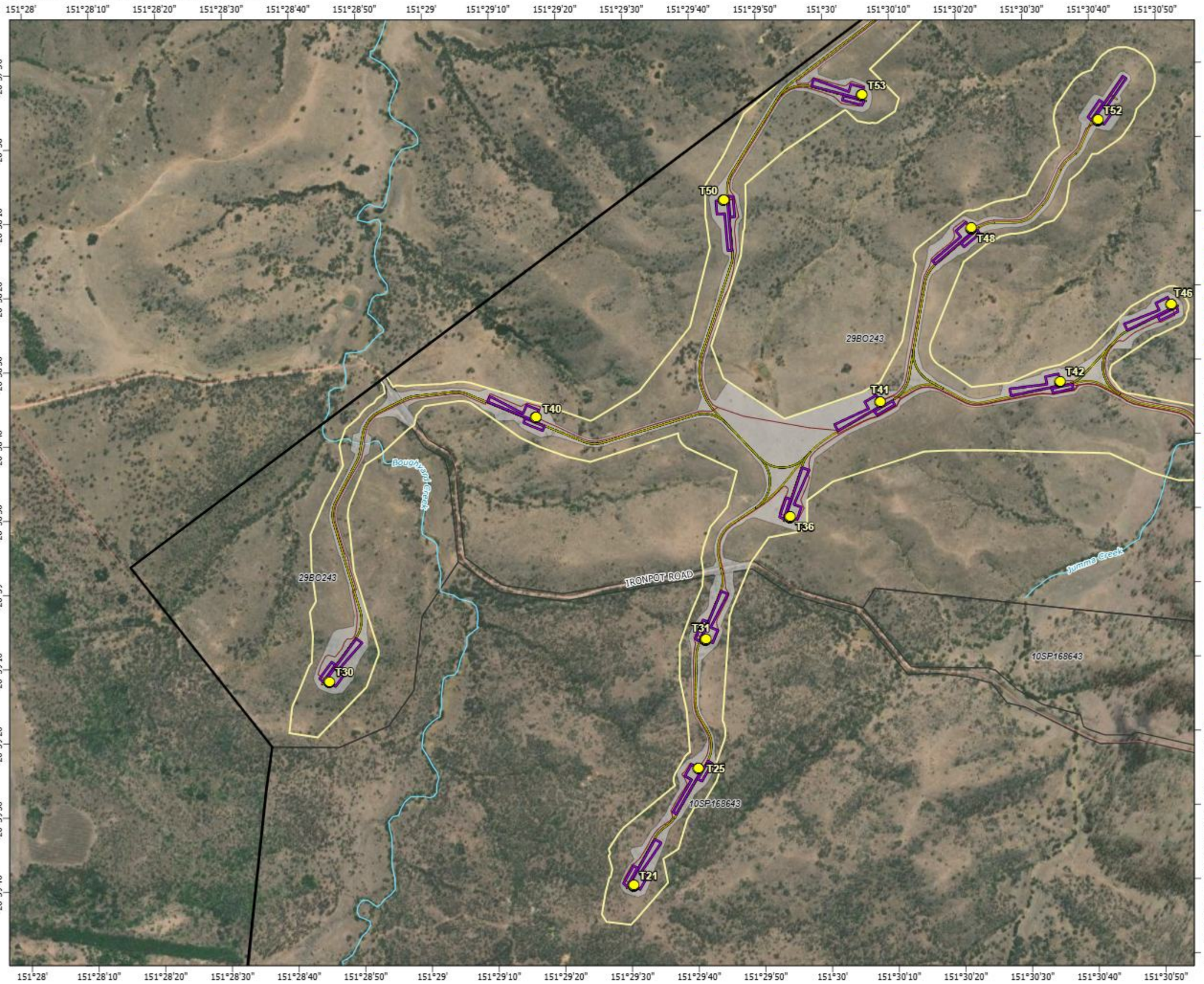
Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

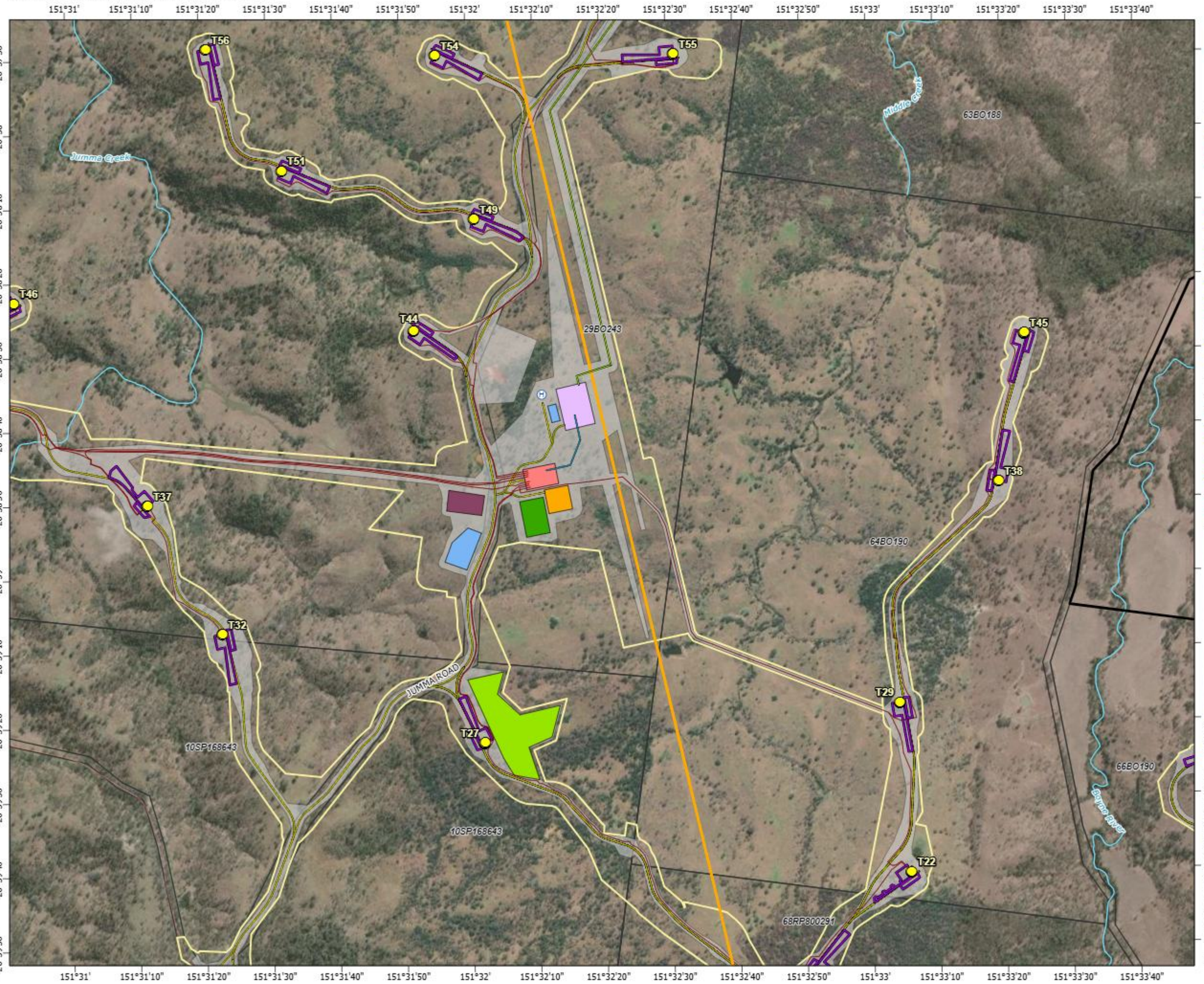
Figure 1-1m

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



Spatial Reference: Geocentric Datum of Australia 1994 Map Grid of Australia Zone 56
Datum: Geocentric Datum of Australia 1994
Units: Metre

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
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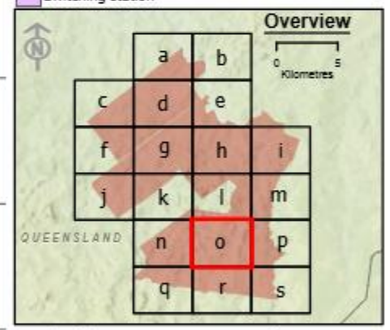
Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



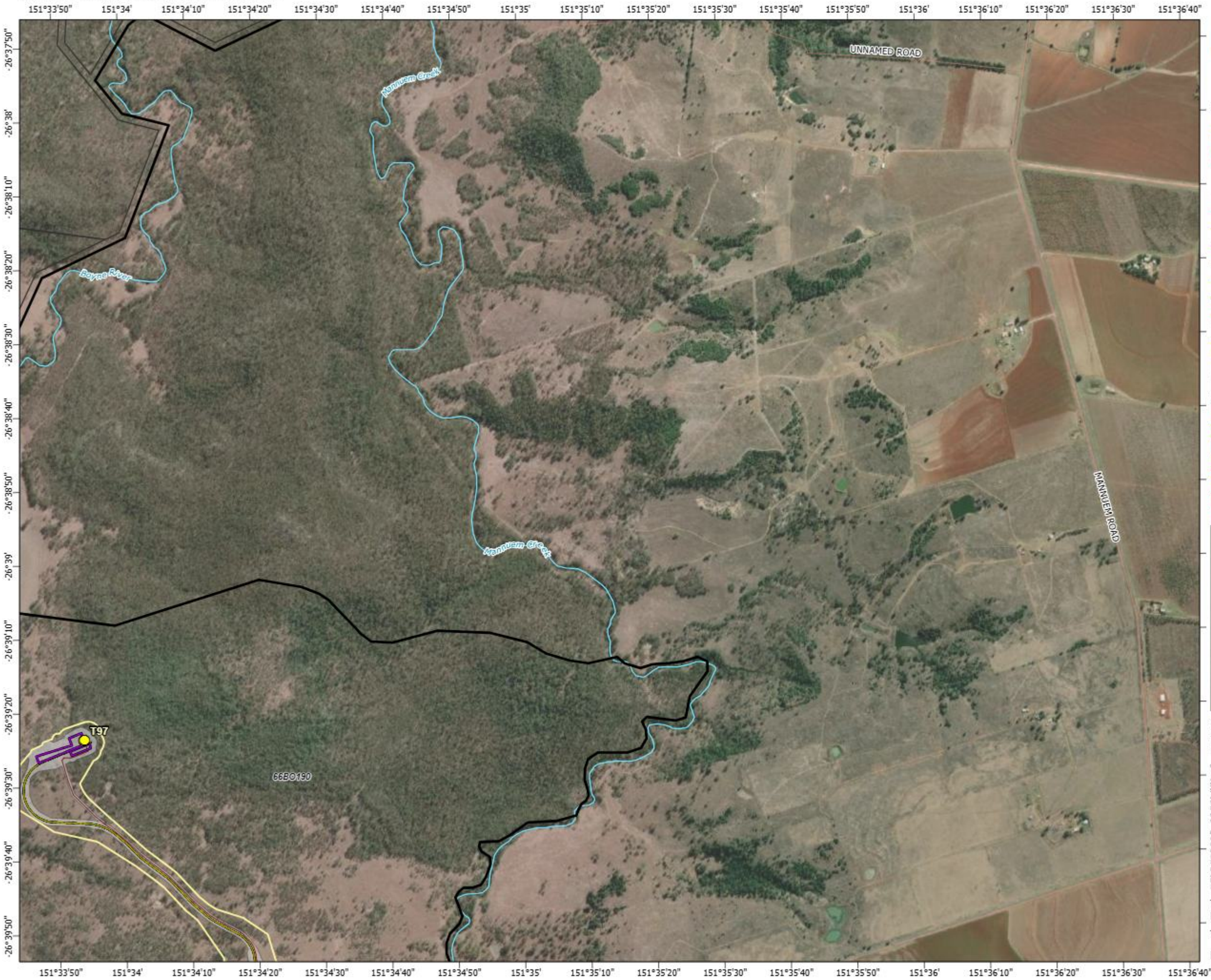
Spatial Reference: Geocentric Datum of Australia 1994 Map Grid of Australia Zone 56
Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1o

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



res AECOM

N

0 275 550 m

Scale: 1:15,000 at A3

Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
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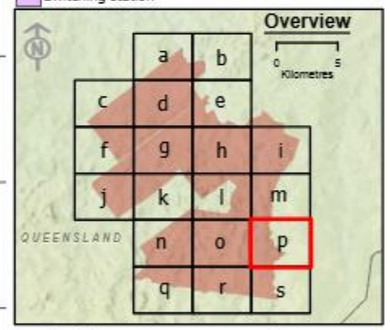
- Planning corridor
- Clearing footprint
- Cadastral boundaries

Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



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Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1p

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure

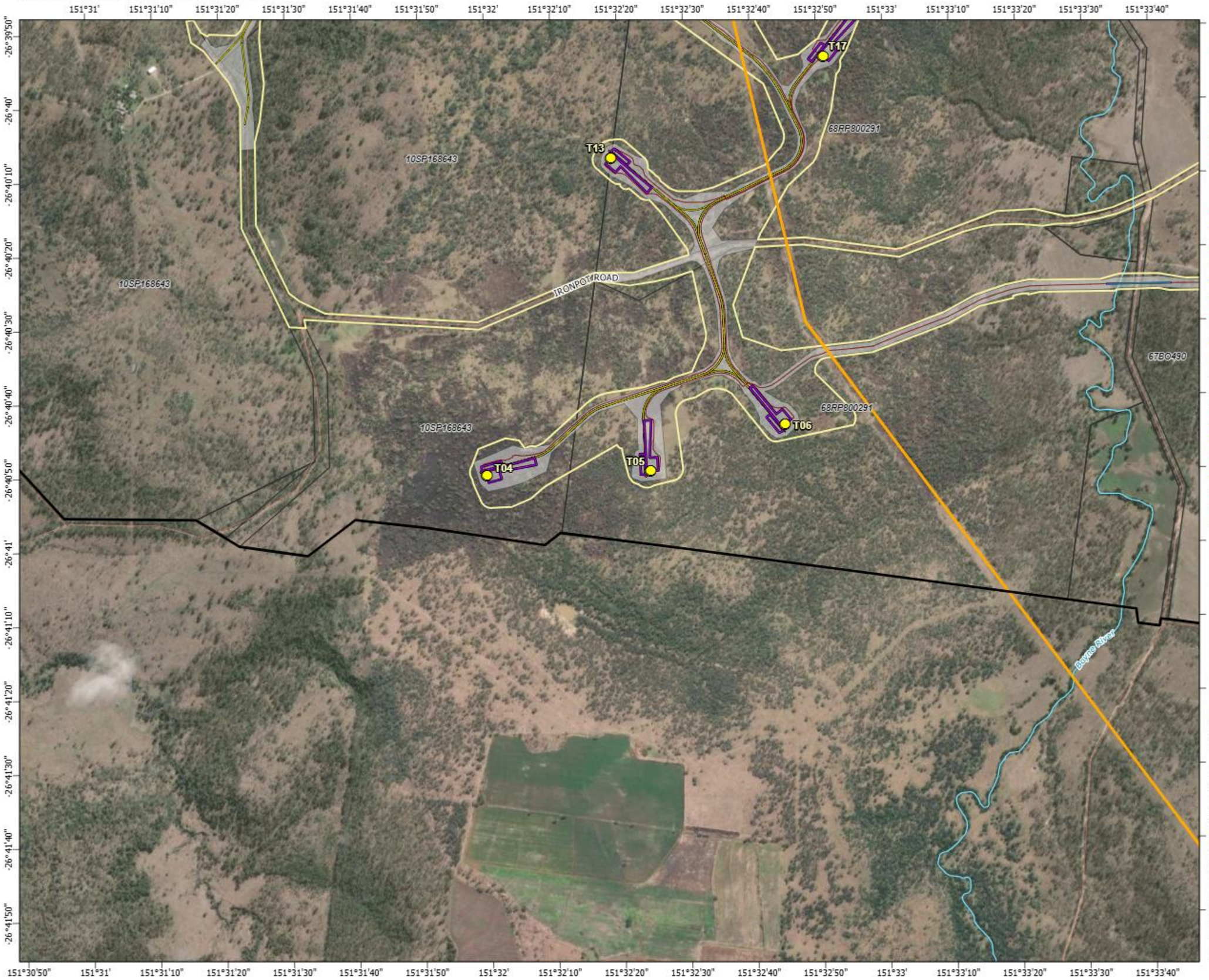
Spatial Reference: Geocentric Datum of Australia 1994 Map Grid of Australia Zone 56
Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1q

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



res AECOM

N

0 275 550 m

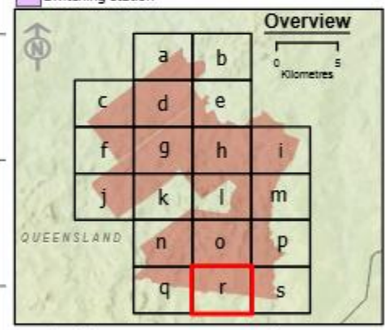
Scale: 1:15,000 at A3

Legend

- Wind turbine generator
- Mast (temporary)
- Mast (permanent)
- Helipad
- Roads
- Watercourse
- Access track
- Turbine hardstand
- Cables - underground
- Cables - overhead 33kV
- Cables - overhead 275kV
- Existing Powerlink 275kV overhead line
- Site Boundary
- Planning corridor
- Clearing footprint
- Cadastral boundaries

Infrastructure areas

- Batch plant
- Borrow pit
- Laydown
- Operations and maintenance building
- Site compound
- Substation
- Switching station



