



# Blue Gum Monoculture to Biodiverse Wetland

## Gwindinup North Mineral Sands Project

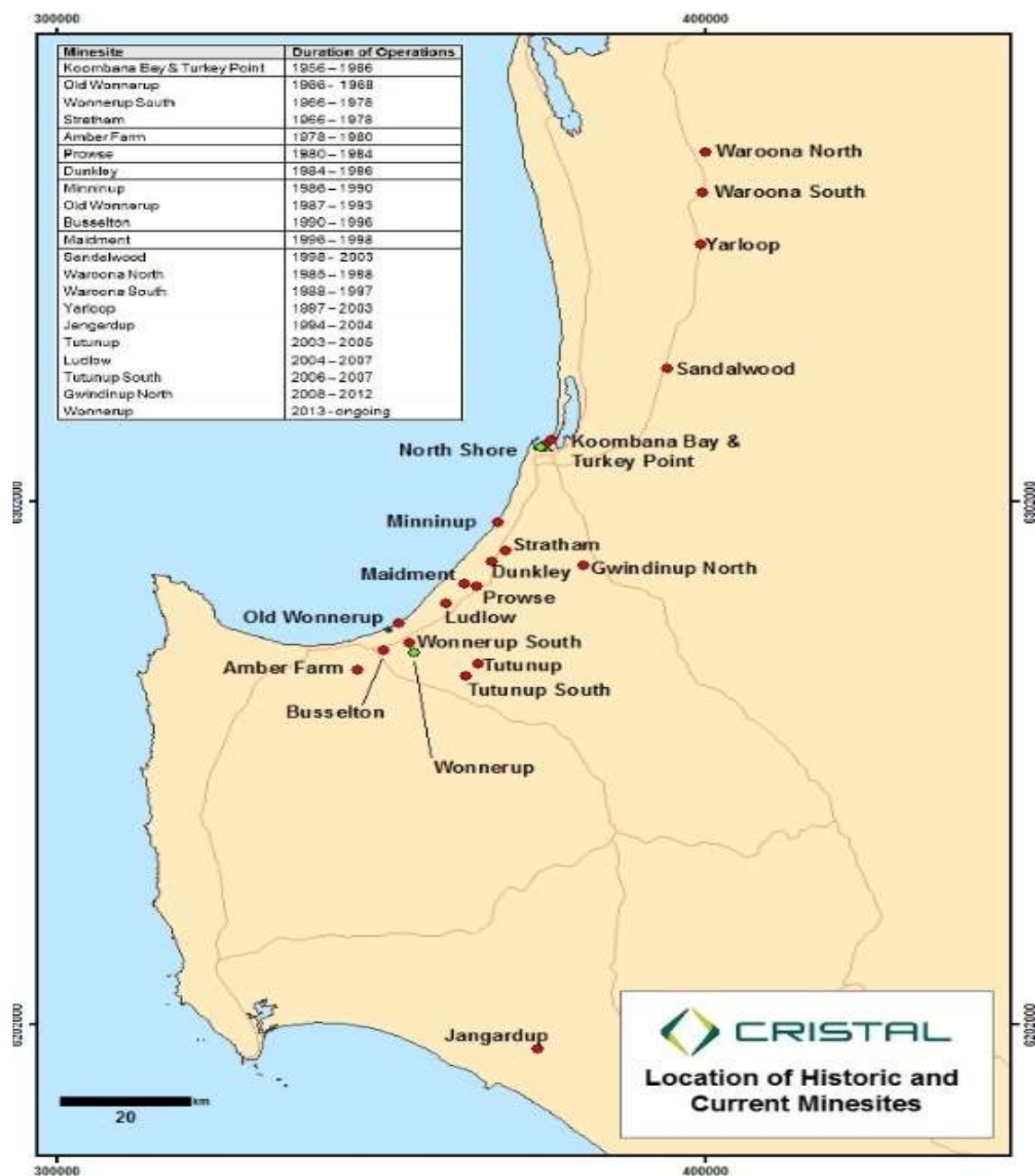
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# Cristal Mining Australia Ltd

