Landscape Briefing: Critical Raw Materials for Australia

Topic 00 Landscape Briefing

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Landscape Summary

1) Executive Framing and Objective

This landscape scan reframes critical raw materials as **mineral-derived materials and intermediates that can materially improve Australia's export position and geopolitical leverage**, while staying buildable within a 0-10 year horizon.

The portfolio uses a policy-and-industry decision lens:

- Export revenue potential (primary ordering criterion)

- Geopolitical leverage (secondary ordering criterion)
- Readiness and adjacency to existing Australian industry (third ordering criterion)

The output package includes:

- Full 60-topic master taxonomy: `content/topics/topic00_landscape-briefing/meta/crm_topics_mas`
- Ranked qualitative tiering (Tier 1 to Tier 3): `content/topics/topic00_landscape-briefing/meta/crm_`
- Top-12 hub and partner archetype mapping: `content/topics/topic00_landscape-briefing/meta/crm_`
- Evidence register with verification status and confidence: `content/topics/topic00_landscape-briefin`

2) Inclusion and Exclusion Logic for Strategic Importance

Included in-scope topics:

- Mineral-derived materials and intermediate processing chains with export value density
- Topics that improve strategic resilience or bargaining power in concentrated global supply chains
- Enablers that unlock multiple anchor export chains
- Byproduct recovery pathways where existing processing streams provide a credible route

De-emphasised or treated as constraints rather than export theses:

- Industrial water and desalination as standalone export themes
- Domestic-first themes without clear export leverage
- Duplicate service categories (consolidated into MRV and market infrastructure categories)

3) Consolidated 60-Topic Taxonomy and De-duplication Notes

The portfolio keeps the full A-G structure with de-duplication applied to overlapping service categories.

- A Anchor export plays: 10 topics
- B Strategic components and specialty materials: 12 topics
- C Enabling platforms: 12 topics
- D High-leverage minor metals and byproduct recovery: 13 topics
- E Circular and regional hub plays: 3 topics
- F Qualification-driven battery ecosystem items: 5 topics
- G Hub infrastructure and capability exports: 5 topics

Total: 60 topics.

4) Tiering Methodology and Decision Rules

This release uses ranked qualitative tiering only (no numeric aggregate score).

Tier definitions:

- Tier 1: clear export and or leverage upside, credible 0-10 year pathway, strong adjacency
- Tier 2: meaningful potential with material constraints in execution, qualification, feedstock, or policy
- Tier 3: long-cycle, low export leverage fit, or currently constraint-dominated

Ranking method:

- Pairwise precedence first by export potential
- Then geopolitical leverage
- Then readiness and adjacency

Blocker handling:

- Policy-gated items are retained and annotated
- Policy gates can cap rank versus equivalent non-gated peers unless a strategic exception is explicit

Core versus watchlist:

- Flexible by evidence rather than fixed quota
- Current cut: Core includes Tier 1 plus upper Tier 2 where constraints are manageable (ranks 1-32)

5) Results: Full Ranked Tier Table (All 60)

Rank	Topic ID	Tier	Portfolio Cut	Topic
1	CRM001	Tier 1	Core	Green iron exports (DRI, HBI, hot metal, ESF pathways)

Rank	Topic ID	Tier	Portfolio Cut	Topic
2	CRM002	Tier 1	Core	Green aluminium (low-carbon alumina plus renewable-powered smelting, alloys)
3	CRM003	Tier 1	Core	Copper upgrading (refining plus semi-fab: rod, wire, foil)
4	CRM004	Tier 1	Core	Rare earth separation to oxides (NdPr, Dy, Tb)
5	CRM011	Tier 1	Core	Permanent magnets (NdFeB): metals, alloys, magnet manufacturing
6	CRM012	Tier 1	Core	Battery-grade lithium chemicals (hydroxide, carbonate where viable)
7	CRM008	Tier 1	Core	Silicon metal at scale (metallurgical silicon)
8	CRM010	Tier 1	Core	Graphite anode materials (purified spherical graphite, coated anode)

Rank	Topic ID	Tier	Portfolio Cut	Topic
9	CRM006	Tier 1	Core	Fertilisers and ag-inputs (potash, phosphate, finished fertilisers; low-carbon ammonia integration)
10	CRM005	Tier 1	Core	Green chemical feedstocks at scale (ammonia, methanol)
11	CRM009	Tier 1	Core	Manganese upgrading (battery and alloying chemicals, EMM and HPMSM pathways)
12	CRM035	Tier 1	Core	Antimony (oxide and metal refining)
13	CRM017	Tier 1	Core	High-purity alumina and specialty alumina products
14	CRM015	Tier 1	Core	Nickel and cobalt sulphates (battery-grade)
15	CRM014	Tier 1	Core	Cathode materials: pCAM and CAM