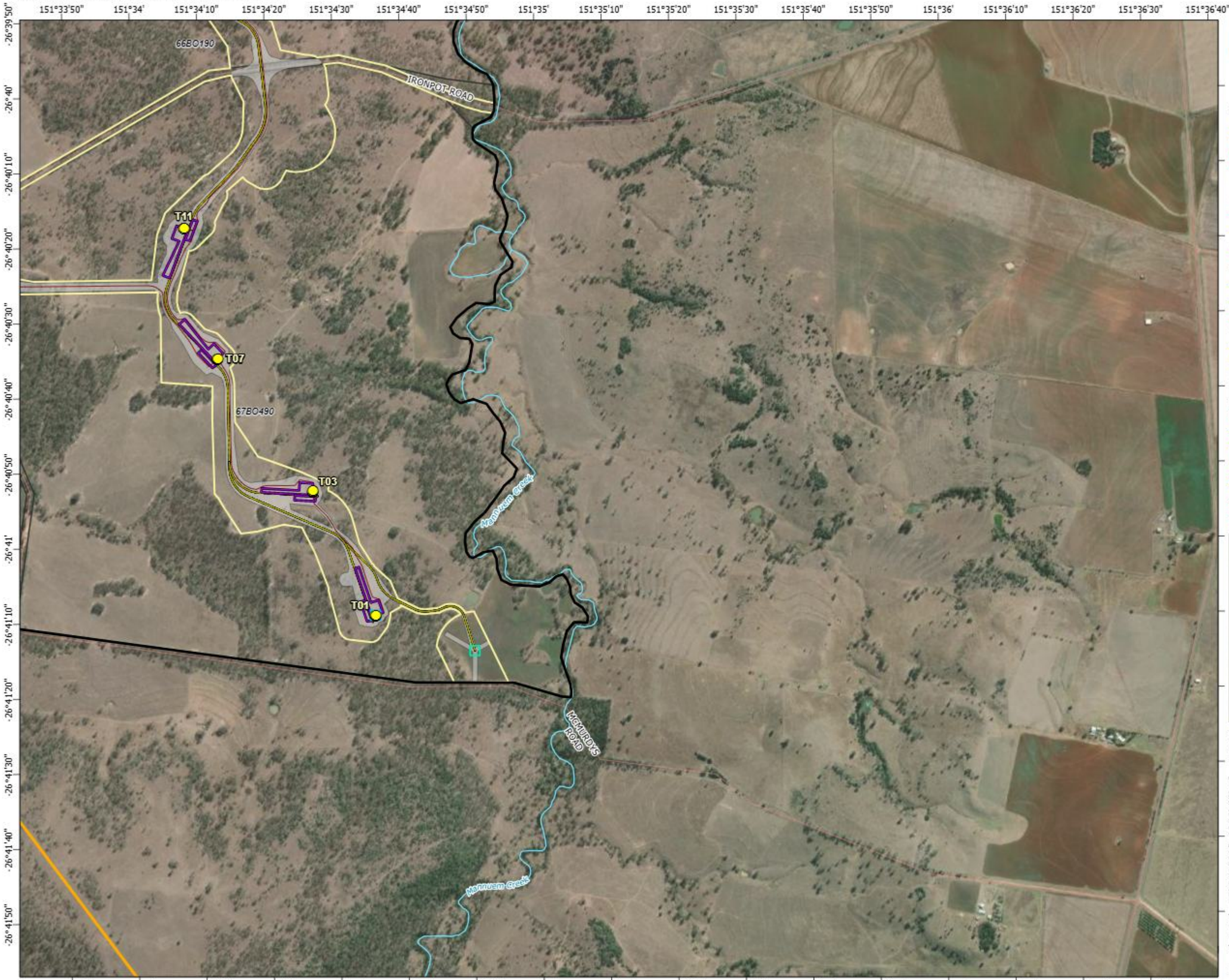
Spatial Reference: Geocentric Datum of Australia 1994 Map Grid of Australia Zone 56
Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1r

The Existing Powerlink 275kV Overhead Line and switching station are Powerlink-owned and operated high voltage infrastructure



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Datum: Geocentric Datum of Australia 1994
Units: Metre

TARONG WEST WIND FARM
PUBLIC ENVIRONMENT REPORT (2025)

Turbine Layout and Infrastructure

Figure 1-1s

2.0 Methodology

Rehabilitation works, can be broken down into the following key steps:

- site assessment
- rehabilitation design documentation
- site works
- maintenance, monitoring and reporting.

2.1 Site assessment

A detailed assessment of the site prior to the commencement of rehabilitation works is essential in the establishment of a site-specific ecological restoration/rehabilitation methodology. In accordance with industry rehabilitation standards (such as the South East Queensland Ecological Restoration Framework Manual[1] and Guideline[2] (SEQERF)). The following checklist will form part of the rehabilitation contractor's site assessment process:

- describe the history and background of the site
- describe the soil, drainage, topography and aspect
- describe the native vegetation on the site and along site boundaries
- describe the weeds on-site
- describe the vegetation dispersal and structure
- describe the fauna use on-site
- describe estimated native regeneration response.

The responses to the checklist will form the foundation for the proposed restoration approach, which may range from *natural regeneration* to *fabrication*, for each rehabilitation area captured by this RMP.

The importance of site-specific measures for flora and fauna habitat, including Matters of National Environmental Significance (MNES) protected under the EPBC Act, must be considered. Many flora and fauna species have specific habitat requirements, foraging patterns and movement patterns. Data from ecological assessments can support the informing of suitable rehabilitation activities.

Progressive rehabilitation shall comprise the following process:

- remove gravel from infrastructure locations
- spread stockpiled topsoil across the rehabilitation areas
- seed the topsoil with a grass species mix appropriate to the pre-clearing vegetation community within the area. Native grasses and non-invasive exotic pasture grasses (e.g. Rhodes grass Chloris gayana) may be considered in cleared pasture areas, in consultation with landholders
- apply initial watering to initiate germination and follow up watering to ensure grass growth.

2.2 Regulatory rehabilitation requirements

The SEQERF was endorsed by the majority of South East Queensland councils and is a valuable reference for rehabilitation contractors across the wider region. The information provided within this RMP will use information from the SEQERF.

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[1] Chenoweth EPLA and Bushland Restoration Services (2012) *South East Queensland Ecological Restoration Framework: Manual*. Prepared on behalf of SEQ Catchments and South East Queensland Local Governments, Brisbane.
[2] Chenoweth EPLA and Bushland Restoration Services (2012) *South East Queensland Ecological Restoration Framework: Guideline*. Prepared on behalf of SEQ Catchments and South East Queensland Local Governments, Brisbane

The SEQERF describes ecological restoration as *the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed*. The ability of a habitat/ecosystem to recover naturally depends on the existing natural regeneration capacity i.e. resilience potential, and the level and type of disturbance, degradation or damage that has occurred within the habitat/ecosystem.

Determination of the resilience potential and level of degradation will assist the Project to determine the level of effort required to restore the ecosystem based on the guidelines of the RMP. The following four ecological restoration approaches are listed under the SEQERF guidelines:

1. natural regeneration
2. assisted natural regeneration
3. reconstruction
4. fabrication.

A fundamental aspect of ecological restoration is restoring both structure and function to a site where appropriate, which enhances its stability and provides better habitat for plants and animals. Structure encompasses factors like vegetation height and density, canopy cover, suitable species, and habitat elements such as fallen logs and rock formations. Function involves the natural, self-sustaining processes present at the site, including its ability to regenerate, undergo succession, and cycle nutrients. To meet these goals, activities may involve managing invasive weeds, re-establishing wildlife habitat, and stabilising the ground and prevent sedimentation/erosion.

3.0 Existing flora and fauna

A primary focus of rehabilitation activities described in this RMP, is the appropriate restoration of habitats that are utilised by flora and fauna that are MNES. The ecological assessment work completed to confirm the presence or absence of MNES is discussed in sections 3.1 and 3.2.

3.1 Flora

Ecological field surveys were conducted over several periods and seasons between 2018 and 2025 completed by Ecosure and SLR Consulting Australia. These surveys recorded 292 flora species, of which 188 were native species and 104 were introduced species.

A total of 36 random meander surveys targeting threatened species were completed in regional ecosystems (RE) representative of riparian vegetation (RE 11.3.25), vine forest (RE 11.8.3), ironbark forest/woodland (RE 11.11.15, RE 11.12.3), spotted gum forest (RE 11.11.4, RE 11.12.6), woodland on laterite (RE 11.7.6) and gum topped box forest (RE 11.5.20).

The likelihood of occurrence assessment following both desktop and field surveys identified only two EPBC Act-listed flora species remain possible to occur across the Project Site:

1. Austral toadflax (*Thesium australe*)
2. Wandering peppercress (*Lepidium peregrinum*)

Targeted surveys of habitat within the impact area, determined these species are unlikely to occur in the impact area, as neither of these species were detected during the field surveys and suitable habitat is highly degraded by existing land uses.

Rehabilitation efforts in riparian areas outside permanent infrastructure may lead to Wandering peppercress and Austral toadflax occupying habitat where they are currently absent. These efforts include managing native vegetation, protecting watercourse integrity, and controlling invasive species to uplift these rehabilitated areas towards potentially providing the necessary environmental conditions for Wandering peppercress and Austral toadflax.

Impacts on all MNES have been minimised through design-phase avoidance measures. Various turbine layouts, planning corridors, and clearing footprints were assessed and refined to reduce potential impacts on remnant and high-value regrowth vegetation, which supports essential flora and fauna habitats across the Project Site. Impacts on one MNES, the semi-evergreen vine thickets of the

Brigalow Belt (North and South) and Nandewar Bioregions, have been avoided by excluding this area from the Project impact area.

The field-verified REs within the Project Site provide habitat of various quality for several EPBC Act-listed fauna species. Riparian vegetation (RE 11.3.25) supports species such as the Koala and Greater glider. Vine forests (RE 11.8.3) offer habitat for the Greater glider, Glossy black-cockatoo, and Grey-headed flying-fox. Ironbark forests and woodlands (RE 11.11.15 and RE 11.12.3) provide essential resources for the Koala and Greater glider, and spotted gum forests (RE 11.11.4 and RE 11.12.6) also support these species. Gum topped box forests (RE 11.5.20) support Koalas, Greater gliders, and Glossy black-cockatoos. The rehabilitation strategy will improve habitat quality and promote the ongoing presence of these MNES species.

During construction, there may be opportunities to retain vegetation in the identified 872 ha Clearing Footprint. However, the maximum impact to remnant vegetation will be 15.5 ha (this equates to less than 0.1% of the Project Site). Therefore, rehabilitation activities will predominantly occur in non-remnant vegetation.

3.2 Fauna

The ecological assessment identified eight EPBC Act-listed fauna species confirmed or likely to occur within the Project Site. These species were identified through a desktop assessment and the detailed targeted field surveys carried out over several periods from 2018 to 2023. The eight species of interest were koala, greater glider, glossy black-cockatoo, grey-headed flying-fox, white-throated needletail, rufous fantail, satin flycatcher and the fork-tailed swift.

MNES fauna that were either confirmed on-site or subject to detailed assessment were (Ecosure, Assessment of Matters of National Environmental Significance for Tarong West Wind Farm, Ironpot, Queensland, 2023a):

- Koala (*Phascolarctos cinereus*), (confirmed)
- Greater glider (*Petauroides armillatus*), (confirmed)
- Spotted-tail quoll (*Dasyurus maculatus*) (not detected)
- Corben's long-eared bat (*Nyctophilus corbeni*) (not detected)
- Glossy black-cockatoo (*Calyptorhynchus lathami lathami*), (confirmed)
- Grey-headed flying-fox (*Pteropus poliocephalus*), (confirmed)
- Black breasted button quail (*Turnix melanogaster*) (not detected)
- White-throated needletail (*Hirundapus caudacutus*), (confirmed)
- Collared delma (*Delma torquata*) (not detected)
- Rufous fantail (*Rhipidura rufifrons*), listed as migratory
- Satin flycatcher (*Myiagra cyanoleuca*), listed as migratory
- Fork-tailed swift (*Apus pacificus*), listed as migratory.

Overall, the ecological survey effort recorded 262 fauna species, including 16 amphibians, 186 birds, 44 mammals and 16 reptiles across the assessment area.

3.3 Introduced species

Ecological field surveys were conducted to identify introduced flora and fauna species occurring within the Project Site. This effort provides insights into the current condition of existing communities and habitats, as well as identifying introduced species that may impact threatened species. The surveys recorded 104 introduced flora species and 12 introduced fauna species.

4.0 Rehabilitation Design

This RMP has been developed with reference to the processes specified in the SEQERF and ecological reporting completed by Ecosure. The rehabilitation design includes management area zones based on vegetation type, providing assessment managers, clients, and contractors with a methodology to facilitate the recovery of ecosystems that have been degraded, damaged, or destroyed.

Bushfire hazard management must be considered to ensure compatibility with rehabilitation strategies. Bushfire management and asset protection zones have been assessed and presented in the Bushfire Management Plan (Land and Environment Consultants, 2024). In some circumstances, only native groundcovers will be appropriate to use in rehabilitation activities to ensure assets are suitably protected from bushfire hazards, for example adjacent to site compounds and electrical infrastructure.

Table 6 lists suitable species for rehabilitation areas.

Table 6 Flora species for use in rehabilitation works

Regional ecosytem	Species		
	Trees	**Shrubs**	**Groundcovers**
11.11.4	*Eucalyptus crebra*	*Acacia leiocalyx subsp. leiocalyx*	*Macrozamia miquelii*
	Corymbia citriodora	*Jacksonia scoparia*	*Themeda triandra*
	Alphitonia excelsa	*Coelospermum reticulatum*	*Aristida caput-medusae*
		Alphitonia excelsa	*Bothriochloa decipiens*
			Aristida queenslandica var. dissimilis
11.11.15/11.3.25	*Eucalyptus crebra*	*Acacia disparrima subsp. disparrima*	*Cymbopogon queenslandicus*
	Corymbia erythrophloia	*Alphitonia excelsa*	*Themeda triandra*
	Eucalyptus melanophloia	*Eremophila mitchellii*	*Heteropogon contortus*
	Eucalyptus camaldulensis	*Acacia cambagei*	*Aristida queenslandica var. dissimilis*
	Eucalyptus tereticornis	*Terminalia oblongata subsp. oblongata*	*Melinis repens*
	Corymbia tessellaris		*Phyla canescens*
			Arundinella nepalensis
			Heteropogon contortus
			Themeda triandra
			Lomandra longifolia
11.12.6	*Corymbia citriodora*	*Xanthorrhoea latifolia*	*Arundinella nepalensis*
	Eucalyptus acmenoides	*Acacia leiocalyx subsp. leiocalyx*	*Heteropogon contortus*
	Eucalyptus crebra	*Alphitonia excelsa*	*Cymbopogon refractus*
			Acacia leiocalyx subsp. leiocalyx
			Bothriochloa decipiens var. decipiens

Regional ecosytem	Species		
	Trees	Shrubs	Groundcovers
11.12.6/11.11.15	*Corymbia citriodora*	*Xanthorrhoea latifolia*	*Arundinella nepalensis*
	Eucalyptus acmenoides	*Acacia leiocalyx subsp. leiocalyx*	*Heteropogon contortus*
	Eucalyptus crebra	*Alphitonia excelsa*	*Cymbopogon refractus*
	Corymbia erythrophloia	*Eucalyptus crebra*	*Acacia leiocalyx subsp. leiocalyx*
	Eucalyptus melanophloia		*Bothriochloa decipiens var. decipiens*
			Cymbopogon queenslandicus
			Themeda triandra
			Aristida queenslandica var. dissimilis
			Melinis repens
11.12.3/11.7.6	*Eucalyptus crebra*	*Acacia leiocalyx subsp. leiocalyx*	*Themeda triandra*
	Eucalyptus tereticornis	*Eucalyptus melanophloia*	*Heteropogon contortus*
	Angophora leiocarpa	*Jacksonia scoparia*	*Melinis repens*
	Corymbia clarksoniana	*Petalostigma pubescens*	*Arundinella nepalensis*
	Eucalyptus melanophloia	*Acacia implexa*	*Cymbopogon refractus*
	Corymbia tessellaris	*Alphitonia excelsa*	*Scleria sphacelata*
	Petalostigma pubescens	*Acacia leiocalyx subsp. leiocalyx*	*Paspalidium distans*
	Corymbia citriodora	*Acacia conferta*	*Gahnia aspera*
	Corymbia citriodora subsp. variegata	*Eucalyptus crebra*	
	Eucalyptus moluccana		
11.12.3	*Eucalyptus crebra*	*Acacia leiocalyx subsp. leiocalyx*	*Themeda triandra*
	Eucalyptus tereticornis	*Eucalyptus melanophloia*	*Heteropogon contortus*
	Angophora leiocarpa	*Jacksonia scoparia*	*Melinis repens*
	Corymbia clarksoniana	*Petalostigma pubescens*	*Arundinella nepalensis*
	Eucalyptus melanophloia	*Acacia implexa*	*Cymbopogon refractus*
	Corymbia tessellaris		
	Petalostigma pubescens		

The selection of trees, shrubs, and ground cover species for the rehabilitation design will be contingent upon their availability from the nursery at the time of planting. It is not intended that grass seeding will be supplemented with native tree or shrub species seed or tubestock. However, the native soil seedbank is likely to remain viable during soil stockpiling (depending on the time stockpiled) and will aid in natural rehabilitation of disturbed areas.

The Contractor will determine the species quantities, with reference to regional ecosystem technical descriptions published and maintained by the Queensland Government[3]. The density of plantings across each rehabilitation category (i.e. assisted regeneration, reconstruction and fabrication) must be moderately escalated to allow for plant failures.

An estimate of rehabilitation requirements for both post-construction and post-decommissioning, has been completed. Table 7 shows the approximate areas that will be subject to rehabilitation either post-construction or post-decommissioning, the type of species to be used (refer Table 6) and the type of rehabilitation (natural regeneration, assisted natural regeneration, reconstruction or fabrication). Some Project components may be subject to retention as is by the landowner, and therefore will not be rehabilitated.

Table 7 Rehabilitation areas (indicative)

Project component	Approximate area (ha)	Post-construction rehabilitation	Rehabilitation as part of decommissioning	Comment
WTG hardstand	31.4	Yes: • partial reconstruction & groundcover replenishment • safe, stable and non-polluting.	Yes: • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	Landholder may elect to retain this infrastructure as is.
Underground cables	228	Yes: • reconstruction & groundcover replenishment • safe, stable and non-polluting.	Yes: • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	-
Batch plant	1.3	Yes: • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	N/A	-
Borrow pit	11.8	Yes: • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	N/A	-
Laydown	4.6	Yes: • rehabilitation type subject to	Yes: • rehabilitation type subject to	Landholder may elect to retain this infrastructure as is.

[3] Regional ecosystems technical descriptions accessible from https://www.publications.qld.gov.au/dataset/re-technical-descriptions

Project component	Approximate area (ha)	Post-construction rehabilitation	Rehabilitation as part of decommissioning	Comment
		landholder agreement • safe, stable and non-polluting.	landholder agreement • safe, stable and non-polluting.	
Operation & Maintenance Building	1.0	Nil	Yes: • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	Landholder may elect to retain this infrastructure as is.
Compound	1.5	Nil	Yes: • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	Landholder may elect to retain this infrastructure as is.
Substation (north and south)	2.2	Nil	Yes: • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	-
Switching station	2.2	Nil	Nil	Powerlink will own this asset.
Helipad	0.0	Nil	Nil	Powerlink will own this asset.
Access roads	70.5	Nil	Yes • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	Landholder may elect to retain this infrastructure as is.
General earthworks areas (e.g. clearing pads, batters to roads and hardstands)	517.4	Yes: • reconstruction and assisted natural regeneration • safe, stable and non-polluting • ground cover only.	Yes: • rehabilitation type subject to landholder agreement • safe, stable and non-polluting.	Landholder may elect to retain this infrastructure as is.