- Mineral Sands Mining in the South West since 1956.
- Based in Bunbury, originally Cable Sands (W.A.) Pty Ltd now a global organization.
- Operations from Waroona to Jangardup on the South Coast.
- Successfully mined, rehabilitated and relinquished 17 of 21 sites over 62 years.
- Three of the remaining sites are now rehabilitated and currently going through the closure process

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# Gwindinup North

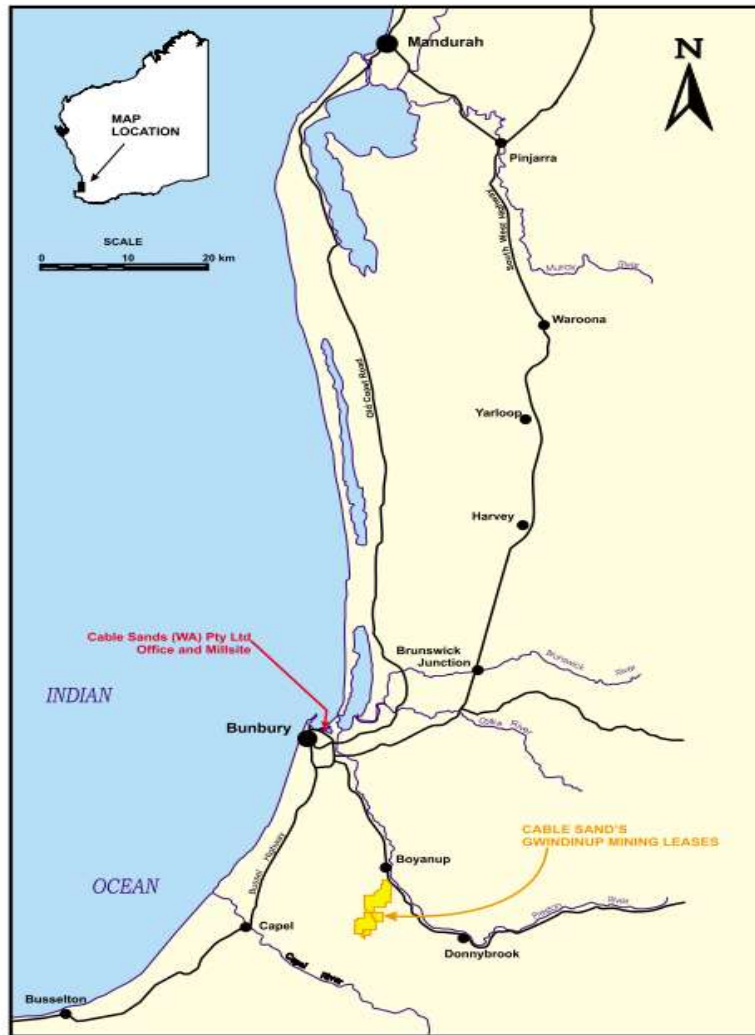


Figure 1: Location of the Gwindinup Mineral Sands Mine

- Situated 3.5km south of Boyanup town site at the base of the *Whicher Scarp*
- 240ha in total area
- 20ha of scattered remnant vegetation
- 72ha of native rehabilitation ranging from Jarrah/Marri/Banksia woodland to swampland

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# Project End Use Goals.