Rank	Topic ID	Tier	Portfolio Cut	Topic
16	CRM016	Tier 1	Core	Vanadium chemicals and electrolyte for flow batteries and long-duration storage
17	CRM039	Tier 1	Core	Selenium and tellurium recovery (copper refining byproducts)
18	CRM036	Tier 1	Core	Gallium recovery and refining (byproduct-led strategy)
19	CRM037	Tier 2	Core	Germanium recovery and refining (byproduct-led strategy)
20	CRM040	Tier 2	Core	Tungsten intermediates and powders (APT, metal powders)
21	CRM041	Tier 2	Core	Tin refining and solder-grade products
22	CRM013	Tier 2	Core	Lithium beyond hydroxide: lithium metal, electrolyte salts (LiPF6), specialty lithium chemicals

Rank	Topic ID	Tier	Portfolio Cut	Topic
23	CRM027	Tier 2	Core	Fluorine and phosphate reagent chains (explicit gating sub-platform)
24	CRM026	Tier 2	Core	Industrial reagents platform (acids, caustic, soda ash, lime) tied to hubs
25	CRM030	Tier 2	Core	Strategic logistics and certified supply ports (QA labs, blending, dedicated terminals, inventory)
26	CRM028	Tier 2	Core	Traceability, certification, MRV, and product passports (market access infrastructure)
27	CRM031	Tier 2	Core	Mining services and EPC export (modular processing plants, commissioning, maintenance)
28	CRM034	Tier 2	Core	Industrial CCS hubs and CO2 transport and storage (protect export competitive-ness)

Rank	Topic ID	Tier	Portfolio Cut	Topic
29	CRM029	Tier 2	Core	Green premium market infrastructure (offtake structuring, trading, price discovery, long-term contracting)
30	CRM024	Tier 2	Core	Firmed clean power platform for industry (generation, transmission, storage, power quality)
31	CRM023	Tier 2	Core	Ore upgrading and beneficiation as a service (pelletisation, impurity removal, other ores)
32	CRM056	Tier 2	Core	Precision metallurgical testing, certification labs, and reference material production
33	CRM032	Tier 2	Watchlist	Industrial control software and optimisation for processing and green metals (exportable capability)

Rank	Topic ID	Tier	Portfolio Cut	Topic
34	CRM025	Tier 2	Watchlist	Hydrogen production and industrial clean energy inputs (primarily as enabler)
35	CRM018	Tier 2	Watchlist	High-purity silica and specialty quartz (PV, semiconductor supply chains)
36	CRM021	Tier 2	Watchlist	High-purity copper and specialty alloys (beyond basic rod and wire)
37	CRM022	Tier 2	Watchlist	Defence-grade materials supply chains (qualified steels, armour inputs, magnets, Ti powders, qualified alloys)
38	CRM049	Tier 2	Watchlist	Black mass import processing hub for Asia-Pacific
39	CRM048	Tier 2	Watchlist	Battery recycling and urban mining (domestic loop plus regional feedstock)

Rank	Topic ID	Tier	Portfolio Cut	Topic
40	CRM044	Tier 2	Watchlist	Specialty phosphates and purified phosphoric acid (non-fertiliser grades)
41	CRM043	Tier 2	Watchlist	Specialty cobalt and nickel metal products (high-purity rounds, powders)
42	CRM045	Tier 2	Watchlist	Boron products and advanced borates (specialty chemicals)
43	CRM047	Tier 3	Watchlist	Advanced refractories and furnace consumables (green iron, copper, alumina enablement)
44	CRM046	Tier 3	Watchlist	High-performance carbon materials (synthetic graphite, needle coke, carbon fibres)
45	CRM019	Tier 3	Watchlist	Green polysilicon (solar-grade, wafers over time)

Rank	Topic ID	Tier	Portfolio Cut	Topic
46	CRM020	Tier 3	Watchlist	Titanium metal and powders (aerospace, defence, additive manufacturing)
47	CRM038	Tier 3	Watchlist	Indium recovery and refining (byproduct-led strategy)
48	CRM042	Tier 3	Watchlist	Bismuth refining and compounds (byproduct)
49	CRM050	Tier 3	Watchlist	Regional recycling hub services model (contracting, logistics, QA, compliance)
50	CRM051	Tier 3	Watchlist	Battery separator materials (specialty polymers)
51	CRM052	Tier 3	Watchlist	Battery binder materials (PVDF and alternatives)
52	CRM053	Tier 3	Watchlist	Electrolyte solvents (DMC, EMC, DEC) and additive packages