4.1 Rehabilitation of agreed areas with landowner

Rehabilitation of decommissioned hardstand and laydown areas will be in accordance with agreements between the Proponent and landowners which stipulate that (unless otherwise agreed with landowner) all above ground infrastructure will be removed to 1 m below ground level. Infrastructure below 1 m will remain in situ (e.g. foundations, electrical reticulation). Bare earth areas will be rehabilitated using appropriate soil and grass-seed. The seed mix will reflect the landowner's preferences (where mutually agreed with the Proponent) and biosecurity regulations.

Rehabilitated areas will be inspected to ensure that these areas are in suitable self-sustaining condition and there are no issues associated with this phase of decommissioning. The Contractor will be responsible for implementing the inspections and issue management protocols. Identified rehabilitation issues must be appropriately addressed as soon as practicable by the Contractor.

In circumstances where the landholder elects to retain only part of the infrastructure (e.g. a portion of the compound area), the balance area will be subject to rehabilitation.

4.2 Rehabilitation of balance areas required for permit compliance

Rehabilitation of all areas required for permit compliance (excluding those to be retained by landowner) will in accordance with relevant conditions or as agreed with the landowner as part of decommissioning. Rehabilitation measures will include compaction with suitable soil for all areas that require additional soil or backfill, reseeding and in some instances revegetation. The seed mix will reflect the landowner's preferences (where mutually agreed with the Proponent) and biosecurity regulation requirements.

Rehabilitated areas will be inspected to ensure that these areas are in a suitable self-sustaining condition and there are no issues associated with the phase of rehabilitation or decommissioning. The Contractor will be responsible for implementing the inspections and issue management. Identified rehabilitation issues must be appropriately addressed as soon as practicable by the Contractor.

Temporary construction areas, such as laydowns, and compounds, will be reinstated as part of the decommissioning process. Turbine hardstand areas that were rehabilitated following construction may also be reinstated during the decommissioning phase to facilitate crane operations. Conversely, borrow pits used in construction will not be reinstated.

Following the cessation of decommissioning activities, all reinstated areas will be subject to the rehabilitation process. Rehabilitation efforts will include soil stabilisation, reseeding with native species, and erosion control measures to promote natural regeneration, as required. These areas will be subject to ongoing monitoring for an appropriate duration to assess vegetation establishment, soil stability and habitat recovery. Monitoring will continue until the completion criteria are met, demonstrating self-sustaining ecosystems that align with pre-disturbance conditions or agreed post-closure land uses. Adaptive management strategies will be implemented as necessary to address any deficiencies and ensure long-term environmental resilience.

4.3 Performance criteria

The RMP establishes benchmark performance criteria to evaluate the success of rehabilitation activities during both the maintenance and post-maintenance phases. These criteria guide the implementation of re-seeding and weed management work and reinforce the targeted rehabilitation outcomes.

- Maintenance Phase Criteria:
  - completion of all required planting activities
  - achieving a 100% kill rate for declared environmental weeds
  - achieving a 98% kill rate for other weeds
- Post-maintenance Phase Criteria:
  - removal of stakes and general rubbish
  - no remaining eroded or degraded areas
  - achieving a 100% kill rate for declared environmental weeds
  - achieving a 98% kill rate for other weeds.

These performance benchmarks support compliance with rehabilitation standards and identify when additional maintenance efforts are necessary to support the rehabilitation activities.

Where the performance benchmarks are not met, additional works will be required. This may include:

- weed control

- grass-seeding watering
- erosion control including reprofiling of the land.

These works will be coordinated by the Contractor and may occur at the request of the Proponent.

The success of this RMP will also influence that of the VMP (Ecosure, 2025). Managing the impacts towards native vegetation will be determined by achievement of prescribed performance outcomes at each stage of the project. Performance outcomes assessed against the construction, operation and decommissioning phase of the project are detailed in the VMP.

Should these performance outcomes not be achieved, this will trigger an audit of the VMP and the implementation of corrective actions where adverse events have occurred. Further details are outlined in the VMP.

4.3.1 Rehabilitation target

The Proponent is committed to achieving a minimum of 60% of herbaceous and grass species within the rehabilitation area within two years of rehabilitation commencement. In addition, the target is to reach at least 60% of the species diversity found in adjacent undisturbed areas, using appropriately sourced native species reflective of the pre-clearance RE. These targets will guide monitoring and adaptive management to ensure progressive and ecologically meaningful rehabilitation outcomes.

5.0 Rehabilitation Stages

After completing the site analysis and defining management areas as part of rehabilitation design, it is necessary to prioritise site works. Before starting any site activities, measures should be taken to protect the area from ongoing degrading impacts such as livestock grazing, unauthorised access, and littering as these may interfere with rehabilitation establishment measures. Areas identified for rehabilitation will be reinstated to their pre-clearance RE classification, where it is safe and practical to do so. This includes consideration of surrounding infrastructure such as compounds and electrical facilities, where safety constraints may limit full ecosystem reinstatement. Some factors that may need immediate attention include:

- the presence of highly invasive weed species which may disperse further prior to substantial site works commencing
- the presence of weed species which may have a long-term impact on ecological communities such as exotic and weed varieties of vines
- flammable materials (including weed thickets, grasses and vines)
- damaging and easy access by 4WD, motorbikes and pedestrians or livestock into core retained vegetation and ecological restoration areas. This may require installation of temporary fencing if deemed appropriate.

Site works can be typically broken down into the following categories:

- primary works
- follow-up works
- maintenance works.

A schedule of works has been designed to demonstrate how specific rehabilitation activities will be undertaken to support the rehabilitation objective (refer Table 8). Rehabilitation works are committed to commence within four weeks of an area no longer being required for construction or operational activities providing the area is safely accessible, ensuring timely progression toward meeting rehabilitation objectives and minimising the duration of land disturbance. The schedule details the various components that the Proponent and Rehabilitation Contractor will coordinate.

Table 8 Indicative works schedule

REHABILITATION WORKS INDICATIVE SCHEDULE OF WORK ITEMS AND MAINTENANCE SEQUENCING																												
Timing	Spring			Milestone Compliance – commence limited ongoing maintenance	Summer			Autumn			Winter			Spring			Summer			Autumn			Winter			Spring			Milestone Compliance / self-sufficient
	Primary Works				Follow-up Works			Follow-up Works / Maintenance Works			Maintenance Works			Maintenance Works			Maintenance Works			Maintenance Works			Maintenance Works			Maintenance Works			
	Month 1	Month 2	Month 3		Month 1	Month 2	Month 3	Month 1	Month 2	Month 3	Month 1	Month 2	Month 3	Month 1	Month 2	Month 3	Month 1	Month 2	Month 3	Month 1	Month 2	Month 3	Month 1	Month 2	Month 3	Month 1	Month 2	Month 3	
Week 1	Pre-start meeting between parties	Establish PP WM	Mulch spreading and jute-mat installation		Watering and Monitoring and reporting (throughout establishment). PP	Watering and Monitoring and reporting (throughout establishment). PP	Watering and Monitoring and reporting (throughout establishment). PP	Watering of replacement plants only	Watering of replacement plants only	Monitoring and reporting.	Watering of replacement plants only		Monitoring and reporting.	Watering of replacement plants only		Monitoring and reporting.	Watering of replacement plants only		Monitoring and reporting.	Watering of replacement plants only		Monitoring and reporting.	Watering of replacement plants only		Monitoring and reporting.	Mulch - top up depths to 100 mm and replace /repair jute-mat if required	Watering of replacement plants only	Monitoring and reporting.	
Week 2	Initial WM	Soil Preparation and cultivation	Natural regeneration plants staking for identification		WM	WM	WM	WM	WM	WM	WM		WM	WM		WM	WM		WM	WM		WM	WM		WM	Natural regeneration plants – WM	WM	WM	
Week 3	WM (removal by hand)	Soil preparation and modification	Planting and watering		Natural regeneration plants – WM	Replacement of failed plants	Replacement of failed plants	Natural regeneration plants – WM	Natural regeneration plants – WM	Replacement of failed plants	Natural regeneration plants – WM		Trees formative pruning			Replacement of failed plants				Natural regeneration plants – WM		Trees formative pruning				Trees formative pruning	Replacement of failed plants	Natural regeneration plants – WM	
Week 4	WM - slashing of maintenance access paths if required	Mulch – stockpiled on site	Planting and watering		WM - access paths upkeep	WM - access paths upkeep	WM - access paths upkeep	WM - access paths upkeep	WM - access paths upkeep	WM - access paths upkeep	WM - access paths upkeep		WM - access paths upkeep	WM - access paths upkeep		WM - access paths upkeep	WM - access paths upkeep		WM - access paths upkeep	WM - access paths upkeep		WM - access paths upkeep	WM - access paths upkeep		WM - access paths upkeep	Replacement of failed plants	WM - access paths upkeep	WM - access paths upkeep	

WM = Weed management work, including wood weed removal, spray, hand removal and incidental tasks for maintenance access

PP = Photo point monitoring

Colour Key to Work Types	
	Weed Management (WM)
	Soil preparation and mulching
	Planting works
	Watering, monitoring and reporting

Table 9 Rehabilitation Team Responsibilities

Party	Description
Proponent	• Ensure all consultants, contractors, sub-contractors, and other personnel involved in the Project are informed of and adhere to the RMP. • Engage qualified consultants and contractors to execute works in accordance with the approval conditions. • Bear all costs associated with the resources needed to complete the works as outlined in the approval that conditioned the rehabilitation work to be implemented. • Coordinate monitoring and reporting activities as specified in this document and the approval conditions.
Contractor	• Complete all works in strict accordance with the approved documentation. • Participate in pre-start and compliance inspections as requested by the Proponent. • Hold or employ relevant qualifications in weed management, revegetation, or fauna management, such as a minimum of Certificate III in Conservation and Land Management, Horticulture, or Rehabilitation Construction, or equivalent experience in rehabilitation. • Maintain all necessary insurances relevant to the scope of works and demonstrate a thorough understanding of applicable laws, acts, policies, and guidelines. • Provide recommendations for amendments to the documentation when specific expertise or on-site conditions necessitate changes.

5.1 Primary works

Attention to fauna habitat and values must be incorporated into this stage. Efforts may focus on enhancing and restoring existing native vegetation areas while promoting safe fauna movement throughout the site.

Rehabilitation areas will incorporate the reuse of fallen logs and rocks from the site to create safe havens and cover for small fauna from predators. This strategy, along with additional revegetation efforts, enhances fauna security and movement within the rehabilitation zones and the overall site.

Adaptive management is an essential part of the management work. An ongoing and systematic approach aimed at improving rehabilitation outcomes by learning from previous and current management practices. It includes:

- identification of ineffective methods and emerging threats during the Project
- use of new and alternative methods
- implementation of new or alternative management methods based on the best available knowledge from other Projects
- review of these new or alternative management methods during the Project.

Having an adaptive approach to rehabilitation works is recommended to achieve rehabilitation criteria and maximise environmental outcomes. This extends to the watering schedule which will be dependent on general climate variability, the time of year that rehabilitation commences and rainfall across the Project Site.

As part of primary works, photo point monitoring locations must be confirmed on-site and staked, if possible, to identify easily for future monitoring works.

For rehabilitation works existing access tracks and/or access tracks to be retained post-rehabilitation should be used wherever practicable. If additional access tracks are required, these should be confirmed by the on-site contractor during this stage if possible. If not possible, for example due to extensive weed infestations that require treatment before access path confirmation, this will be reviewed as part of follow-up works.

5.1.1 Weed management

Weed management is a crucial aspect of rehabilitation site works. It plays a key role in supporting both natural regeneration and assisted natural regeneration. Additionally, effective weed management is an essential preliminary step for reconstruction and fabrication efforts.

Declared environmental weeds refer to species listed under the *Biosecurity Act 2016* as declared invasive plants (weeds), meaning they are considered harmful to the environment and can be detrimental to social issues. These plants are regulated in Queensland to minimise their spread and adverse impacts on native ecosystems, agriculture, and natural resources. The Biosecurity Act 2016 requires a level of obligation and consider steps to minimise risks associated with invasive plants and animals.

Weed Management is to be undertaken in accordance with the SEQERF and primary, follow-up and maintenance works. Weed management in work areas will address all species declared at the Commonwealth, state, and local levels, as well as any invasive weeds identified on-site.

It is important that rehabilitation contractors are experienced in:

- knowledge of relevant biosecurity legislation
- plant identification skills
- knowledge of different weed management techniques.

Weed management works, requires assisted planting and larger scale planting (reconstruction and fabrication). Prior to installation, the following items should be considered:

- species selection
- sourcing plant material
- timing of planting
- site preparation
- planting density
- planting installation.

Contemporary weed management techniques for restricted weeds are published by the Queensland Government[4] and South Burnett Regional Council[5]. Methods considered suitable for use at the Project Site include herbicide control and application, and physical control (e.g. hand removal). The Rehabilitation Contractor will advise on the appropriate methods upon completion of an initial site inspection, and these will be subject to approval by the Proponent. For more information refer to the weed fact sheets, published by the Queensland Government, that detail treatment and control details are available (refer Appendix A).

5.2 Follow-up works

Following primary works, follow-up works will be required. This will include continued weed maintenance, replacement of failed plantings and new infill planting following weed removal work.

Photo point monitoring must continue during this stage at monthly intervals.

[4] Queensland Government, 2018. *Controlling weeds (invasive plants) on your property* accessed at https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/invasive/manage/control
[5] South Burnett Regional Council, 2024. *Biosecurity* accessed at https://www.southburnett.qld.gov.au/biosecurity

Watering of rehabilitation areas will be crucial if rainfall does not supply a sufficient amount. Rainfall should not be relied upon in the first instance.

Where access paths for rehabilitation works are not already set-out or the existing configuration is inadequate, establish access paths that will support the long-term rehabilitation program.

Monitoring will be undertaken bi-annually for a minimum of five years, or until the completion criteria are met and sustained. Assessments will evaluate vegetation establishment, species diversity, and weed management. If monitoring results indicate that rehabilitation is not progressing as expected, adaptive management measures will be implemented. This may include additional planting, adjustments to watering schedules, weed control interventions, and habitat enhancements.

5.3 Maintenance works

As with all ecological rehabilitation work, maintenance is fundamental in ensuring Project success. Maintenance is likely to be required following restoration of flora and habitat and will be for the agreed rehabilitation timespan. On-going maintenance at the site will ensure that the desired end-product can be achieved, a fully functioning system that can support itself in the future, with minimal maintenance and input required.

Maintenance of the rehabilitation area might include:

- herbicide spraying to control competing weeds.
- watering while plants are establishing. This is often highly variable and depends on the suite of species planted, weather conditions and time of year when planted. A watering schedule may consist of watering every day for week 1, twice per week for weeks 2-6 and then weekly from weeks 6-12.
- repair of tree guards if they become damaged
- replenishment of mulch
- addition of logs, rocks and fauna habitat
- maintaining exclusion fencing
- additional planting if required.

Additional planting may be necessary to replace plants that do not survive, either to meet survival rate requirements or to fill gaps. It might also be beneficial to introduce new species at various stages of vegetation succession. An adaptive management approach should be employed; if a particular plant species consistently fails to thrive on a site, consider replacing it with a species that is performing well.

Ongoing weed management until the rehabilitation area reaches self-sufficiency is vital to support the long-term rehabilitation success. As shown in Table 8, weed management is routinely scheduled throughout the management period.

5.3.1 Monitoring

Monitoring of rehabilitation efforts is another way to assess ecological restoration success alongside the established benchmarks. This monitoring can be conducted through regular site inspections, completion of record sheets, and note-taking. Notes should be shared with the rehabilitation team, and any necessary corrective actions should be implemented based on these observations.

Monitoring during the establishment period needs to be clearly assigned and will require quarterly reporting. The monitoring program can be reviewed at this time, and a longer-term, less intensive program proposed where justified.

The routine photo point surveys will support the monitoring and reporting program.

5.3.2 Progress reporting

Following progress of this rehabilitation plan, it is important that the methods and results from maintenance and monitoring surveys/observations are recorded. This should be undertaken, even when a method is not successful, to assist with future Projects.

6.0 References

Guideline for the preparation of a Rehabilitation Plan (GCC). (n.d.).

South East Queensland Ecological Restoration Framework. (2012).

AECOM. (2024). *Planning Assessment Report Tarong West Wind Farm* .

AECOM. (2025). *Environmental Management Plan for Tarong West Wind Farm.* Queensland: RES Australia Pty Ltd.

AECOM. (2025a). *Decommissioning Management Plan for Tarong West Wind Farm.* Queensland: RES Australia Pty Ltd.

Ecosure. (2023a). *Assessment of Matters of National Environmental Significance for Tarong West Wind Farm, Ironpot, Queensland.* RES Australia Pty Ltd.

Ecosure. (2025). *Vegetation Management Plan for Tarong West Wind Farm.* Queensland: RES Australia Pty Ltd.

Land and Environment Consultants. (2024). *Bushfire management plan.*

Appendix A

Weed Fact Sheets

Restricted invasive plant

Madeira vine

Anredera cordifolia

Madeira vine is an invasive, South American vine that blankets and smothers trees, shrubs and understory species. It grows prolifically at rates of up to one metre per week and the weight of the vine can cause canopy collapse of mature native trees. It produces large numbers of subterranean and aerial reproductive tubers that persist in the environment and make effective management difficult.

The impacts of Madeira vine can be so severe that it causes irreversible damage to the invaded ecosystem, leading to its categorisation as a transformer species.

Madeira vine is considered one of Australia's worst environmental weeds and has been listed as a Weed of National Significance.

Legal requirements

Madeira vine is a category 3 restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Queensland Government

Description

Madeira vine is also known as potato vine or lambs tail vine. It has fleshy, waxy green, heart-shaped leaves which are usually 4–5 cm in length. The stems are slender and hairless, initially herbaceous but becoming woody with age.

Clusters of 5 mm to 25 cm aerial tubers are produced along the length of the stem. These are light brown or green, and 'warty' in appearance. The vine also produces potato-like subterranean tubers which can grow up to 20 cm in diameter and at depths of up to 1 m.

Madeira vine produces dense blankets of creamy flower spikes from December to April. The flower spikes are approximately 10 cm long and are made up of numerous small flowers along a drooping, central stem.

Distribution and habitat

Madeira vine is common in urban areas where it has been introduced as a garden plant. It typically invades riparian vegetation, the edges of rainforests, tall open forests and damp sclerophyll forests.

In Queensland, Madeira vine infestations are most highly concentrated in the coastal and hinterland regions of south east Queensland. However it has also invaded regions of central Queensland and is found as far north as Cairns and the Atherton Tablelands.