- ✓ Removal of blue gum plantation
- ✓ Removal of agricultural drains
- ✓ Establish sumpland/Wetland through the centre of the site
- ✓ Establish native riparian vegetation cover along the sumpland
- ✓ Establish fauna habitat within the revegetation
- ✓ Create ecological links between established remnant vegetation retained during mining and the rehabilitated land
- ✓ Installation of fences - native vegetation and farming can co exist
- ✓ Place all native rehabilitated land into Conservation Covenant

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# Pre Mining Land Use/History

Originally used for mixed farming, and prior to mining a blue gum plantation operated by WACAP



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# Mined 2008 - 2012



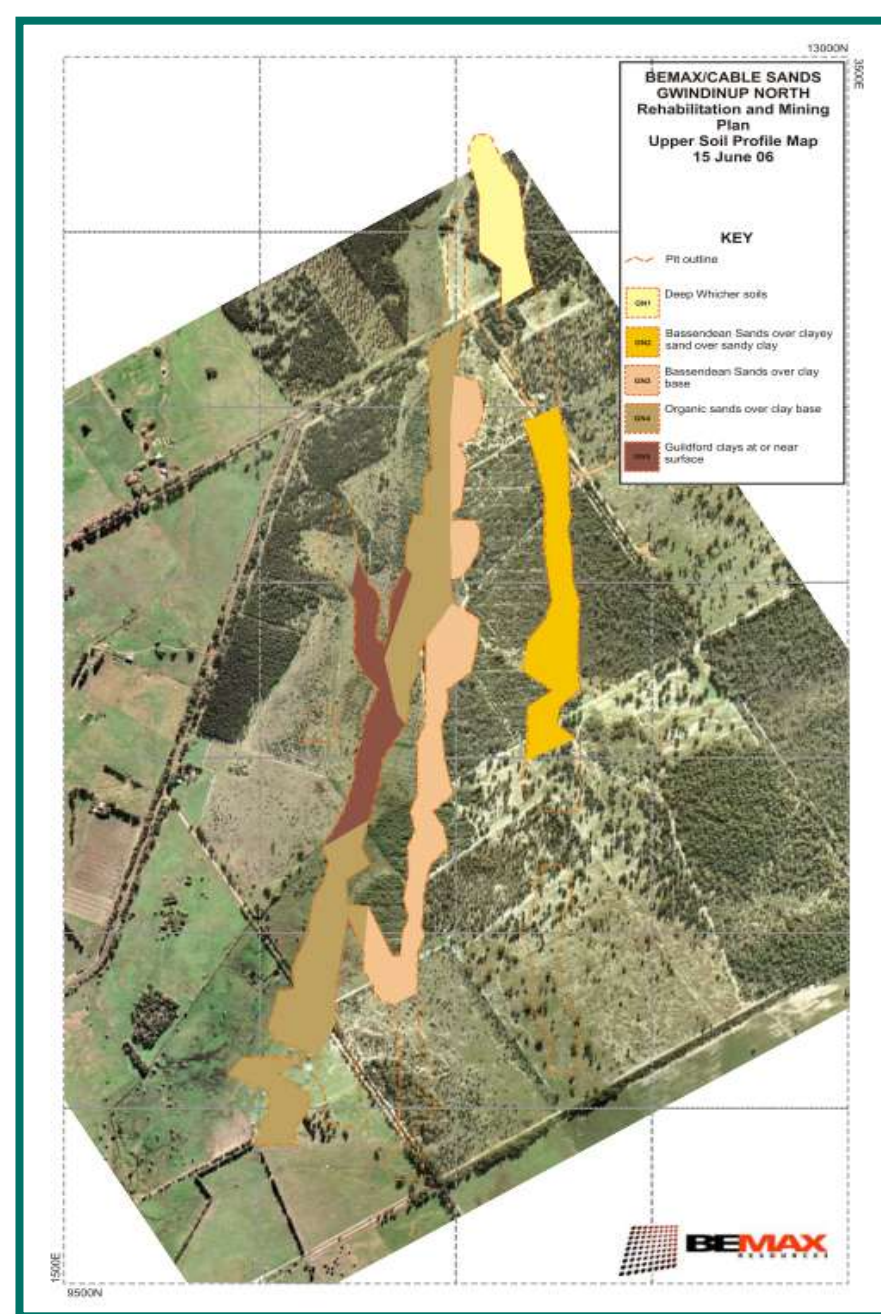
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# Planning and Identifying Risks to Successful Rehabilitation