Rank	Topic ID	Tier	Portfolio Cut	Topic
53	CRM054	Tier 3	Watchlist	Electrolyte formulation and qualification capability (OEM-facing)
54	CRM055	Tier 3	Watchlist	Anode and cathode precursor supply chain QA and metrology (reference materials, test protocols)
55	CRM033	Tier 3	Watchlist	Strategic reserves and stockpile services (governance, storage, QA, financing)
56	CRM057	Tier 3	Watchlist	Commodity finance and project finance capability packaged for green metals
57	CRM058	Tier 3	Watchlist	Subsea and cryogenic logistics supply chain (CO2, hydrogen carriers, ammonia terminals) leveraging LNG adjacency

Rank	Topic ID	Tier	Portfolio Cut	Topic
58	CRM059	Tier 3	Watchlist	Industrial gases expansion tied to hubs (oxygen, nitrogen, argon; cryogenics)
59	CRM007	Tier 3	Watchlist	Uranium value lift toward fuel-cycle services via partnerships (policy-gated)
60	CRM060	Tier 3	Watchlist	Industrial water as a gating enabler for hubs (constraint item, not export thesis)

Rationale Patterns Observed

- Tier 1 is dominated by materials that combine export scale with leverage in concentrated supply chains.
- Tier 2 contains high-potential opportunities where qualification, infrastructure, or chemistry complexity is the main limiter.
- Tier 3 includes longer-cycle capability plays, policy-capped options, and constraint-focused enablers.

6) Core Portfolio and Watchlist Cut

Current portfolio split:

- Core portfolio: 32 topics (all Tier 1 and upper Tier 2)
- Watchlist: 28 topics (lower Tier 2 and all Tier 3)

Decision logic used in this cut:

- Keep topics in Core where pathways are credible within 0-10 years and dependencies are manageable.

- Move topics to Watchlist where readiness is low, qualification cycles are long, or policy and feedstock constraints dominate.

7) Top 12 Hub and Partner Archetype Mapping

Top-12 mapping is provided in `content/topics/topic00_landscape-briefing/meta/crm_top12_hub_partne`

Summary of likely hub concentration:

- Pilbara and Mid West WA: green iron, green chemicals, manganese pathways
- Kwinana and wider WA industrial corridor: lithium chemicals, rare earths, anodes, specialty processing
- Gladstone QLD: aluminium, silicon, chemical feedstocks
- Townsville and North Queensland corridors: copper and selected minor-metals pathways
- Hunter NSW and selected east coast nodes: magnets and advanced manufacturing supply chains

Partner archetypes used:

- Operator
- EPC
- Offtaker
- Technology licensor
- Financier

8) Constraint Layer Across the Portfolio

Cross-cutting constraints that materially affect rank outcomes:

- Firmed clean power cost and reliability
- Reagent platform maturity, especially fluorine and phosphate chains
- Port and certified logistics throughput
- Industrial CCS availability for hard-to-abate pathways
- Policy gates for specific chains (for example uranium fuel-cycle services)
- Long qualification timelines in defence and battery subsegments

9) Evidence Confidence and Unresolved Uncertainties

Evidence register: `content/topics/topic00_landscape-briefing/meta/crm_evidence_register.csv`

Confidence posture in this release:

- High confidence: portfolio framing, critical-mineral scope anchors, GA map and portal utility
- Medium confidence: ranking order within middle tiers where several pathways are close substitutes
- Lower confidence: long-cycle qualification-heavy battery ecosystem items and exact timing of commercial inflection points

Key unresolved uncertainties:

- Speed of buyer qualification in advanced battery and defence material segments
- Timing and competitiveness of domestic hydrogen-delivered costs
- Actual pace of enabling infrastructure build-out in power, logistics, and CCS

10) Next-Pass Work Plan for Quantitative Validation

1. Add quantitative scoring overlays (trade value at risk, concentration risk, capex intensity, qualification time).
2. Convert top-12 mapping into hub-by-hub project pipeline sheets with candidate counterparties.
3. Pull commodity-specific GA and allied datasets for each Top-12 topic and tighten evidence confidence.
4. Add explicit trigger conditions for promoting Watchlist topics into Core.