Potential distribution modelling suggests the possibility of significant range increases in Queensland if spread is not actively contained.

Control

Managing Madeira vine

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by Madeira vine. This fact sheet provides information and some options for controlling Madeira vine.

Management strategies

Successful management of Madeira vine requires exhaustion of the tuber bank. Tubers can remain viable for up to 15 years and can be easily spread through poor green waste management or via gravity and water movement from ridges and watersheds or during floods.

A management plan should be carefully designed and include a commitment to regular, long-term follow-up control. The disturbance caused by control work stimulates particularly vigorous vine growth and if management isn't carried out appropriately may lead to an even greater problem. Plan to:

1. Prevent Madeira vine spread

Identify isolated plants or sparse populations and control these first. Also consider the topography of the landscape and prioritise isolated infestations on high ground or at the top of catchments.

2. Reduce established infestations

Weed strategically, protecting the better quality native vegetation first e.g. treat Madeira vine infesting trees that are still living. Where possible, work from the edge of the infestation toward the core – the exception may be where you need to protect isolated areas of high biodiversity value.

3. Follow-up, rehabilitate and monitor

The size of the area targeted at each stage should be manageable enough to enable thorough follow-up control two to three times a year. Ensure activities do not spread the tubers.

Monitor the site to ensure effective native plant regeneration (highly degraded sites may require active replanting) and early detection of invasion by other weed species.

Physical control

Physical control of Madeira vine is difficult because of the extent of underground tubers and ease of fragmentation of the vine and root system. However, it may be practical for smaller or immature infestation sites or as a follow-up to remove persistent tubers.

Cutting and pulling the vines from the canopy is not generally recommended because it results in a rain of viable tubers and may be dangerous if dead and dying branches are pulled down with the vine. However, this may be necessary where there is extreme stress on the host plant. In this case, tarpaulins should first be laid on the ground to collect as many of the aerial tubers as possible.

Tubers and vegetative material must be disposed of appropriately as they will shoot in contact with moist soil. Ideally tubers and vines should be composted on-site to reduce the risk of further spread. Compost sites should be established away from other vegetation where they can be easily and frequently foliar sprayed. Alternately, double bag the plants and tubers in non-biodegradable plastic bags and dispose of them in landfill waste. **Do not** dispose of Madeira vine in council green waste bins as this may spread the weed.

Biological control

The leaf feeding beetle *Plectonycha correntina* was first released in Queensland in 2011. Both the adult and larval stages feed on the leaves of Madeira vine and it is expected that large reductions in leaf area will reduce the plant's ability to produce energy and cause it to deplete the resources stored in its tubers. Significant defoliation should also promote canopy recovery in host plants. Releases of the insect have occurred in New South Wales and Queensland and at many of these sites the beetle has established and significant leaf feeding damage has been observed.

Herbicide control

Herbicides can be effective if they are carefully chosen and selectively applied. The main application techniques are scrape and paint and foliar spray, although basal barking and cut stump are also used.

A range of selective, non-selective; residual and non-residual herbicides are available for spot spraying Madeira vine regrowth and seedlings. There are pros and cons associated with each of these that must be considered on a site by site basis:

Non-selective and non-residual herbicides

These are herbicides like glyphosate which will affect most plant species they come in contact with but don't remain active in the soil. In most instances glyphosate is the preferred herbicide for madeira vine management because there are few restrictions on who can use it and where it can be used (frog friendly versions like Roundup® Biactive are available for areas adjacent to waterways). However, care must be taken to avoid contact with desirable species as in-discriminate spraying will open up bare ground for opportunistic weed invasion.

Selective and residual herbicides

Residual herbicides are more effective at controlling Madeira vine tubers – enabling more rapid management of infestations; and selective herbicides, if used correctly, allow non-susceptible species to persist, providing competition to future weed invasion.

For example, research indicates that foliar sprays of triclopyr (300 g/L) + picloram (100 g/L) + aminopyralid (e.g. Grazon Extra®), even at sub-label mix rates of 20–40 mL/10 L of water is particularly effective for the management of regrowth, juveniles and tubers. At these rates non-susceptible species like grasses, ferns, rushes and sedges should be unaffected. However, it may impact other woody plants and vines, particularly in the immature stages and the use these herbicides should be avoided at more sensitive sites. In degraded and heavily infested sites where native species recolonisation from adjacent areas or active revegetation will be required, these selective and residual herbicides should provide a better control option.

Application techniques

Scrape-paint application

This approach is suitable for medium to large basal stem sizes and provides the safest management option in sensitive environments. It is however extremely labour intensive as every vine must be treated individually.

Scrape 10–20 cm sections of the vine down to the white fibrous layer and immediately paint the exposed areas with concentrated herbicide (see Table 1 for recommended herbicides and rates). Repeat the process as high up the stem as can be reached, and where possible, scrape areas on both sides of the stem. Be careful not to ring bark the stem as this will halt the spread of the herbicide.

Foliar spray

Traditionally, foliar spray has been used as a secondary treatment to manage prostrate growth and seedlings once the primary stems have been treated using scrape and paint techniques. However, some practitioners now recommend the use of foliar spray as a stand alone treatment. This approach has been developed to increase the cost effectiveness of management but does carry the risk of off-target damage. Decisions on the applicability of this management approach should be made on a site-by-site basis, considering the vegetation composition and sensitivity of the site, as well as the skills of those applying the herbicide.

Handheld equipment (handgun and hose or knapsack) is useful to spot spray prostrate stems, seedlings and regrowth.

Some selective herbicides can be used to treat vines climbing over non-susceptible (or weedy) host plants; however extreme care must be taken.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

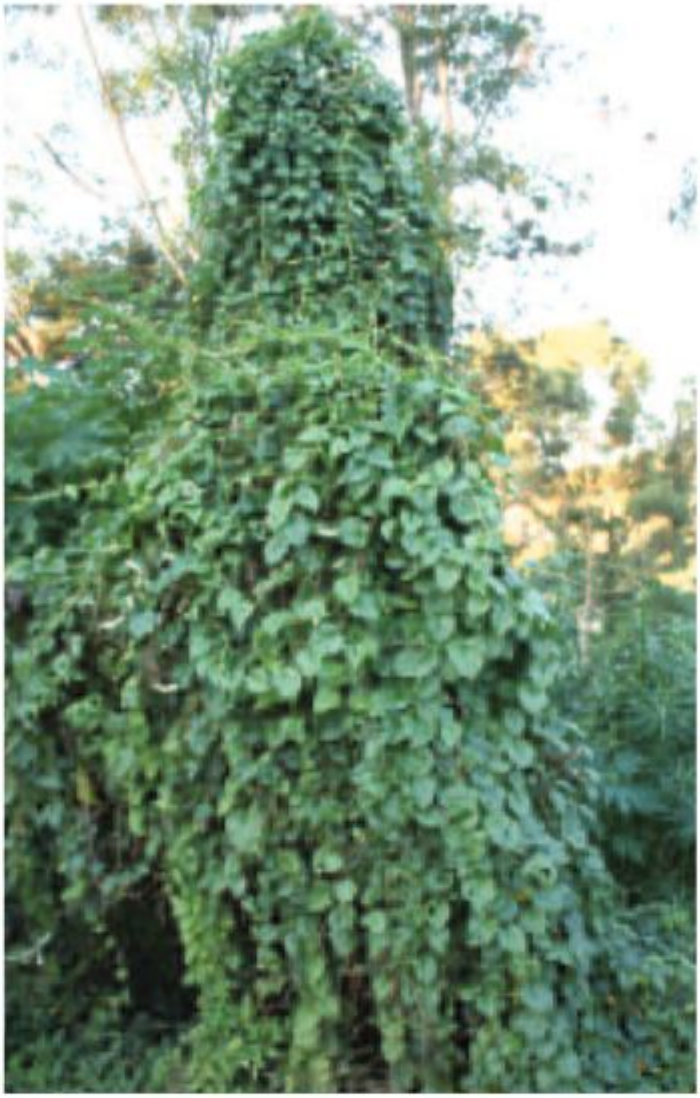


Table 1. Herbicides for the control of Madeira vine

Method	Herbicide	Rate	Registration status	Comments
Basal bark (scrape and paint)	Picloram 44.7 g/L + Aminopyralid 4.47 g/L (e.g. Vigilant II® herbicide gel)	Neat 3–5 mm layer of gel applied to scraped surface	Registered Australia wide (rhizomatous plants)	Appropriate for medium sized to well established vines with tubers Apply herbicide to scraped section of vine within 15 seconds
	Glyphosate 360 g/L (e.g. Ken-up Aqautic 360, Roundup® Biactive, Weedmaster Duo®)	667 mL/1 L water (1:1.5)	PERMIT 11463 (expires 30/06/2023)	
Basal bark	Fluroxypyr^{S} 333 g/L (e.g. Starane Advanced®)	21 mL/1 L diesel/kerosene	Registered	Appropriate for medium sized to well established vines with tubers Always treat vines away from the host tree
	Fluroxypyr^{S} 200 g/L (e.g. Flagship® 200, FMC Fluroxypyr 200 Herbicide)	35 mL/1 L diesel	PERMIT 11463 (expires 30/06/2023)	
Cut stump	Picloram^{R} 44.7 g/L + Aminopyralid 4.47 g/L (e.g. Vigilant II® herbicide gel)	Neat 3–5mm layer of gel applied to scraped surface	Registered (rhizomatous plants)	Appropriate for young vines without aerial tubers; or vines with immature tubers Only use for mature vines where prompt follow-up treatment of new growth arising from fallen tubers is possible Where possible, apply in spring before new tubers proliferate Apply herbicide to the cut surface of stem within 15 seconds
	Glyphosate 360 g/L (e.g. Ken-up Aquatic 360, Weedmaster Duo®)	500 mL/1 L water (1:2)	PERMIT 11463 (expires 30/06/2023)	
Foliar application	Fluroxypyr^{S} 200 g/L (e.g. Flagship® 200, FMC Fluroxypyr 200 Herbicide)	50 mL/10 L water	Registered	Appropriate for madeira vine treatment in disturbed areas of native vegetation or spot spraying of seedlings and prostrate growth Apply to healthy actively growing vines only Apply only when supporting plant and understory is dead or weedy Apply early autumn (March–April) Do not spray beyond the point of runoff
	Fluroxypyr^{S} 333 g/L (e.g. Starane Advanced®)	21 mL/10 L water		
	Fluroxypyr^{S} 400 g/L (e.g. Nufarm Comet 400, Decoy 400)	25 mL/10 L water		
	Glyphosate 360 g/L (e.g. Ken-up Aquatic 360, Weedmaster Duo®)	100 mL/10 L water	PERMIT 11463 (expires 30/06/2023)	
	Metsulfuron-methyl^{SR} 600 g/kg (Associate, Ken-Met 600)	1–5 g/10 L water + non-ionic surfactant	PERMIT 82307 (expires 31/03/2022)	
	Glyphosate 360 g/L + Metsulfuron-methyl^{SR} 600 g/kg	200 mL Glyphosate + 1.5 g Metsulfuron-methyl /10 L water		
	Triclopyr 300 g/L + Picloram 100 g/L +/- Aminopyralid 8 g/L^{SR} (e.g. Grazon Extra®) or Triclopyr 300 g/L + Picloram 100 g/L (e.g Farmoz Fightback®, Nufarm Conqueror®)	35–50 mL/10 L water	PERMIT 11463 (expires 30/06/2023)	

^{S}Selective herbicide
^{R}Residual herbicide
Prior to using the herbicides listed under PER11463 (expires 30/06/2023) you must read or have read to you and understand the conditions of the permit. To obtain a copy of this permit visit apvma.gov.au

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

This fact sheet is developed with funding support from the Land Protection Fund.

Restricted invasive plant

Groundsel bush

Baccharis halimifolia

Groundsel bush rapidly colonises disturbed areas, especially overgrazed pastures. It competes with pasture species for water and nutrients. Groundsel bush spreads rapidly from windborne seed, making clearing groundsel bush from paddocks a very time-consuming and expensive task.

In native *Melaleuca* wetlands, groundsel bush can form a dense understorey, suppressing growth of native sedges and interfering with the natural ecosystem.

Groundsel bush can become abundant in the vegetation along watercourses and in coastal woodlands and forest areas if not controlled.

The wind-dispersed seed can be a nuisance in urban areas where it sticks to insect screens and germinates in home gardens. Urban problems include potential allergies caused by airborne pollen and seed 'fluff'.

Legal requirements

Groundsel bush is a caegory 3 restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

Queensland Government

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Groundsel bush is a densely branched shrub usually no more than 3 m high. Stems are green, maturing to brown and woody. Bark of mature plants is deeply fissured. Leaves are dull green, alternate, wedge shaped, 2.5–5 cm long and 1–2.5 cm wide, with a few lobes in the upper part. It has a deep branching taproot with numerous fibrous laterals in the upper soil.

Male and female flowers are borne on separate plants. Male flowers are pale yellow and open around mid to late March, slightly earlier than the female flowers. Female flowers are white and inconspicuous at the end of branches until seeds are fully developed.

Life cycle

Female plants flower around late March to early April and once pollinated develop a fluffy appearance, with tufts of white hair that begin to blow the fluffy seeds in the breeze from mid to late April. Most germination occurs in the autumn/winter period.

Plants normally do not flower in the first year of growth. Plants that are 2 m tall can produce from 500 000 to a million seeds.

Seeds from mature plants drift in the breeze like thistle seeds, most falling within a few metres of the parent bush. Wind updrafts can carry seeds many kilometres.

Seeds germinate readily with rainfall; however, if they become buried they can remain dormant for several years.

Methods of spread

Seeds are readily transported by wind, running water, vehicles and machinery. Soil disturbance in infested areas usually leads to substantial germination. Further infestation occurs unless the ground is sown to pasture or other competitive ground cover.

Habitat and distribution

Groundsel bush is a native of Florida (United States) and coastal areas adjacent to the eastern side of the Gulf of Mexico.

It was introduced into the Brisbane region as an ornamental plant in 1900 and has spread along the coastal areas of south-east Queensland (north to Miriam Vale) and down the New South Wales coast. Scattered plants have occurred as far west as the Chinchilla region.

Groundsel bush is a rapid coloniser of cleared, unused land and is particularly suited to moist gullies, salt marsh areas and wetlands. It also does well on high, cleared slopes.

Control

Managing groundsel bush

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by groundsel bush. This fact sheet provides information and some options for controlling groundsel bush.

Pasture management

In grazing situations, good pasture management will greatly reduce groundsel bush invasions. Slashing, timely use of fertiliser and management of stocking rates can assist in control by maintaining a healthy pasture. Good pastures provide competition to limit re-invasion of groundsel bushes. Consult pasture agronomists on the best options for your property.

For tall, dense infestations, burning can reduce the amount of above-ground material (and even kill the odd plant) making it a lot easier to spray regrowth. Annual burning does not reduce existing plant numbers, but allows grasses to establish more quickly and out-compete groundsel bush seedlings.

Regular slashing over a period of several years will result in a decreased level of infestation. In non-grazing situations, reforestation will eventually assist in control of groundsel bush. However, it is important to ensure that seed production is prevented while trees are establishing.

Mechanical control

Hand-pull small plants. Dig larger plants out or cut them off more than 10 cm below ground level.

As groundsel bush is a perennial woody plant with underground growing buds, slashing or burning will rarely kill plants and such action will generally result in regrowth occurring. Therefore the regrowth will need to be promptly controlled.

Biological control

Since the biological control program began for groundsel bush in 1967, over 35 different insects have been tested but only six have become permanently established in the field:

1. Stem borer (*Megacyllene mellyi*)
   This beetle is restricted to areas adjacent to salt marshes where the sap flow in the host plant is lower. Newly hatched larvae are drowned by the heavier sap flow in plants growing in non-saline soils. Dense populations of this insect can reduce groundsel bush infestations in suitable habitats.
2. Plume moth (*Oidaematophorus balanotes*)
   This insect is present in all areas. Damage is caused by larvae tunnelling in the stems and varies from severe dieback to death of individual branches. Populations of the moth appear to be restricted by ant predation on the eggs and young larvae. This in turn restricts plant damage.
3. Gall-fly (*Rhopalomyia californica*)
   The larvae of this mosquito-like fly feed within development shoots and buds. Initially this insect caused heavy damage when it was released. However, soon after its release it was attacked by a small native

wasp that drastically reduced gall numbers. Galls can always be found in low numbers, but occasionally higher numbers are found in patches. Overall damage to the plant is minimal.

4. Groundsel bush leaf beetle (*Trirhabda baccharidis*)
   This beetle is restricted to similar habitats to the stem borer, where the larvae can form suitable cocoons and pupate in the soil. Plants will be totally defoliated in autumn, but can recover and are in full leaf next spring. In some years larvae severely damage the buds and flowers.
5. Leaf skeletoniser (*Aristotelia ivae*)
   The larvae of this moth eat the soft leaf tissue leaving the skeletal woody veins. Though widespread, populations do not become large enough to cause significant damage. It is most commonly found in the spring on new leaves.
6. Leaf miner (*Buccalatrix iveila*)
   The larvae of this small moth mine in the leaf blades and later skeletonise the leaves in a manner similar to *Aristotelia*. This insect is widespread within the range of groundsel bush and causes minor damage.

Research has seen a move away from insect biocontrol to plant disease biological control agents. Two diseases have been studied in Florida. Experimental field releases of the rust fungus *Puccinia evadens* from Florida commenced in 1998 and this pathogen is now established at several sites.

Groundsel bush rust (*Puccinia evadens*) acts as both a leaf and stem parasite, causing defoliation during summer and winter and stem dieback over summer. The infection process requires a moisture film on the leaf or stem surface. The dry spores are spread by wind.

The presence of these biocontrol agents does not relieve landholders from their responsibility under Queensland legislation to manage the biosecurity risks associated with this invasive plant.