- Soil profile reconstruction - not interrupting sub soil water flows.
- Animal pests. (kangaroos & rabbits)
- Correctly identifying vegetation complexes.
- Erosion.
- Impacting landowners down stream.
- Weeds



# Soil profiles - cont...

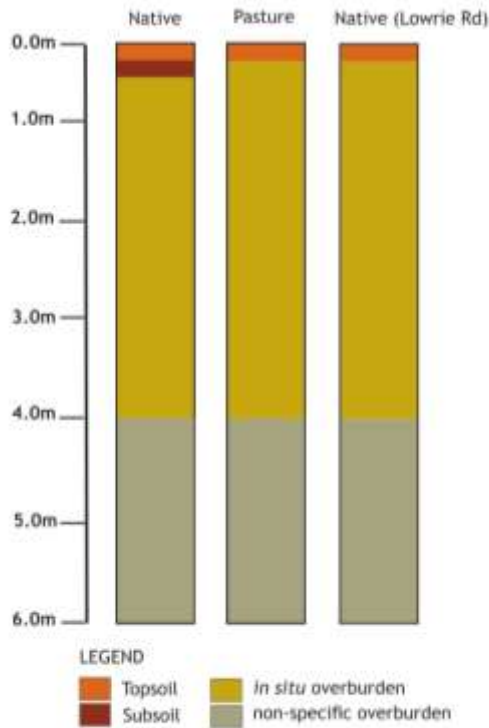


Figure 8 Conceptual post-mining soil profile for GN1 Deep Whicher Soils

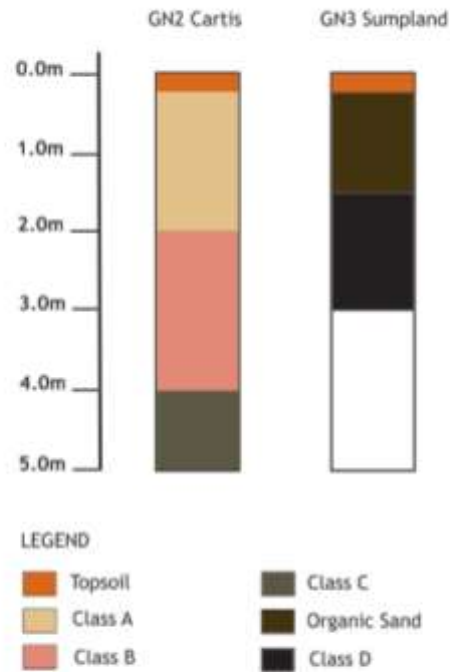


Figure 9 Conceptual post-mining soil profile for GN2 Bassendean Sands over Clayey Sands over Sandy Clay (Cartis) & GN3 Organic Sands over Clay (Sumpland)

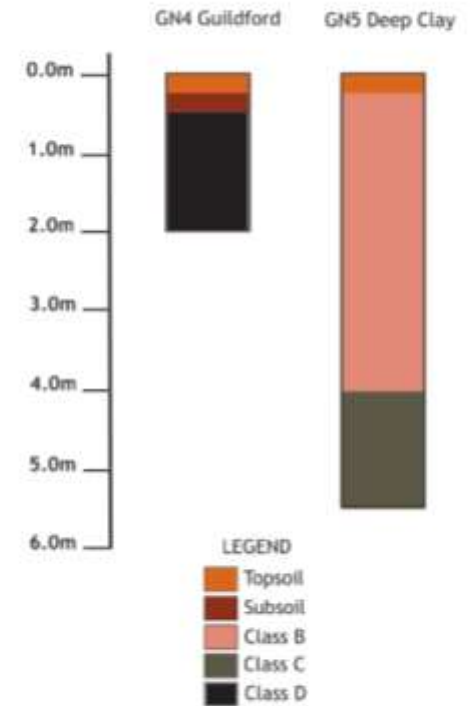


Figure 10 Conceptual post-mining soil profile for the GN4 Guildford Clays near surface & GN5 Deep Clay Basement under Sands

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# The Soil Profile Man - Mel Howes



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# End of Mining - Backfill and Soil Reconstruction



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Test pits to confirm the soil profile returned correctly.