Herbicide control

Before using any herbicide, always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label. Table 1 details the herbicides for groundsel bush control.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

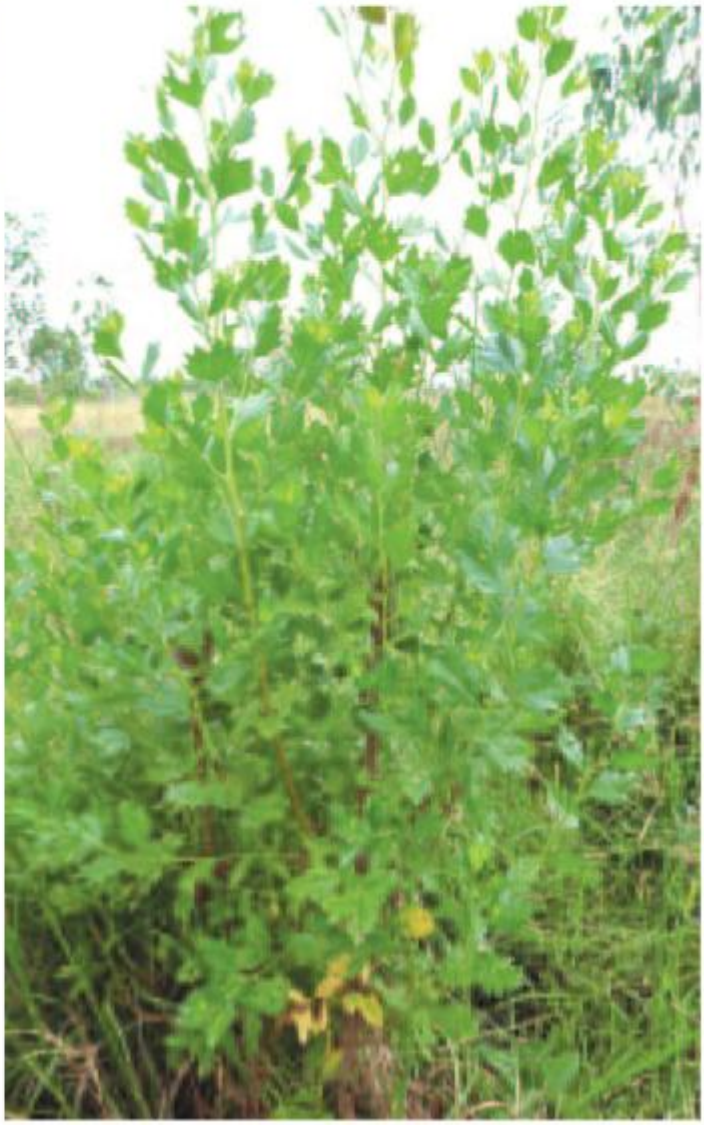


Table 1. Herbicides for the control of groundsel bush

Situation	Herbicide	Rate	Comments[1,2,3]
Pastures, non-agricultural, commercial, industrial land and rights-of-way	2,4-D amine 625 g/L (e.g. Ken-Amine 625)	2.9–4 L/ha 220 mL/100 L water 240 mL/15 L	Aerial application—higher rate for bushes Spray when actively growing High volume foliar spray Misting. Lightly wet plants
Pastures and non-agricultural land	2,4-D acid 300 g/L (e.g. Affray 300)	10 L/ha 33 mL/1 L kerosene or mineral turpentine 100 mL/10 L water 1 L/10 L water 0.37 L/ha	Helicopter spraying Basal bark or cut stump Knapsack foliar spray Sprinkler spray—1 L/100 m2
Pastures, rights-of-way and industrial land	2,4-D as sodium salt 700 g/kg (e.g. Tornado DF)	275 g/100 L water	High volume spot spray Addition of a surfactant is recommended (consult label)
Irrigation channels/banks, non-agricultural, commercial, industrial land, home gardens, pastures, rights-of-way and forests	Glyphosate4—IPA 360 g/L (e.g. Roundup Biactive)	700 mL – 1 L/100 L water 100–150 mL/15 L water 1:9 (2 x 2 mL dose per 0.5 m bush height)	Handgun—high rate in winter Knapsack foliar spray Splatter gun foliar spray
Commercial, industrial land, pastures and rights-of-way	Picloram + 2,4-D 75 g + 300 g (e.g. Tordon 75-D®)	0.65 L/100 L	Spot spray
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 300 g/L + Picloram 100 g/L (e.g. Conqueror[5]) Triclopyr 300 g/L + Picloram 100 g/L + aminopyralid 8 g/L (e.g. Grazon Extra[5])	250–350 mL/100 L 30 mL/15 L	Foliar spray Handgun Knapsack Use lower rate for plants 1–1.5 m tall in spring to summer, higher rate plants over 1.5 m or autumn treatment
Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + Picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Basal bark or cut stump
Recreational, commercial, industrial land, pastures, rights-of-way and forests	Triclopyr 600 g/L (e.g. Garlon 600®)	160–320 mL/100 L water 500 mL/60 L diesel	Foliar spray Lower rate for seedlings and plants to 2 m, higher rate for plants over 2 m Basal bark/cut stump
Home gardens, commercial situations and recreation areas	Triclopyr 50 g/L (e.g. Defender Blackberry Plus Tree Killer)	200 mL in 1 L kerosene or diesel	Basal bark, stem injection Refer to product label for details
Home gardens, parks, golf courses, factories and other similar situations	Triclopyr 60 g/L (e.g. Richgro Tree & Blackberry & Woody Weed Killer)	200 mL in 1.1 L kerosene or diesel	
Grass pasture	MCPA 340 g/L + Dicamba 80 g/L (e.g. Kamba M)	2.8–4 L/ha 0.19–0.27 L/100 L 60 mL/15 L	Broadacre (boom) spray Handgun Knapsack
Pastures, forests, rights-of-way and industrial situations	Clopyralid 300 g/L (e.g. Lontrel®) Clopyralid 600 g/L (e.g. Lontrel Advanced) Clopyralid 750 g/kg (e.g. Clomac)	330 or 500 mL/100 L 165–200 mL/100 L water 130 or 200 g/100 L water	Handgun Spray foliage when growth is active Use higher rate on plants over 2 m tall
Pastures	Tebuthiuron 200 g/kg (e.g. Graslan®)	1 gm/m²	Hand application (restrictions on use apply)

The formulations of 2,4-D, clopyralid and glyphoste listed here are examples only. Other formulations are available and many include groundsel bush on the label, but the treatments listed may vary. Consult the product label for more informaiton.For users who rely on home garden packs, triclopyr is available in products containing 50 g/L (e.g. Yates Tree & Blackberry Killer, Amgrow Chemspray Tree & Blackberry Killer), 60 g/L (e.g. Richgro Tree & Blackberry & Woody Weed Killer) or 120 g/L (e.g. David Grays Blackberry & Tree Killer). Registered uses vary so users should consult labels carefully before proceeding and follow instructions closely.

Notes

[1] Pasture legumes are susceptible to these herbicides.
[2] Cut stump treatments—cut as close to ground as possible and apply mixture immediately (within 15 seconds).
[3] Basal bark treatments—paint/spray 25 cm band around base of each stem.
[4] Glyphosate will kill pasture species.
[5] Cannot be used in hazardous areas without a DAF permit.

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

This fact sheet is developed with funding support from the Land Protection Fund.

Restricted invasive plant

Cat's claw creeper

Macfadyena unguis-cati (L.) A.H.Gentry
(syn. *Dolichandra unguis-cati* (L.) L.Lohmann)

Cat's claw creeper is a native of tropical America and is an aggressive climber that was used as an ornamental in older-style Queensland gardens. This vine has the ability to completely smother native vegetation, even growing up over trees, and many bushland areas already have serious infestations of this weed. The vine has a vigorous root and tuber system, which adds to difficulties in controlling the weed.

Cat's claw creeper has been recognised as a Weed of National Significance due to its invasiveness and potential impacts.

Legal requirements

Cat's claw creeper is a category 3 restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

Queensland Government

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Cat's claw creeper is a vine with long slender stems. Older stems become very woody with time. Its leaves each have two leaflets, with a three-clawed tendril (the cat's claw) growing between them. It has large, bright yellow, bell-shaped flowers in spring. The vine bears very long, narrow and flat pods containing many papery seeds.

Life cycle

Seed capsules mature in late summer to autumn, approximately 8–10 months after flowering. Seed begins to drop in late May, with peaks in July and August. Seeds germinate best when not buried and will germinate readily in moist leaf litter. Although seed viability is low, seed production is high and some seeds produce multiple seedlings.

Established plants can reproduce vegetatively from tubers and creeping stems. Detached tubers and cuttings may re-sprout in moist conditions. Roots start to develop tubers in their second year and plants may be well established before they start to flower.

Methods of spread

Cat's claw creeper produces numerous seeds with papery wings that aid dispersal, particularly by water and wind. Tuberous roots also spread by floods and humans.

Habitat and distribution

Cat's claw creeper is native in Central and South America and the West Indies. It is widely naturalised around the world, occurring in southern Africa, south-eastern USA and Hawaii, Asia, the Pacific Islands, Republic of Cape Verde, Mascarene and recently in Europe. Cat's claw creeper grows in a range of soil types, but does not tolerate poorly drained soils. Plants are capable of surviving heavy frost but seed germination is reduced at low temperatures.

Cat's claw creeper prefers warm-temperate, tropical and sub-tropical areas. It can be found in gardens, over fences, along roadsides, waterways and in disturbed rainforests. It occurs in coastal and sub-coastal areas of south-eastern Queensland, and in central and northern Queensland.

Control

Managing cat's claw creeper

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by cat's claw creeper. This fact sheet provides information and some options for controlling cat's claw creeper.

Physical control

Use a pruning saw, machete or brush hook to cut all leads/stems up the trees. All above the cut will die, but regrowth will occur from the underground tubers.

Digging the tubers out is not practical in most cases. Don't allow the regrowth to reach host tree's canopy; if they get away you will have to re-cut them.

Herbicide control

The regrowth is best treated with a foliar spray. Glyphosate 360 (mixed at a rate of 83 mL to each 1 L of water) can be applied in a cut stump method. It is best done in pairs. Cut the lead as close to the ground as possible and spray/paint on the herbicide.

The glyphosate must be applied within 15 seconds of cutting—while the sap is running—to take the poison down into the roots and tubers. If not within 15 seconds, re-cut lower and try again.

Because of the multitude of tubers the herbicide tends to knock them down one at a time with new regrowth coming from the next tuber. Be prepared to continue control over the next five years.

PER13914 allows the use of products containing 300 g/L of triclopyr plus 100 g/L picloram with or without 8 g/L aminopyralid, subject to particular conditions that are set out in the permit.

The herbicides listed in the table that follows are permitted to be used in the listed situations. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label and the conditions in the APVMA permit.

Biological control

Cat's claw creeper is currently a target for biological control. The tingid bug *Carvalhotingis visenda*, the moth *Hypocosmia pyrochroma* and a leaf-mining jewel beetle *Hylaeogena jureceki* have been released. The tingid is widely established in majority of release sites and cause visible effects in some areas.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

Table 1. Herbicides for the control of cat's claw creeper

Situation	Herbicide	Rate	Comments
Pasture, non-crop situation (PERMIT 10533)	Glyphosate 360 g/L (e.g. Weedmaster Duo)	10 mL/L water	Foliar application Ensure vines are actively growing at time of treatment and not under stress of drought, waterlogging or cold (0–2 m high). High-volume (knapsack or handgun) spray to wet foliage, ensuring complete coverage over top growing terminals.
		83 mL/L water	Cut stump Ensure vines are actively growing at time of treatment and not under stress of drought, waterlogging or cold. Cut vine close to ground and immediately wet stump surface thoroughly using splatter gun, spray, swab or brush. Remove any branches on the stump and treat any cut surface.
	Dicamba 500 g/L (e.g. Kamba 500)	4 mL/L water	Foliar application Ensure vines are actively growing at time of treatment and not under stress of drought, waterlogging or cold (0–2 m high). High-volume (knapsack or handgun) spray to wet foliage, ensuring complete coverage over top growing terminals.
		33 mL/L water	Cut stump Ensure vines are actively growing at time of treatment and not under stress of drought, waterlogging or cold. Cut vine close to ground and immediately wet stump surface thoroughly using splatter gun, spray, swab or brush. Remove any branches on the stump and treat any cut surface.
Non-agricultural areas, domestic and public service areas, commercial and industrial areas, bushland/ native forests, roadsides, rights-of-way, vacant lots, wastelands, wetlands, dunal and coastal areas	Fluroxypyr 200 g/L (e.g. FMC Fluroxypyr 200 Herbicide)	35 mL/L Diesel/kerosene	Basal bark spray (PERMIT 11463)
Riparian zones	Triclopyr 300 g/L plus picloram 100 g/L (e.g. Nufarm Conqueror)or Triclopyr 300 g/L plus Picloram 100 g/L plus Aminopyralid 8 g/L (e.g. Grazon Extra)	400 mL of product per 100 L water	Foliar spray. Avoid getting spray on leaves of host and do not spray within 5 m of a waterway. Other restrictions apply. (PERMIT 13914)

Persons who wish to prepare for use and/or use products for the purposes specified in APVMA permits PER11463 or PER10533 must read, or have read to them, the details and conditions of the permit. APVMA permit PER11463 expires on 30 June 2023 and PER10533 expires on 31 July 2028. Both are available from the APVMA website at apvma.gov.au

Read the label carefully before use and always use the herbicide in accordance with the directions on the label.

This fact sheet is developed with funding support from the Land Protection Fund.

06/20

Restricted invasive plant

Lantana

Lantana camara

Currently, lantana covers more than 5 million ha of subcoastal New South Wales to Far North Queensland. Small infestations of lantana have also been found in central west Queensland, the Northern Territory, Western Australia, South Australia and Victoria. Efforts are under way to control these.

Lantana is mainly spread by fruit-eating birds and mammals. It forms dense thickets that smother and kill native vegetation and are impenetrable to animals, people and vehicles.

Queensland Government

Research indicates more than 1400 native species are negatively affected by lantana invasion, including many endangered and threatened species. As lantana is a woody shrub that has thin, combustible canes, its presence can also create hotter bushfires, altering native vegetation communities and pastures.

Legal requirements

All lantana species (*Lantana camara* and *Lantana montevidensis*) are category 3 restricted invasive plants under the *Biosecurity Act 2014*. They must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Lantana camara is a heavily branched shrub that can grow in compact clumps, dense thickets or as a climbing vine.

The stems are square in cross section, with small, recurved prickles. Most leaves are about 6 cm long and are covered in fine hairs. They are bright green above, paler beneath and have round-toothed edges. Leaves grow opposite one another along the stem. When crushed the leaves produce a distinctive odour.

Flowers appear throughout most of the year in clustered, compact heads about 2.5 cm in diameter. Flower colours vary from pale cream to yellow, white, pink, orange and red. Lantana produces round, berry-like fruit that turn from glossy green to purplish-black when ripe.

Life cycle

Flowering and germination occurs all year round but peaks after summer rains. Several thousand seeds can be produced per square metre and these can remain viable for several years.

Research indicates some ornamental lantana varieties have the ability to set seed and can spread vegetatively. They also produce some viable pollen and have the potential to cross-pollinate with wild forms, creating new varieties that could naturalise in the environment.

If the number of naturalised varieties increase due to genetic drift from ornamental varieties, it will make finding effective biological control agents even more difficult and potentially extend the climatic tolerances and range of the weed's spread.

Methods of spread

Spread mostly through the garden ornamental trade, by fruit eating birds and mammals.

Lantana camara can also spread via a process known as layering, where horizontal stems take root when they are in contact with moist soil. It will also reshoot from the base of vertical stems.

Habitat and distribution

Lantana camara is native to the tropical and subtropical regions of North, Central and South America.

Lantana camara is found throughout most coastal and subcoastal areas of eastern Australia, from the Torres Strait islands to southern New South Wales. It grows in a wide variety of habitats, from exposed dry hillsides to wet, heavily shaded gullies.

Toxicity

Many lantana varieties are poisonous to stock. It is difficult to tell which varieties are toxic so it is better to treat all forms as potentially poisonous. The toxins in lantana include the triterpene acids, lantadene A (rehmannic acid), lantadene B, and their reduced forms.

Most cases of lantana poisoning occur when new stock are introduced into lantana-infested areas. Stock bred on lantana-infested country avoid lantana unless forced to eat it due to lack of other fodder. Young animals introduced to lantana areas are most at risk.

Symptoms of lantana poisoning depend on the quantity and type of lantana consumed and, under some circumstances, the intensity of light to which the animals are exposed.

Early symptoms of depression are noticeable, with head swaying, loss of appetite, constipation and frequent urination. After a day or two the eyes and the skin of the nose and mouth start yellowing with jaundice, and the muzzle becomes dry and warm. The eyes may become inflamed and have a slight discharge. The animal also becomes increasingly sensitive to light. Finally, the muzzle becomes inflamed, moist and very painful ('pink nose'). Areas of skin may peel and slough off. Death commonly occurs 1–4 weeks after symptoms occur. Death from acute poisoning can occur 3–4 days after eating the plant.

If animals show any of the early symptoms, they should be moved to lantana-free areas, kept in the shade and monitored. Veterinary treatment should be sought immediately. Some remedies may include intravenous fluids, treating skin damage with antibiotics, or drenching with an activated charcoal slurry.

Care should be taken when introducing new or young animals into a paddock if lantana is present. Ensure they have enough fodder to stop them eating lantana in quantities sufficient to result in poisoning. During drought, animals should not be placed in lantana-infested areas without alternative food.

Control

Managing *Lantana camara*

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by *Lantana camara*. This fact sheet provides information and some options for controlling *Lantana camara*.

A general principle is to commence control programs in areas of light infestations and work towards the denser infestations using a mix (integration) of control methods gives the best results. Size, density and geographic location of infestations are important considerations for choosing which mix of control methods to use.

For large lantana infestations, treatment with herbicides by foliar spraying is usually not economically feasible. However, fire, dozing/stick raking, slashing/cutting, aerial helicopter spraying can reduce dense infestations, making follow-up spot treatments with chemicals more economically viable.

Lantana camara seed banks remain viable for at *least* four years, so follow-up control to kill seedlings before they mature is vital to ensure initial management efforts to control the parent bush are not wasted.

Appropriate fire regimes may become part of a management program to ensure *Lantana camara* invasiveness is reduced and pasture is maintained.

Removal of *Lantana camara* within areas of remnant vegetation may require a permit under the *Vegetation Management Act 1999*. Further information should be sought from the Department of Natural Resources and Mines before works commence.

Mechanical control

Stick raking or ploughing can be effective in removing standing plants. However, regrowth from stumps and/or increased seedling germination in disturbed soil is common and the site will require follow-up treatment.

Grubbing of small infestations—for example, along fence lines—can be a useful and effective method of removing plants, although this is time consuming.

Repeated slashing can also reduce the vigour of lantana, exhausting its stored resources and reducing its likelihood of re-shooting.

Some locations—for example, very steep inclines or gullies—are not suitable for mechanical control options because of the danger of overturning machinery and soil erosion.

Fire

Regular burning will reduce the capacity of plants to survive; however, initial kill rates are variable.

The effectiveness of this method will depend on the suitability of available fuel loads, fire intensity, temperature, relative humidity, soil moisture and season.

Pasture re-establishment can then provide competition to inhibit lantana seed germination. Fire is not recommended in non–fire tolerant vegetated areas such as rainforest, or wooded or plantation areas.

A typical control program for fire may include:

- exclude stock to establish a pasture fuel load
- burning (may require a permit)
- sow improved pastures—consult your local Biosecurity Queensland officer for advice
- continue to exclude stock until pasture has established and seeded
- burn again in summer before rain and spot spray *Lantana camara* regrowth when > 0.5 m high and when it is actively growing (see Table 1).

Biological control

Since 1914, 32 biological control agents have been introduced into Australia in an attempt to control lantana. Eighteen have established, of which several insect species cause seasonal damage, reducing the vigour and competitiveness of lantana in some areas.

Biosecurity Queensland research programs continue to investigate agents suitable for release in Australia, and test the viability of these agents in an effort to identify more effective biological control agents.

It is important to remember that biological control alone should not be relied upon for managing lantana infestations. Consideration should be given to other available control techniques.

The four most important biological control agents are:

- **sap-sucking bug (*Teleonemia scrupulosa*)**
  Found in dry areas from Cooktown to Wollongong, this small, mottled, bug feeds on the underside of leaves, growing tips and flower buds, causing the leaves to drop early and stopping the plant from flowering.
- **leaf-mining beetle (*Uroplata girardi*)**
  Found in most lantana infestations from Cape Tribulation to Sydney as well as around Darwin, except in very dry or high altitude areas. The adult beetles are dark brown. They shelter in curled leaves and feed on the upper leaf surfaces. Larvae feed in leaves causing blotches to spread across the leaf. This beetle reduces plant vigour and can suppress flowering.
- **leaf-mining beetle (*Octotoma scabripennis*)**
  Found in most lantana infestations from Atherton to Wollongong. Adults of this species feed on the upper leaf surface, while larvae feed and mine the centre of the leaf and cause blotches. This activity reduces plant vigour and can suppress flowering.
- **seed-feeding fly (*Ophiomyia lantanae*)**
  Found from Cape Tribulation to Eden in New South Wales and also around Darwin and Perth. *Ophiomyia* is a small black fly that feeds on flowers and lays eggs on the green fruits. The maggots of the fly eat the seed and make the fruit unattractive to birds, reducing seed spread.

Other agents such as *Aconophora compressa* (a stem-sucking bug) and *Leptobyrsa decora* (a sap-sucking bug) have caused some damage in specific geographic areas.

Note: Landholders are advised not to consume their time collecting established insects for distribution. Due to their own ability to disperse, these insects will be periodically/seasonally present in areas that are climatically suitable for them.

Herbicide control

Herbicide recommendations for lantana are shown in Table 1. Users of herbicides have a legal obligation to read herbicide labels and use only the registered rates.

Variation in results can be a result of inconsistent application methods, mix rates or seasonal variation. Red-flowered and pink-edged red-flowered lantana are often considered the most difficult to control because their leaves are often smaller and tougher. However, herbicides can kill these varieties if you carefully follow application procedures.

For single-stemmed lantana, basal bark spraying and cut stump methods also give good results at any time of year (but best when the plant is actively growing). On multi-stemmed varieties, you will obtain best results by carefully applying herbicide to each stem.

When treating actively growing plants less than 2 m high, overall spraying of foliage to the point of run-off is recommended. Splatter gun techniques are also effective and particularly useful in hard-to-access areas. This is best done in autumn—when sap flows draw the poison down into the root stock, but before night temperatures get too cold.

Remove grazing animals from spray areas during and soon after treatment. Stress can cause increased sugar levels in the leaves of lantana plants, making them more palatable.

Landholders and contractors should check if the property is situated in a hazardous area. This prevents the use of some herbicides, as defined in the *Agricultural Chemicals Distribution Control Act 1966*.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

Table 1. Herbicides for control of *Lantana camara*

Situation	Herbicide	Rate	Optimum time[1]	Comments
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Fluroxypyr 200 g/L (e.g. Flagship 200)	500 mL to 1 L/100 L water	October to April	Thorough wetting of plants is required, higher rate should be used for larger plants.
	Fluroxypyr 333 g/L (e.g. Starane Advanced)	300–600 mL/100 L water		
	Fluroxypyr 400 g/L (e.g. Comet 400)	250–500 mL/100 L water		
Domestic areas, commerical, industrial and public service areas, agricultural non-crop areas, forests and rights-of-way	Glyphosate 360 g/L (e.g. Roundup Biactive, Glyphosate 360)	1 L/100 L water	October to April	Wet plant thoroughly. Glyphosate affects any green plant it comes into contact with. Glyphosate is available in a range of strengths. Consult labels for rates for other glyphosate formulations.
	Glyphosate 450 g/L (e.g. Glyder 450)	800 mL/100 L		
	Glyphosate 540 g/L (e.g. Roundup PowerMax)	660 mL/100 L		
	Glyphosate 700 g/kg (e.g. Macspred Dri 700)	500 g/100 L		
Agricultural non-crop areas, commercial and industrial areas, pastures and rights-of-way	2,4-D 300 g/L + Picloram 75 g/L (e.g. Tordon 75-D)	0.65 L/100 L water	March to May	Thoroughly wet foliage and soil around base of plant. Legumes are affected if sprayed.
Non-crop and rights-of-way	Dichlorprop 600 g/L (e.g. Lantana 600)	500 mL/100 L water	December to April	Must thoroughly wet all leaves. Please refer to product label for situation details.
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 300 g/L + Picloram 100 g/L + aminopyralid 8 g/L (e.g. Grazon Extra®)	350 mL to 500 mL/ 100 L water	Summer to autumn	Wet plant thoroughly. Use the higher rate on plants over 1 m. Legumes may be affected if sprayed.
	Triclopyr 300 g/L + Picloram 100 g/L (e.g. Conqueror)			
Pastures, rights-of-way and industrial	2 ,4-D amine 625 g/L (e.g. Ken-Amine 625)	320 mL/100 L water	March to May	Use a coarse spray with sufficient pressure to penetrate canopy and wet stems as well as foliage. Spray at the end of a wet Summer (March to May). Defoliation should occur but respraying of new growth will be necessary in following Autumn. Broadcast grass seed and keep stock off following Summer to allow the pasture to establish. Damage may result to pasture legumes. Red-flowered lantanas are more resistant to 2,4-D
	2 ,4-D amine 700 g/L (e.g. Amicide Advance 700)	285 mL/100 L water Consult label for other formulations of 2,4-D		
Native pastures, rights-of-way, commercial and industrial areas	Metsulfuron-methyl 600 g/kg (e.g. Associate, Lynx® 600)	10 g/100 L water plus wetter	March to May	Plants up to 2 m tall. Thoroughly wet all foliage and stems. Spray should penetrate throughout the bush. Addition of a wetting agent e.g. Pulse is recommended. Results variable. Not found effective in tropics. Follow-up sprays are necessary .
Native pastures, rights-of-way, commercial and industrial areas	Glyphosate 360 g/L (e.g. Weedmaster Duo, Glyphosate 360) plus Metsulfuron-methyl 600 g/L (e.g. Associate, Ken-Met 600) + tank mix	400 mL glyphosate 360 + 3 g metsulfuron/ 100 L water	March to May	Apply to actively growing bushes up to 2 m tall. Spray to thoroughly wet all foliage and stems. Spray to penetrate throughout the bush. Do not apply during periods of summer drought stress. Addition of a wetting agent e.g. Pulse is recommended
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Fluroxypyr 140 g/L + Aminopyralid 10 g/L (e.g. Hotshot)	500–700 mL /100 L water/100 L water	October to April	Apply to actively growing plants. Spray all foliage, including stems, to the point of run-off. Use the lower rate on seedlings and regrowth 0.5–1.2 m tall and the higher rate on plants 1.2–2 m tall.
	(I) Basal bark (II) Cut stump			
	Triclopyr 600 g/L (e.g. Garlon 600)	1 L/60 L diesel	Any time Best results when actively growing	(I) Apply to lower 40 cm of every stem Must ensure complete coverage around stem (II) Cut close to ground level Immediately apply herbicide
	Triclopyr 240 g/L + Picloram 120 g/L (e.g. Access)			
	Picloram 44.7 g.L + Aminopyralid 4.47 g/L (e.g. Vigilant II® Herbicide Gel)	3–5 mm gel		(II) If diameter of stump is › 20 mm, use a minimum of 5 mm gel thickness

Table 1. Herbicides for control of *Lantana camara* (continued)

Situation	Herbicide	Rate	Optimum time[1]	Comments
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Glyphosate 360 g/L (e.g. Roundup, Weedmaster Duo)	Undiluted	Any time Best results when actively growing	APVMA permit PER11463 (expires 30/06/2023) Prior to using the herbicides listed under PER11463 you must read or have read to you and understand the conditions of the permit To obtain a copy of this permit visit apvma.gov.au.
	Splatter gun			
	Glyphosate 360 g/L (e.g. Weedmaster Duo, Glyphosate 360)	1:9 glyphosate + water	October to April	2 x 2 mL dose per 0.5 m height of lantana. Addition of Pulse Penetrant may improve control.
	Metsulfuron methyl 600 g/L (Associate, Lynx® 600)	2 g/L water	March to May	
	Aerial			Follow label directions for equipment and other requirements for aerial application.
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 300 g/L+ Picloram 100 g/L (e.g. Conqueror) or Triclopyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L (Grazon Extra)	10 L/ha	When actively growing	Helicopter only. Minimum of 200 L water per ha. Follow-up re-spray will be required. Do not burn within six months of treatment.
	Triclopyr 300 g/L + Picloram 100 g/L (e.g. Conqueror) or Triclopyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L (Grazon Extra) + 2,4-D amine 625 g/L (e.g. Ken-Amine 625)	1.5 L + 6 L 2,4-D /ha	When actively growing	Helicopter only.Minimum of 200 L water per ha. Follow-up re-spray will be required. Do not burn within six months of treatment.
Non-crop and rights-of-way	Dichlorprop 600 g/L (e.g. Lantana 600)	6–8 L/ha	When plant actively growing	

[1]Optimum times are only a guide. *Lantana camara* must be actively growing for the herbicide to work.
Labels often recommend the additional use of a wetting agent or surfactant within the mix. Herbicides types vary in their selectivity against other species and soil residual.

Read the label carefully before use and always use the herbicide in accordance with the directions on the label.

This fact sheet is developed with funding support from the Land Protection Fund.

Restricted invasive plant

Broad-leaf privet

Ligustrum lucidum

Broad-leaf privet is a naturalised weed in South East Queensland; a potential invader of riparian vegetation and disturbed sites. In some coastal areas it displaces rainforest species. Broad-leaf privet is densely branched and can form thickets; destroying native animal habitat and disrupting their access through natural corridors. It is also recognised as a weed in South Africa and is known to cause significant irritations to sufferers of hay fever.

Legal requirements

Broad-leaf privet is a category 3 restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

Queensland Government

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Broad-leaf privet is an evergreen shrub up to 10 m tall. Branches are closely packed. Leaves are dark green, broad, leathery, 4–13 cm long, 3–6 cm wide, with pointed tips, growing in opposite pairs. Flowers are tubular, cream or white, 3.5–6 mm long, with sickly sweet fragrance. Berries are black, 9 mm long, 12 mm in diameter, occur in dense bunches. Each berry can contains two seeds. The seeds have a ribbed surface and are about 5 mm long.

Life cycle

Flowers in summer to produce clusters of black berries. The fruit is present during autumn and winter and with each berry containing two seeds, a tree can produce up to 10 million seeds annually. The seeds stay viable in the soil up to two years before germinating. A tree can live up to 100 years.

Methods of spread

Mostly spread by fruit eating birds. People have commonly cultivated it as a wind break or hedge. Fruit can float and be spread by water.

Habitat and distribution

Originally from Japan and China, tree privet is regularly seen in ornamental gardens throughout South East Queensland.

Broad-leaf privet prefers warm humid environments and it often found along creeks, gullies and drainage lines. Also a weed of open woodlands, grasslands, pastures, waste areas, disturbed sites, and roadsides.

Control

Managing broad-leaf privet

The GBO requires a person to take reasonable and practical steps to minimise the risks posed by broadleaved pepper tree. This fact sheet provides information and some options for controlling broad-leaf privet.

Physical control

Broad-leaf privet seedlings may be controlled by mowing or hand-pulling. If removing by hand, take care not to break the taproot or regrowth is likely to occur.

Take care to ensure your own and others safety when trimming or lopping bamboo near power lines.

For electrical safety information visit worksafe.qld.gov.au/electricalsafety.

Herbicide control

Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

Table 1. Herbicides for the control of broad-leaf privet

Situation	Herbicide	Rate	Comments
Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + Picloram 120 g/L (e.g. Access)	2 L product in 60 L diesel	Cut stump: plants with a basal diameter up to and in excess of 5 cm Apply immediately after the cut is made Basal bark spray: plants with a basal diameter up to 5 cm
	Triclopyr 600 g/L (e.g. Garlon 600)	1 L product in 12 L diesel	Cut stump: plants with a basal diameter up to and in excess of 10 cm Treat at any time of year Basal bark spray: only for plants with stem diameter less than 10 cm Treat at any time of year
Non-crop areas including native vegetation, conservation areas, gullies, reserves and parks	Picloram 43 g/kg + Aminopyralid 4.47 g/L (e.g. Vigilant II®)	Apply a layer of product 3–5 mm thick over cut surface	Cut stems no higher than 10 cm above ground level Stems greater than 20 mm in diameter, apply 5 mm thick. In multi-stem plants treat at least 80% of stems including all main stems
	Glyphosate 360 g/L (e.g. Roundup)	Use undiluted, apply 1–2 mL per 2 cm cut	Stem injection: up to 25 cm basal 1 mL per cut, 25–60 cm basal 1 mL per cut
		1 L product to 1 L water, 1:1 in water	Cut stump: 0–30 cm diameter cut close to ground and immediately wet stump surface
Native pastures, commercial and industrial areas and rights-of-way	Metsulfuron-methyl 600 g/kg (e.g. Associate)	10 g per 100 L water plus wetting agent	Foliar spray: apply to bushes up to 3 m high Complete spray coverage is essential DO NOT spray when plants are stressed
Non agricultural areas (native pastures), commercial and industrial areas and rights-of-way	Aminopyralid 375 g/kg + Metsulfuron-methyl 300 g/kg (e.g. Stinger)	20 g/100L water	Foliar spray: apply to plants up to 3 m high Complete foliar spray coverage is essential for control Partial spray coverage will result in regrowth recovery
Non agricultural areas (native pastures), commercial and industrial areas and rights-of-way	Aminopyralid 375 g/kg + Metsulfuron-methyl 300 g/kg (e.g. Stinger)	20 g/10 L water plus Pulse Penetrant (20 mL/10 L)	Low volume high concentration application techniques (gas gun) Apply to plants up to 3 m high Partial spray cover will result in regrowth recovery
Native pastures, rights-of-way, commercial and industrial areas	Triclopyr 75 g/L + Metsulfuron-methyl 28 g/L (e.g. Zelam Brush Weed)	250 mL/100 L water	Actively growing plants up to 3 m high Thorough coverage is essential for good control; partial coverage will result in regrowth Do not spray when bushes are stressed

Read the label carefully before use and always use the herbicide in accordance with the directions on the label.

This fact sheet is developed with funding support from the Land Protection Fund.

06/20

Restricted invasive plant

Common pest pear or prickly pear

Opuntia stricta

Common pest pear is an upright, drought tolerant shrub that rapdily invades pastures and natural areas and overwhelms native vegetation. Dense infestations can also impede access and reduce stock-carrying capacity.

It can also reduce land use and pastures. The spines can cause injury to stock, humans and native animals, reducing or preventing grazing activities and productivity.

Possession, propagation and distribution of common pest pear as an ornamental plant are not considered reasonable and practical measures to prevent or minimize the biosecurity risks posed by common pest pear.

In Queensland it is illegal to sell common pest pear on Gumtree, eBay, Facebook, at markets, nurseries or any marketplace.

Queensland Government

Legal requirements

Common pest pear is a category 3 restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical measures to prevent or minimise the bioscurity risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

This spreading cactus grows up to 1.5 m high and forms large clumps. The stems are divided into oval, blue-green spineless pads 20 cm long and 10 cm wide. Areoles are in diagonal lines along the pads 2.5 cm to 5 cm apart and have a cushion of brown wool containing bristles but usually no spines. When spines occur they are stout, yellow and up to 4 cm long.

Flowers are up to 7.5 cm wide, bright lemon yellow, green at the base and sometimes have pinkish coloured markings on the outer petals. Immature fruit is green, oval-shaped, has a deep cavity on one end and tapers at the other. Fruit turns purple as it matures, 6 cm long and 3 cm wide, with carmine-coloured (dark red) seeds and a fleshy pulp. Seeds are 4–5 mm long, 4–4.5 mm wide and are generally yellow to pale brown in colour.

Life cycle

Common pest pear reproduces by seed and vegetatively via stem segments. Flowering occurs mostly during spring and summer.

Methods of spread

Common pest pear can spread by segments breaking off and attaching to animals, footwear, vehicles and machinery. The stem segments break off easily from the parent plant. These pads can survive long periods of drought before weather conditions allow them to set roots. It can also spread by floodwaters, and in some cases by being rolled along bare ground by strong winds.

Fruit are eaten by birds and other animals, and the seeds then spread in their droppings. The seeds have hard seed coats that allow them to survive heat and lack of water. People can also spread cacti for ornamental plantings.

Habitat and distribution

Native to southern United States of America, central America and northern South America, common pest pear has become invasive throughout Western Asia, Africa and Europe.

It is widespread throughout the eastern parts of Australia and also scattered throughout many other areas of the country. It is most abundant in central and southern Queensland and northern New South Wales.

Common pest pear prefers hot, semi-arid environments but also occurs in drier sub-tropical and warmer temperate regions. It can be found along roadsides, disturbed sites, pastures, open woodlands, forests, rangelands and grasslands.

Control

Managing common pest pear

The GBO requires a person to take reasonable and practical measures to minimise the biosecurity risks posed by common pest pear. This fact sheet provides information and some options for controlling common pest pear.

The best control for common pest pear incorporates integrated management strategies, including herbicides, mechanical, physical and biological control methods.

Physical control

Dig out plants completely and deep bury. Ploughing is not considered an effective means of control unless followed by annual cropping.

For advice on disposal options, contact your local government office or Biosecurity Queensland on 13 25 23.

Mechanical control

Mechanical control using machinery is difficult because prickly pear pads can easily re-establish.

Biological control

Common pest pear once covered vast areas of Queensland, until it was successfully controlled by the biological control agent in the late 1920s, *Cactoblastis cactorum*. Although common pest pear was not completely eradicated, the agent achieved an acceptable level of control.

Both the moth introduced 90 years ago and a more recent introduction of the cochineal bug, *Dactylopius opuntiae* have proven to be effective in reducing the fruiting and abundance of common pest pear. Once established on individual plants, the adults provide a continuous supply of new insects to attack new growth and surrounding plants. While the cactoblastis moth is an efficient flyer and can disperse itself, cochineal insects are wind-borne and may require some manual assistance for dispersal onto new plants.