Independently verified



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# Key Project Contractors

- *Onshore Environmental* (planning, botany services, soil profile reconstruction monitoring & vegetation monitoring)
- *Cape Life Environmental* (planting, seeding and seed collection)
- *Total Horticulture* (planting and seeding)
- *Cape Environmental Services* (compliance and closure)
- *Mainspray* (weed control)
- *Helispecs* (weed control)
- *Contract Fencing Services & Capel to Cape Fencing*
- *Animal Pest Management Services* (rabbit and fox control)

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# Key Suppliers for the project

- *Landsave Organics* (soil biology)
- *Seed Shed* (seed supply)
- *Formosa Seeds Pty Ltd* (seed supply)
- *Bushlands Native Seed Supply* (seed supply)
- *Tranen Revegetation South West* (seed supply)
- *Nindethana Seed Service Pty Ltd* (seed supply)
- *Boyanup Botanical Nursery* (seedling supply)
- *Geographe Community Landcare Nursery* (seedling supply)
- *Carramar Coastal Nursery* (seedling supply)

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# Site Preparation

Original ripping



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# Ripping

## Type 2

- Better water capture
- Ability to plant on top in wet conditions and in the bottom in dry conditions
- Acts as contours - prevents erosion
- Creates micro-climate - seedlings and seed prosper



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# Fencing



Weed control - helicopter  
and conventional methods



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# Application of Soil Biology.



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# Cristal Nursery



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# Batching ¼ Hectare Lots



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# Rehabilitation Works Examples

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# Lowrie Road July 2012



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# Lowrie Road August 2018



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# Aerial - Lowrie Road November 2017



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2012 pictured - 1 year



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## 2012 Rehab - August 2018



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## 2012 Rehab - 1 year



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## 2012 Rehab - August 2018



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## Aerial - 2012 Rehab November 2017



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2013 - 1 year



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## Same Location - August 2018



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# 2013 Planted Wetland - August 2018



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2014



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## 2015 Upland Rehab (Seeding in progress)



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## Upland Rehab 2015 - 2 years



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# 2015 Rehab - August 2018



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# Aerial - 2015 Rehab - November 2017



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## 2017 Rehab (June) Waiting to Plant.



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# Planted September 2017 - Picture August 2018



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# 2017 Ponds Created - note Habitat Log



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# September 2017 - prior to planting and seeding



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# September 2017 (Still very wet)



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# 2017 Rehab - August 2018



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## 2017 Rehab – 11 months old



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## Seed Germination - August 2018



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# Aerial - Wetland November 2017



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# Upland June 2016



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# Upland 2016 Rehab - August 2018



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# Aerial - 2016 Rehab



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2017 Upland November



2017 Upland August 2018

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# Completion Criteria

ASPECT	CRITERIA	ASSESSMENT
Native Vegetation	Understorey density & cover 1.29 plants / M <sup>2</sup> cover Over-storey density 0 plants / M <sup>2</sup> cover 3.7% Native veg reclamation > 65ha	Spring 2016 – target exceeded Native vegetation improved structurally & floristically  >72ha established since 2012
Soil	Rehab surface stable, vegetated and no uncontrolled run-off	Achieved
Weeds	Ground coverage no greater than pre-mining (<12%)	2016 – marginally higher 2017 surveys currently being reported Some remedial control likely
End Land Use	The site meets the agreed end land use/s	The site has been revegetated in accordance with agreed plans

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# Lessons Learned

- Planning and understanding your soil profile is critical
- Identifying all threats to successful rehabilitation and eliminating / managing those risks is critical. If you don't get it right the first time remedial work is costly and not always effective. If your soil and ground prep are not right nor will the rehab.
- Commitment to ongoing management is critical. Don't just plant/seed and walk away.
- Be prepared to be flexible...have a plan B!