How to distribute cochineal

Spreading cochineal insects involves the manual transfer of cochineal-infested segments onto more distant plants (>50 m away). For safe handling, use strong tongs and a knife to cut infested stem segments. Carry infested plant material in plastic tubs with lids. Don't leave cochineal in direct sunlight or hot vehicles. Using tongs, the infested stem segments should be wedged or tied near new fresh segments on the receiving plant, so that the insect nymphs can crawl over to infest fresh plant segments.

Many other opuntioid cacti species are still incorrectly referred to as prickly pear. Some of these are controlled by different biological control agents – including different species of cochineal that all look very similar. For effective control, the correct biological control agent must be used for each species. Refer to factsheets for *Opuntia aurantiaca*, *Opuntia monacantha* and *Opuntia tomentosa* for further information about the biological agents that target those species.

Herbicide control

Herbicide options available for the control of common pest pear in Queensland are listed in Table 1.

Landholders and contractors should check if the property is in a hazardous area as defined in the *Agricultural Chemicals Distribution Control Act 1966* prior to spraying.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

Table 1. Herbicides for the control of common pest pear

Situation	Herbicide	Rate	Comments
Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + Picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Apply as an overall spray
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Aminopyralid 8 g/L + picloram 100 g/L + triclopyr 300 g/L (e.g. Grazon Extra)	500 mL/100 L of water	Foliar spray
	Picloram 100 g/L + triclopyr 300 g/L (e.g. Fightback)	500 mL/100 L of water	Foliar spray
	Triclopyr 600 g/L (e.g. Garlon)	3000mL/100 L of water	Foliar spray –slow acting
	Triclopyr 600 g/L (e.g. Garlon)	1330 mL/100 L of diesel distillate	Basal bark or cut stump Apply as a thorough foliar spray
Areas of native vegetation, bushland reserves and revegetation areas, non-crop areas and open public spaces	Glyphosate 360 g/L (e.g. Roundup Biactive)	1:1.5 with water to undiluted herbicide	Permit 82307 (expires 31/07/2022) Injection: drill, frill or axe
Non-agricultural areas, domestic and public service areas, commercial and industrial areas, bushland/native forests, roadsides, rights-of-way, vacant lots, wastelands, wetlands, dunal and coastal areas	Glyphosate 360 g/L (e.g. Roundup Biactive)	Neat	Permit 11463 (expires 30/06/2023) Drill, frill, axe or stem injection at 1 mL per 2 cm hole or cut
	Triclopyr 240 g/L + Picloram 120 g/L (e.g Access)	1 L/60 L diesel	Permit 11463 (expires 30/06/2023)
	Picloram 100 g/L + triclopyr 300 g/L (e.g. Fightback)	500 mL/100 L of water	Permit 11463 (expires 30/06/2023) Foliar spray
	Aminopyralid 8 g/L + picloram 100 g/L + triclopyr 300 g/L (e.g. Grazon Extra)	500 mL/100 L of water	Permit 11463 (expires 30/06/2023) Foliar spray

Read the label carefully before use and always use the herbicide in accordance with the directions on the label.

Placing a biological control infected stem segment

Pad infected by the biological agent cochineal bug

This fact sheet is developed with funding support from the Land Protection Fund.

08/20

Restricted invasive plant

Velvety tree pear

Opuntia tomentosa

Velvety tree pear is an upright, drought tolerant shrub that rapdily invades pastures and natural areas and overwhelms native vegetation. Dense infestations can also impede access and reduce stock-carrying capacity.

It can also reduce land use and pastures. The spines can cause injury to stock, humans and native animals, reducing or preventing grazing activities and productivity.

Possession, propagation and distribution of velvety tree pear as an ornamental plant are not considered reasonable and practical measures to prevent or minimise the biosecurity risks posed by velvety tree pear.

In Queensland, it is illegal to sell velvety tree pear on Gumtree, eBay, Facebook, Facebook Marketplace, at markets, nurseries or any marketplace.

Queensland Government

Legal requirements

Velvety tree pear is a category 3 restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical measures to minimise and prevent the biosecurity risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

This tree-like plant forms a central woody trunk over 40 cm wide and grows up to 6 m high. The stems are divided into oblong pads that are dull green and velvety to touch due to the dense covering of short fine hairs. The pads are 15–35 cm long, 8–12 cm wide and 1.5–2 cm thick.

Young plants have 2–4 white or pale yellow spines located in the areoles with one spine reaching a length of 2.5 cm. The areoles usually become spineless as the plant matures. A more spiny variety does exist and has more than 50 spines in each areole on the trunk.

The flowers are a deep orange, 4–5 cm long and 4–5 cm wide. The fruit is green, turning to reddish-purple as they mature. They are egg-shaped, about 5 cm long and 3 cm wide, and dull red. The top of the fruit is saucer-shaped with circular lines that meet in the centre and give the fruit a shrivelled appearance. The fruit produces many seeds, 3–5 mm long within a reddish pulp.

Life cycle

Velvety tree pear reproduces by seed as well as stem fragments, fallen flowers and immature fruit. Flowering occurs mostly during spring and summer.

It can also spread by attaching to animals, footwear, vehicles and machinery. It can also spread in garden waste and by people growing as an ornamental plant.

Fruit are eaten by birds and other animals, and the seeds then spread in their droppings.

Methods of spread

Velvety tree pear can spread by segments breaking off and attaching to animals, footwear, vehicles and machinery. The stem segments break off easily from the parent plant. These pads can survive long periods of drought before weather conditions allow them to set roots. I can also spread by floodwaters, and in some cases by being rolled along bare ground by strong winds.

Fruit are eaten by birds and other animals, and the seeds then spread in their droppings. The seeds have hard seed coats that allow them to survive heat and lack of water.

Habitat and distribution

Native to Mexico and Guatemala, velvety tree pear is common around Goondiwindi and Warwick. It is also widespread throughout central and southern Queensland.

Velvety tree pear prefers hot, semi-arid environments but also occurs in drier sub-tropical and warmer temperate regions. It can be found along roadsides, railways, disturbed sites, pastures, open woodlands, rangelands and grasslands.

Control

Managing velvety tree pear

The GBO requires a person to take reasonable and practical measures to minimise the biosecurity risks posed by common tree pear. This fact sheet provides information and some options for controlling velvety tree pear.

The best control for velevety tree pear incorporates integrated management strategies, including herbicides, mechanical, physical and biological control methods.

Physical control

Dig out plants completely and deep bury. Ensure that all tubers that can grow are removed and destroyed. Ploughing is not considered an effective means of control unless followed by annual cropping.

For advice on disposal options, contact your local government office or Biosecurity Queensland on 13 25 23.

Mechanical control

Mechanical control using machinery is difficult because stem segments can easily re-establish.

Biological control

Velvety tree pear has been recognised as a pest in Queensland since the 1920's. It has been partially controlled since the late 1920's by the biological control agent, *Cactoblastis cactorum*. Both the cactoblastis moth introduced 90 years ago and a more recent introduction of the cochineal bug, *Dactylopius opuntiae* have proven to be effective in reducing the fruiting of velvety tree pear, and to reduce the abundance of seedlings and plants under 1 m in height.

While cactoblastis larvae and cochineal bug can kill young tree pear, they have little impact on large plants. Older tree pear pads and stems contain tough, fibrous material that the insects cannot penetrate.

Some evidence suggests that felling or pushing over large trees where there are nearby infestations of cochineal, is a way to increase the impact of the biological control agents.

The insects multiply in number when they are protected from the elements, forming a nursery that can spread to regrowth from cut stumps or pads in contact with the ground. Once established, the adults provide a continuous supply of new insects to attack new growth and surrounding plants. Cochineal insects are wind-borne and may require some manual assistance for dispersal onto new plants.

How to distribute cochineal

Spreading cochineal insects involves the manual transfer of cochineal-infested segments onto other plants. For safe handling, use strong tongs and a knife to cut infested stem segments. Carry infested plant material in plastic tubs with lids. Don't leave cochineal in direct sunlight or hot vehicles. Using tongs, the infested stem segments should be wedged or tied near new fresh segments on the receiving plant, so that the insect nymphs can crawl over to infest fresh plant segments.

Many opuntioid cacti species are incorrectly referred to as prickly pear, which is the common name for common tree pear *(Opuntia stricta)*. Different opuntioid cacti are controlled by different biological control agents – including different species of cochineal that all look very similar. For effective control, the correct biological control agent must be used for each species.

Refer to factsheets for *Opuntia aurantiaca*, *Opuntia monacantha* and *Opuntia stricta* for further information about the biological agents that target these species.

Herbicide control

Herbicide options available for the control of velvety tree pear in Queensland are listed in Table 1.

Landholders and contractors should check if the property is in a hazardous area as defined in the *Agricultural Chemicals Distribution Control Act 1966* prior to spraying.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

Table 1. Herbicides for the control of velvety tree pear

Situation	Herbicide	Rate	Comments
Agricultural non-crop areas, commercial and industrial areas, fence lines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + Picloram 120 g/L (e.g Access)	1 L/60 L diesel	Apply as an overall spray
Non-crop areas around buildings, commercial and industrial areas, domestic and public service areas and rights-of-way	Amitrole 250 g/L + Ammonium thiocyanate 220 g/L (e.g. Amitrole T)	4000 mL/100 L of water	Foliar spray
	Amitrole 250 g/L + Ammonium thiocyanate 220 g/L (e.g. Amitrole T)	Neat	Stem inject 1 mL injected into cuts at 3 cm spacing
Areas of native vegetation, bushland reserves and revegetation areas, non-crop areas and open public spaces	Glyphosate 360 g/L	1:1.5 with water to undiluted herbicide	Permit 82307 (expires 31/07/2022) Injection: drill, frill or axe
Non-agricultural areas, domestic and public service areas, commercial and industrial areas, bushland/native forests, roadsides, rights-of-way, vacant lots, wastelands, wetlands, dunal and coastal areas	Glyphosate 360 g/L	Neat	Drill, frill, axe or stem injection at 1 mL per 2 cm hole or cut Permit 11463 (expires 30/06/2023)
	Triclopyr 240 g/L + Picloram 120 g/L (e.g Access)	1 L/60 L diesel	Permit 11463 (expires 30/06/2023)
	Picloram 100 g/L + triclopyr 300 g/L (eg fightback	500 mL/100 L of water	Foliar spray Permit 11463 (expires 30/06/2023)
	Aminopyralid 8 g/L + picloram 100 g/L + triclopyr 300 g/L (e.g. Grazon Extra)	500 mL/100 L of water	Foliar spray Permit 11463 (expires 30/06/2023)

Read the label carefully before use and always use the herbicide in accordance with the directions on the label.

Pad infected by the biological agent cochineal bug

Note the velvety appearance on the pad

This fact sheet is developed with funding support from the Land Protection Fund.

01/21

Restricted invasive plant

Rat's tail grasses

Sporobolus pyramidalis, S. natalensis, S. jacquemontii and *S. fertilis*

Rat's tail grasses are invasive grasses that can reduce pasture productivity, out-compete desirable pasture grasses and cause significant degradation of natural areas. They are often referred to as weedy *Sporobolus* grasses.

These species were originally introduced and trialled as pasture grasses and for soil conservation and have been unintentionally spread from these initial introductions and other accidental introductions as contaminants in pasture seed, fodder, on vehicles and machinery and in and on livestock. Rats tail grasses have now adapted well to large areas of northern, eastern and southern Australia. They have low palatability when mature, are difficult to control and can quickly dominate a pasture, especially following drought, overgrazing or soil disturbance. They can affect cattle health and productivity reducing weight gain and growth rates and weaning percentages and weights. These grasses are a significant threat to the broader environment given they are well adapted to Australia, difficult to control and form dense almost mono-specific stands where conditions allow.

Queensland Government

Four species of introduced Sporobolus grasses are invasive plants in Queensland:

- giant rat's tail grass *(Sporobolus pyramidalis and Sporobolus natalensis)*
- American rat's tail grass *(Sporobolus jacquemontii)*
- giant Parramatta grass *(Sporobolus fertilis)*.

Legal requirements

Giant, American and giant Parramatta rat's tail grasses are category 3 restricted invasive plants under the *Biosecurity Act 2014*. A person must not release these invasive plants into the environment, give away or sell as a seed, plant or something infested with its seeds. The Act requires everyone to take all reasonable and practical measures to minimise the biosecurity risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description and distribution

Rat's tail grasses are robust, perennial tussock grasses growing up to 2 m high. They are difficult to distinguish from other pasture grasses before maturity. However, their leaves are noticeably tougher than those of any other species.

They can also be difficult to distinguish from native *Sporobolus* grasses; however, the native grasses tend to be shorter and softer and have less dense seed heads than giant rat's tail grass. The seeds of all species are indistinguishable in pasture seed samples using current identification techniques.

Giant rat's tail grass

Giant rat's tail grass grows up to 2 m high, with a seed head of up to 45 cm long and 3 cm wide. Seed head shape changes from a 'rat's tail' when young to an elongated pyramid shape at maturity. Unlike Parramatta grass and giant Parramatta grass, giant rat's tail grass does not develop 'sooty spike' on its seed heads.

Distribution: Coastal and sub-coastal areas from Cape York (Queensland) to the Central Coast of New South Wales including the Central Highlands of Queensland.

American rat's tail grass

American rat's tail grass grows to 50–75 cm tall, with a seed head of up to 25 cm long and 0.5–3 cm wide. Distribution: Coastal and sub-coastal areas from Cape York to South East Queensland.

Giant Parramatta grass

Giant Parramatta grass grows to 0.8–1.6 m tall, with a seed head of up to 50 cm long and 1–2 cm wide. The branches of the seed head are pressed against the axis and overlap, although lower ones generally spread at maturity. Distribution: Coastal and sub-coastal areas from Cape York to South Coast of New South Wales.

Life cycle and adaptation

Rat's tail grasses flower and seed in the frost-free period of the year, with the main seeding in summer/autumn.

They are prolific seed producers with seed production of 85,000 seeds per square metre recorded in dense stands of giant rat's tail grass in a single year. The viability of rat's tail grass seed is about 90% with asignificant proportion of seed remaining viable for up to 10 years.

Rat's tail grasses are well adapted to a wide range of soils from low to high fertility, acid to alkaline and sandy to heavy clay soils in high and low rainfall locations. This includes the seasonally dry monsoonal tropics, wet and dry tropics, subtropical and temperate regions of Australia. They also tolerate saline soil conditions.

Methods of spread

Rat's tail grasses are spread in the gut and manure, and the coat and hooves of livestock, on the coat of invasive and native animals and in mud, hay, and untested pasture seed. Vehicles and machinery are also important spreaders of seed. Rivers, watercourses and any fast-flowing water can also move significant amounts of seed over long distances particularly where there are low levels of ground cover.

Control

Managing rat's tail grasses

The GBO requires a person to take reasonable and practical steps to minimise the risk of spreading rat's tail grass seed and the establishment of new infestations. This fact sheet provides information to assist with minimizing spread and a summary of options for controlling rat's tail grasses.

Prevention and early detection

Maintain competitive pastures with high levels of ground cover as this reduces the risk of rat's tail grass establishment. Heavy grazing does not control rat's tail grasses —research indicates that continuous heavy grazing actually favours its spread.

When moving stock from infested areas into clean areas, spell the stock in yards or a small holding paddock for at least seven days to allow rat's tail grass seed to pass thought the gut of the animal. Similarly, quarantine new stock in yards or small holding paddocks before releasing them into large paddocks to minimize the risk of rats tail grass seed spread and enable early detection and control of any rat's tail grass plants that establish. Move stock when there is no dew or rain, to decrease the amount of seed sticking to their coats (see Table 1).

Establish weed-free buffer strips along boundary and internal fences where necessary, drainage lines and roadsides to restrict the spread of rat's tail grasses. When practical, **regularly** controlling rats tail grasses in riparian zones will reduce the movement of seed by water and limit spread. Always clean machinery thoroughly after working in infested areas. Follow integrated control strategies using herbicides, pasture management practices that maintain high levels of ground cover and property hygiene practices that limit the risk of seed spread.

Consider the attributes of replacement pasture grasses when deciding what to sow. If possible, choose grasses that are:

- well adapted to local environmental conditions and soil types
- stoloniferous or rhizomatous in growth habit
- resistant to heavy grazing
- palatable and productive
- competitive all year (i.e. do not open up in late winter/spring)
- not inclined to decline as soil fertility decreases
- fast to establish.

If a sown pasture species does not contain most of these attributes, it is unlikely to be successful as part of a rat's tail grass control program.

Some pasture species, while providing strong competition once established, are weak competitors with rat's tail grasses in their early stages of establishment (e.g. Koronivia grass and Bisset creeping blue grass). These grasses are most successful against rat's tail when sown with other grasses that are vigorous when young and provide early competition against rat's tail grasses (e.g. Rhodes grass).

Biological control

Biosecurity Queensland is investigating potential biological control agents. To date no agent has been approved for the control of rat's tail grasses.

Management strategies

Always commence control programs in areas of light infestation, and work towards the denser infestations.

If, after considering the management options set out below, you choose to use a herbicide option, ensure you apply all herbicides strictly according to the directions on the label and the directions of any Australian Pesticides and Veterinary Medicines Authority (APVMA) permit. You **must** read APVMA permit 9792 if you wish to prepare or use products for the control of rat's tail grasses in situations other than those specified on the product label.

Some herbicides permitted or registered for giant rat's tail grass control have withholding periods and significant ongoing management requirements in grazing and dairy farming. If you have or may have dairy or beef cattle on your property at any stage in the future, carefully consider these requirements when choosing herbicides for use on your property.

Some details of management options are provided below.

Scattered plants and light infestations

Choose **one** of the following options:

(a) spot spray with glyphosate
(b) spot spray with flupropanate
(c) use glyphosate through a pressurised wick wiper
(d) hand chip, bag and remove stools from the paddock and burn them.

Dense infestations on arable land

(a) Cropping option

First summer (early)

1. Boom spray with glyphosate as per label or permit directions and burn prior to ploughing.
2. Spot spray or hand chip fence lines, headlands, drainage lines, shelter belts etc. for weedy rat's tail grasses missed in cultivation. Plant a long-season forage sorghum variety using a recommended pre-emergent herbicide.
3. Spot spray or hand chip any surviving rat's tail grasses to prevent reseeding.

Second summer

1. Boom spray with glyphosate to control new seedlings and crop regrowth prior to cultivation.
2. Follow the same procedures and similar cropping as for the first summer.

Third summer

1. Boom spray with glyphosate to control crop regrowth and any rat's tail grass seedlings.
2. Plant paddocks with improved pastures using minimum tillage techniques to restrict bringing buried seed to the surface. Use a direct drill planter or surface broadcasting and rolling techniques. Plant fast-growing pasture grasses at triple the standard sowing rates to compete with rat's tail grass seedlings.
3. Fertilise the pasture for fast pasture establishment.
4. Spot spray or hand chip rat's tail grass seedlings.

(b) Pressurised wick wiper option

To be effective, this option requires three treatments over an 18-month period.

First treatment (midsummer)

1. Make sure there is a 30 cm height difference between rat's tail grasses and other pasture plants by selective grazing of the 'good' pasture.
2. Wick wipe rat's tail grass using glyphosate as per label or permit directions.
3. Graze using increased stocking rates after wick wiping.

Second treatment (late summer or autumn)

Wick wipe rat's tail grass using glyphosate as per label or permit directions.

Third treatment (next summer)

Wick wipe rat's tail grass using glyphosate as per label or permit directions.

Dense infestations on non-arable land

Choose **one** of the following options:

(a) In summer, apply glyphosate through a pressurised wick wiper (if terrain and timber allow).

(b) In summer, boom or blanket spray with glyphosate in split applications as per label or permit directions (see Table 2) and replant the pasture using fast-growing pasture grasses at double the standard sowing rates.

(c) In winter or spring, boom or blanket spray with flupropanate as per label or permit directions.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

Table 1. Best practices for management for rat's tail grass infestations

Dos	Don'ts
Cattle	
• Manage the grazing and stocking rate to maintain high levels of ground cover. • Where possible muster only in the afternoon when the dew has dried to minimise seed plants and seeds are dry. • Restrict cattle to a small paddock or a laneway free of rat's tail grasses with sufficient feed for seven days after grazing the rat's tail grass paddock to minimize seed spread in manure.	• Don't overgraze, as this will reduce ground cover to a low level which will promote rat's tail grass seedling emergence and to emerge. • Where possible avoid mustering on wet days or when the soil is muddy. • Don't deliberately overstock paddocks infested with rat's tail grass as this generally promotes rats tail grass.
Machinery	
• Provide a specific hose-down tarmac/area to clean contaminated machinery. • Keep roadways, laneways, stock routes and machinery corridors free of rat's tail grass to minimise risk of seed movement by machinery/vehicles. • If necessary in rats tail grass infested areas operate machinery when plant material and soil are dry to minimise seed movement.	• Don't slash areas infested with rat's tail grasses unless slashing is part of an integrated control program. • Don't knowingly drive vehicles through rat's tail grass infestations as contaminated vehicles are a major source of seed spread.
General hygiene	
• Enclose specimens for identification in tied bags or closed containers while transporting to prevent seed spread.	• Don't drive around the farm with a loose suspected rat's tail grass specimen in the cabin or in the back of a vehicle as this spreads seed.
Pasture management	
• Maintain sown pasture vigour with a maintenance fertiliser program. • Use planting methods that minimise soil disturbance when planting legumes into an infested pasture. • Plant the recommended competitive pasture grasses suitable for your climate and soil type.	• Don't allow soil fertility run-down as this reduces the competitiveness of sown pasture species and favours rat's tail grass. • Don't renovate an infested pasture as soil disturbance will favour rats tail grasses. • Don't burn the pastures infested with rat's tail grasses unless burning is part of an integrated control program such as a wick wiping, pre-cropping pasture
Hay and pasture seed	
• Determine the origin of hay to ensure there is a minimal risk of contamination with rat's tail grasses. • Feed hay in a yard, feedlot or small holding paddock so any rats tail grass plants introduced in the hay can be readily detected and controlled. • Only purchase seed from a reputable seed merchant.	• Don't knowingly purchase hay or seed contaminated with rat's tail grass. • Don't buy seed without knowing its origin.
Control strategies	
• Choose the most suitable control strategy based on your situation and the rat's tail grass population before starting the job. • If dairy or beef cattle will be in the paddock at any time in the future, carefully consider the exclusion and withholding requirements of the herbicides and the long-term implications before commencing treatments. • If spot spraying with glyphosate, operate close enough to spray downwards on to the plant to limit off target damage. • Use low-pressure spraying equipment to reduce the risk of off target damage.	• Don't spot spray with glyphosate using a high-pressure gun from the cabin of a vehicle as this results in off target damage increasing the risk of rats tail grass establishment. • Don't overspray with glyphosate past the point of spray run-off.

Table 2. Herbicides for the control of rat's tail grasses

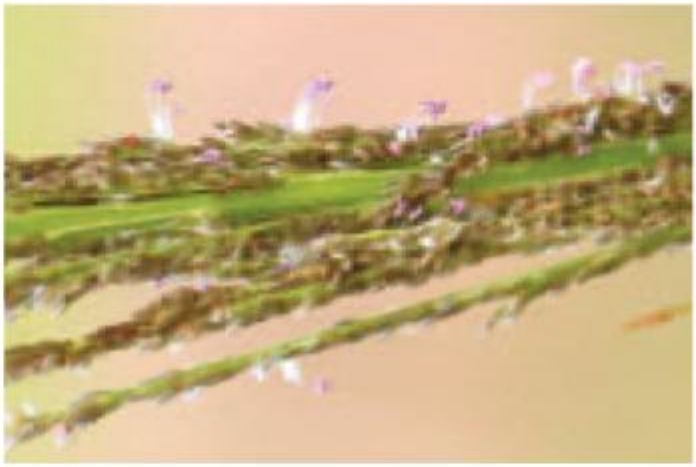
Situation	Application method	Herbicide[1]	Rate	Comments
Pasture, grazed woodlands and agricultural situations prior to sowing, tree and vine crops, lucerne and agricultural non-crop situations	Boom spraying	Glyphosate 360 g/L (e.g. Roundup Biactive, Weedmaster Duo)	6 L/ha	
Wasteland, forest and conservation areas, margins of aquatic areas, roadsides and easements, rights-of-way, commercial and industrial areas and public service areas	Boom spraying Double knockdown split application		3 L/ha + 3 L/ha	Follow up the first treatment with a later knockdown treatment such as herbicide or tillage
Pasture, grazed woodlands and agricultural situations prior to sowing, tree and vine crops, lucerne and agricultural non-crop situations Wasteland, forest and conservation areas, margins of aquatic areas, roadsides and easements, rights-of-way, domestic, commercial and industrial areas, turf, playing fields, golf courses, public service areas and areas surrounding agricultural buildings	Spot spraying		1 L per 100 L water	
	Double knockdown split application		1 L + 1 L per 100 L water	Follow up the first treatment with a later knockdown treatment such as herbicide or tillage
	Wick wiping		3.3 L per 10 L water	
Pasture, grazed woodlands, agricultural non-crop situations Wasteland, forest and conservation areas, roadsides and easements, rights-of-way,	Boom spraying	Flupropanate 745 g/L (e.g Tussock, Taskforce)	1.5–2 L/ha	**Do not** use in channels, drains or watercourses **Do not** reseed treated areas until at least 100 mm of leaching rain has fallen **Do not** spray near desirable susceptible trees **Do not** apply above 3 L/ha to steeply
	Suppression of seedlings in improved		0.5–2 L/ha	
Pasture, grazed woodlands and agricultural non-crop situations Wasteland, forest and conservation areas, roadsides and easements, rights-of-way, commercial and industrial areas, golf courses, public	Spot spraying		200 mL per 100 L water	
	Wick wiping		500 mL per 10 L water	

[1]Read APVMA permit PER9792 for rates for products containing glyphosate 450 g/L or glyphosate 540 g/L.

The herbicides in Table 2 are permitted under PER9792 (expires 30 November 2025). You **must** read the permit if you wish to prepare or use products for the control of rat's tail grasses in situations other than those specified on the product label. The permit is available on the APVMA website apvma.gov.au

Read the label carefully before use and always use the herbicide in accordance with the directions on the label.




This fact sheet is developed with funding support from the Land Protection Fund.

08/21

Athel pine

Tamarix aphylla

Although tamarisks have been planted to control erosion, this practice is now discouraged. (Photo: John Stretch)

- Also known as: athel tree
- This plant is a Weed of National Significance
- This plant must not be sold anywhere in NSW

Profile

How does this weed affect you?

Athel pine is one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts.

Athel pine forms dense stands along inland rivers. It consumes water more quickly than native plants, thereby reducing the number and quality of watering holes. It concentrates salt, which is excreted by its leaves. This makes the ground beneath athel pines more salty and excludes native pasture grasses and other salt-sensitive plants.

It can change river flow patterns and cause overland flooding and bank erosion.

Because they are drought tolerant and fire resistant, athel pines decrease the frequency of fires and alter vegetation structure.

Infestations reduce the cultural and aesthetic value of affected land and may impact on tourism in the region.

There are several other Tamarix species, all commonly known as tamarisks, that are weeds in Australia.

Where is it found?

Athel pine is classified as a 'sleeper' weed because it was present in Australia for some time before it became weedy. A native of northern Africa and Asia, it was first introduced into Whyalla, South Australia, in 1930 via California. Since then it has been extensively planted as shade and wind breaks and for erosion control around rural South Australia, New South Wales, Queensland, Western Australia, and the Barkly Tablelands and Alice Springs regions of the Northern Territory.

The worst infestations of athel pine occur along 600 km of the Finke River in Central Australia near Alice Springs. The explosion in its abundance and range is thought to have been caused by large floods in the 1970s and 1980s, which washed seeds and vegetation downstream and provided the moist conditions required for germination.

Other athel pine outbreaks have occurred throughout inland Australia since the 1990s at Starvation Lake and Tilcha Flow (SA), Burnett and Darling Downs regions (Qld) and Menindie Lakes (NSW). Infestations on the Gascoyne and Avon Rivers (WA) have recently been shown to include both athel pine (*Tamarix aphylla*) and another weedy tamarisk species *Tamarix parviflora*.

Based on climate, athel pine could potentially infest inland watercourses throughout Australia. A few infestations exist outside of the projected distribution, perhaps surviving on below-ground water resources.

How does it spread?

Athel pine can reproduce by dropping seeds or, more commonly, by revegetation of plant parts. Although athel pine seeds die quickly if not kept moist, they are easily dispersed by both wind and water and may also be spread by animals. A single tree can produce thousands of seeds every year. Its habit of making nearby soil saltier may be assisting its expansion because it thrives in saline conditions.

What does it look like?

Athel pine is a spreading tree to 15 m with pendulous, jointed branches. Immature trees have light grey trunks and stems. Mature trees have a thick, rough, dark grey to black bark, and grey-brown stems, and can be up to 1 m in diameter. The minute, dull green leaves superficially resemble pine tree 'needles'. However, athel pine is misleadingly named as it is a flowering plant, not closely related to true pine trees (conifers). Its small flowers are pinkish-white without stalks, growing on 30–40 mm long spikes from the ends of the previous year's branches. The fruit is bell shaped with a hairy tuft, and contains numerous small cylindrical seeds. The seeds have a tuft of fine hairs which assists wind dispersal. The trees have strong woody roots which penetrate and spread deeply throughout the soil.

Do not confuse athel pine with native she-oaks

Athel pines resemble native she-oaks (*Casuarina* and *Allocasuarina* species), which are found in similar locations. Although both have needle-like 'leaves', they may be distinguished by careful examination of the needles and fruit. The segments of she-oak needles are 5–10 mm long, whereas the segments on athel pine needles are only 1–2 mm long. The hard, woody she-oak fruit resembles a small pine cone, whereas athel pine fruit is tiny and bell shaped. Additionally, athel pine flowers (white–pink, growing at the end of stems) are conspicuous during the summer.

What type of environment does it grow in?

Athel pine is drought resistant and is well suited to arid and semi-arid rangelands. It is tolerant of saline and alkaline soils and, although it flourishes best in and around rivers, is not restricted to the riverine environment. It has escaped cultivation and become naturalised in all mainland states and territories except Victoria.

Acknowledgements

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References

CRC for Australian Weed Management (2003). *Weed Management Guide: Athel pine or Tamarisk*. CRC for Australian Weed Management, Adelaide, South Australia.

More information

- PlantNET NSW FloraOnline, Tamarix aphylla. Royal Botanical Gardens and Domain Trust. (http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Tamarix~aphylla)
- Weed futures: Determining current and future weed threats in Australia, Tamarix aphylla. Macquarie University. (http://www.weedfutures.net/species.php?id=1235)

Control

Preventing the further spread of athel pine is critical to the successful management of this problem. As part of the prevention of spread measures, the planting of athel pine for windbreaks, shade or erosion control is now actively discouraged. Weedy *Tamarix* species should not be imported or further planted, and alternative species should be used. Generally, a native *Casuarina* or *Allocasuarina* species will make a good alternative, especially for windbreaks. However, local council weed officers will provide advice.

Control athel pine near rivers

Athel pine in the upper catchments of rivers are the highest priority for control. Experience indicates that athel pine spreads fastest along waterways, especially when summer flooding aids the downstream dispersal of vegetative material and germination of seeds. Therefore, mature athel pines in the uppermost parts of catchments are the highest priority for eradication. Control can then focus on downstream infestations. The lowest priority for control are mature trees away from water.

Early control efforts

Athel pine was not formally recognised as a weed in Australia until the late 1980s when control attempts first examined its susceptibility to different herbicides and different application techniques. In the mid 1990s mechanical control was attempted on the Finke River, and since then integrated control methods using both mechanical and chemical means have been used to combat the spread of athel pine.

Remove seedlings by hand and mature trees mechanically

Seedlings can be easily removed by hand in sandy ground, and large trees can be removed by ripping and bulldozing, taking care to remove as much of the root system as possible. A large bulldozer is required if the trees are fully grown. If possible the area should be deep ripped to bring any root material to the surface and, where appropriate, a suitable pasture should be sown to outcompete any regrowth of athel pine. Otherwise, care shouldbe taken to reduce the amount of soil covering felled stems and exposed roots as they may re-shoot. Follow-up treatments will be required as some re-shooting is likely. Permits may be required to conduct mechanical control if native species will be affected.

Herbicides may be better suited where erosion is a problem

Herbicides may be used as part of the follow-up to initial mechanical control, and are preferred in sensitive environments (eg riverbanks) where mechanical control may damage non-target species and cause erosion and habitat loss. Herbicide control generally entails treating each stem separately. Registered herbicides can be applied in several different ways. Frilling, where small notches are cut into the bark until the white sapwood is reached and herbicide is injected immediately into the notches, has been used successfully in the Carnarvon area. There should be about 50 mm between notches, and drenching guns or veterinary syringes can be used to deliver herbicide into each notch. An alternative approach with larger stems is the cut-stump technique, where the main stem is cut off by chainsaw and the stump is immediately painted with herbicide. Care should be taken to reach as close to the roots as possible.

Smaller trees that have not developed rough bark can be treated by the basal bark technique, which involves soaking the circumference of the stem, to a height of 250 mm above soil level, with herbicide to the point of run-off. Very small stems can be snapped or cut, and herbicide applied to the stem. Foliar spray over the entire plant is effective on small trees (less than 2 m). However, the impacts on non-target species (both natives and crops) prevent this method being used in the Carnarvon area.

Herbicide options

WARNING - ALWAYS READ THE LABEL
Users of agricultural or veterinary chemical products must always read the label and any permit, before using

the product, and strictly comply with the directions on the label and the conditions of any permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this information. To view permits or product labels go to the Australian Pesticides and Veterinary Medicines Authority website www.apvma.gov.au

See Using herbicides (http://www.dpi.nsw.gov.au/biosecurity/weeds/weed-control) for more information.

PERMIT 9907 Expires 31/03/2025
Fluroxypyr 200 g/L (Comet® 200 herbicide)
Rate: 35 mL per L diesel/kerosene
Comments: Basal bark
Withholding period: Do not graze failed crops and treated pastures or cut for stock feed for 7 days after application. See label for further information.
Herbicide group: 4 (previously group I), Disruptors of plant cell growth (Auxin mimics)
Resistance risk: Moderate

PERMIT 9907 Expires 31/03/2025
Fluroxypyr 333 g/L (Starane™ Advanced)
Rate: 21mL per L diesel/kerosene
Comments: Basal bark
Withholding period: Do not graze failed crops and treated pastures or cut for stock food for 7 days after application. See label for more information.
Herbicide group: 4 (previously group I), Disruptors of plant cell growth (Auxin mimics)
Resistance risk: Moderate

PERMIT 9907 Expires 31/03/2025
Glyphosate 360 g/L (Various products)
Rate: One part product to 1.5 parts water
Comments: Cut stump, drill, frill axe or injection
Withholding period: Nil.
Herbicide group: 9 (previously group M), Inhibition of 5-enolpyruvyl shikimate-3 phosphate synthase (EPSP inhibition)
Resistance risk: Moderate

PERMIT 9907 Expires 31/03/2025
Glyphosate 360 g/L with Metsulfuron-methyl 600 g/kg (Various products)
Rate: 1:1.5 (ratio glyphosate to water) plus 1 g metsulfuron to 1 L water
Comments: Stem injection
Withholding period: Nil.
Herbicide group: 9 (previously group M), Inhibition of 5-enolpyruvyl shikimate-3 phosphate synthase (EPSP inhibition)
Resistance risk: Moderate

Biosecurity duty

The content provided here is for information purposes only and is taken from the *Biosecurity Act 2015* and its subordinate legislation, and the Regional Strategic Weed Management Plans (published by each Local Land Services region in NSW). It describes the state and regional priorities for weeds in New South Wales, Australia.

Area	Duty
All of NSW	**General Biosecurity Duty** *All pest plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.*
All of NSW	**Prohibition on certain dealings** *Must not be imported into the state, sold, bartered, exchanged or offered for sale.*
Central West	**Regional Recommended Measure** *Land managers should mitigate the risk of the plant being introduced to*

Area	Duty
	their land. Land managers should eradicate the plant from the land and keep the land free of the plant. A person should not deal with the plant, where dealings include but are not limited to buying, selling, growing, moving, carrying or releasing the plant. Notify local control authority if found.

Tamarix ramosissima, or salt cedar, is closely related to athel pine and is similar in appearance. (Photo: Colin G. Wilson)

Flower buds near Carnarvon, WA, in early February. (Photo: John Stretch)

Athel pine has infested hundreds of kilometres of the Finke River in central Australia. (Photo: Colin G. Wilson)

The segments of athel pine needles are only 1–2 mm long. (Photo: Les Tanner)

Flowers and fruit from Bingara, NSW, in February. (Photo: Les Tanner)

The drooping needles are superficially similar to native Casuarina and Allocasuarina species. (Photo: John Gavin)

Finke River athel pine infestation after blade ploughing. (Photo: John Gavin)

Athel pine was traditionally planted around homesteads for shade. (Photo: Les Tanner)

Reviewed 2023