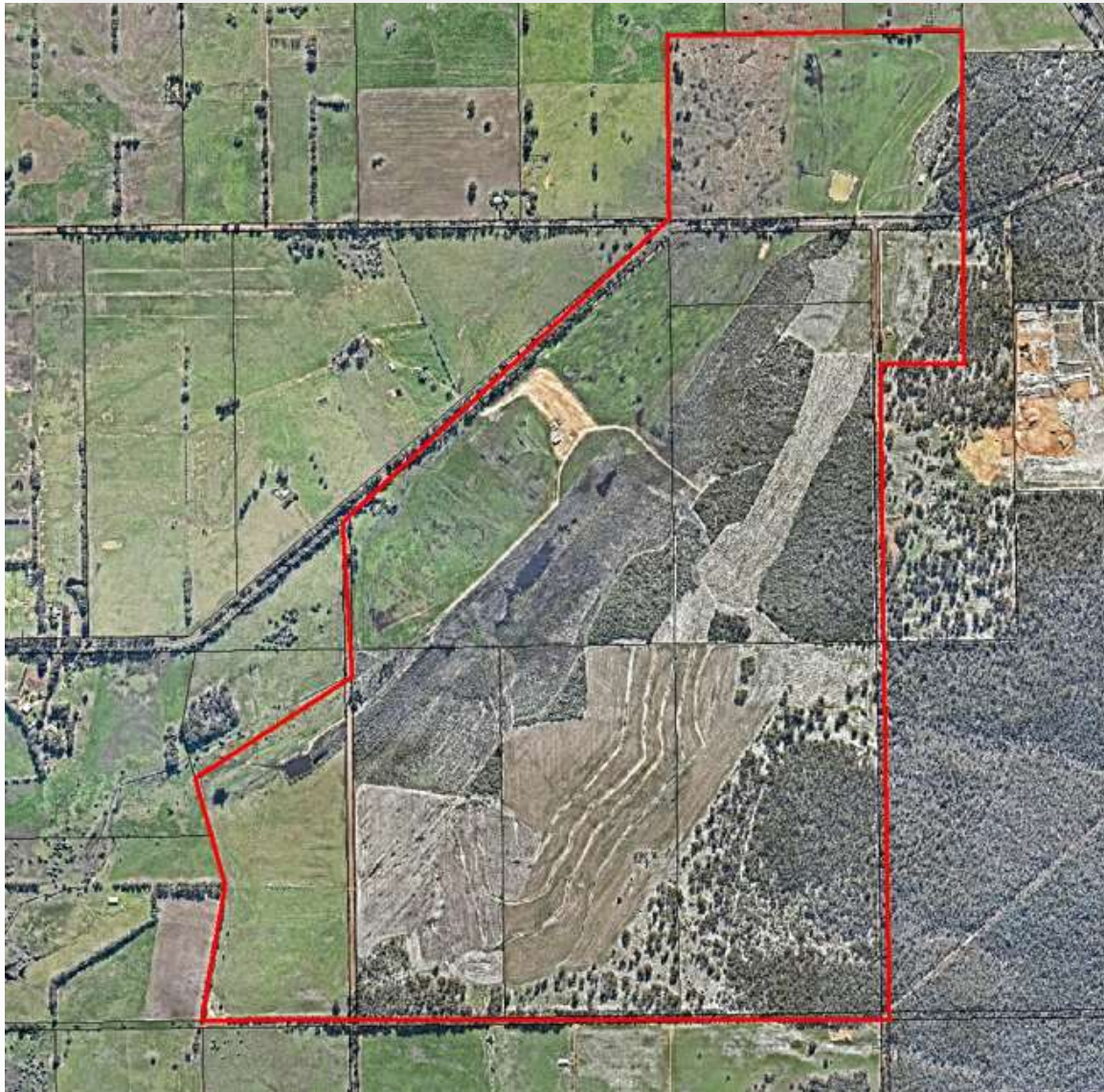
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# Gwindinup Minesite Rehabilitation



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