

MANGANESE

INVESTMENT OPPORTUNITIES

WORLD-CLASS RESOURCE PROVINCE | SECURE INVESTMENT LOCATION
WORLD-LEADING GEOSCIENTIFIC DATA | GLOBAL MINING SERVICES INDUSTRY

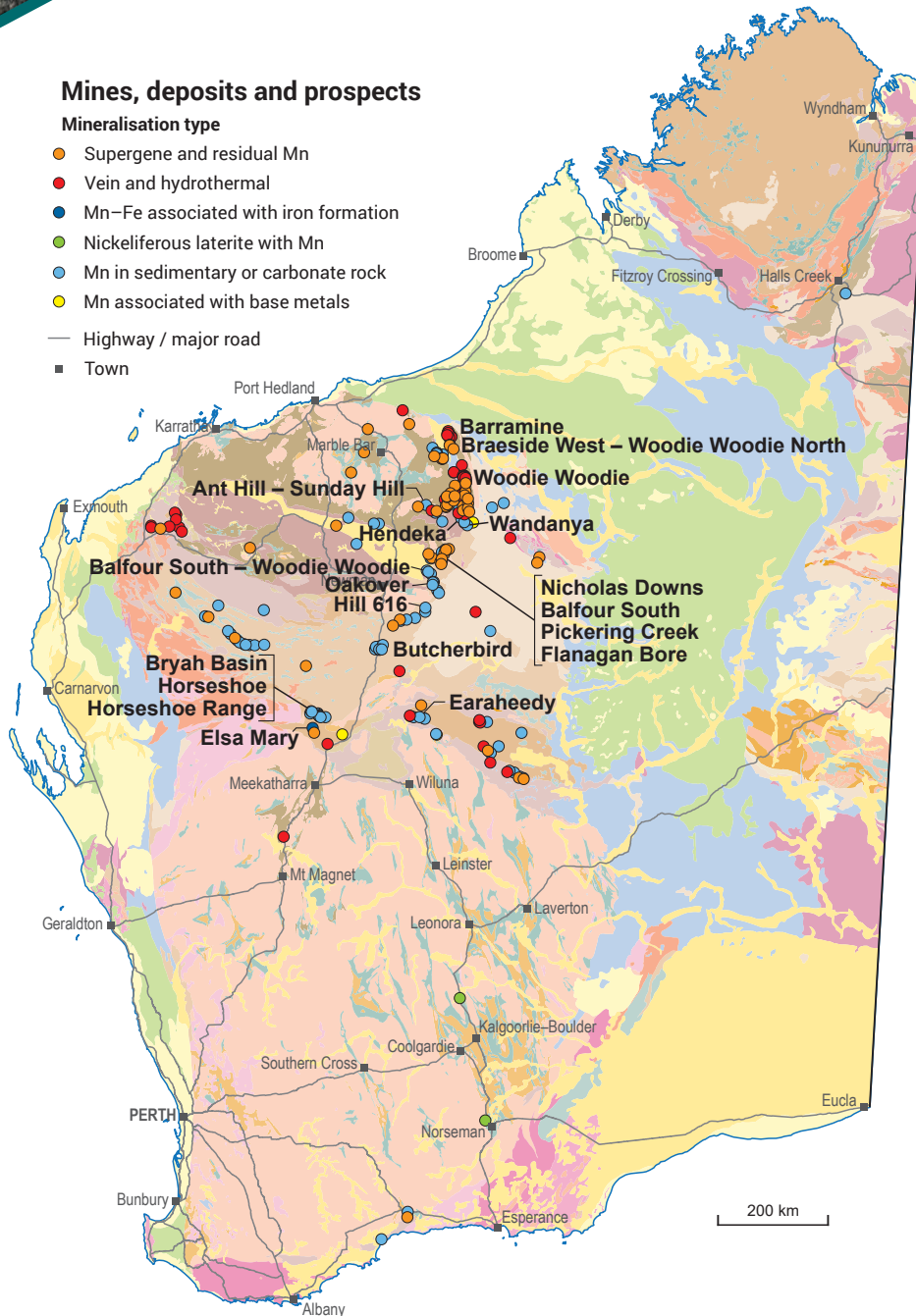
Mines, deposits and prospects

Mineralisation type

- Supergene and residual Mn
- Vein and hydrothermal
- Mn-Fe associated with iron formation
- Nickeliferous laterite with Mn
- Mn in sedimentary or carbonate rock
- Mn associated with base metals

Highway / major road

Town



Plans announced for conversion of manganese concentrate to battery grade HPMSM

- Western Australia has two operating manganese mines, Woodie Woodie and Butcherbird
- Western Australian current Mineral Resources are >100 Mt of contained manganese, which is an essential alloy in the steel-making process
- There is also growing demand from the electric vehicle industry as manganese is an important stabilizing component of battery cathodes
- Black Canyon Ltd has discovered and controls the largest manganese Mineral Resources at the Balfour Mineral Field (BMF), which comprises the Balfour South, Pickering Creek and Flanagan Bore Projects. The total Mineral Resource Estimate (MRE) is 314 Mt at 10.5% Mn classified as Measured (32%), Indicated (48%) and Inferred (20%) for 33.1 Mt of contained manganese. Black Canyon Ltd completed a Scoping Study for the BMF confirming a 16-year mine life with an average mining production rate of 3 Mtpa. High-purity manganese sulfate monohydrate (HPMSM) testwork has delivered high-grade manganese concentrate, demonstrating downstream feedstock potential

Recent resource updates

- Upgraded MRE of 274 Mt at 10% Mn and Mineral Reserve estimate of 49.2 Mt at 10.4% Mn at the Butcherbird Project
- Upgraded MRE of 13.6 Mt at 17.9% Mn at the Ant Hill Project. Resource Development Group have commenced commercialisation studies to confirm direct shipping ore opportunities. HPMSM has been produced from the Ant Hill deposit
- Significant upside potential was identified at the BMF with JORC Exploration Targets ranging from 160 to 215 Mt at 11–12% Mn, containing 18–24 Mt of manganese

Discoveries

- Black Canyon Ltd announced the discovery of stratabound, fault-related hydrothermal high-grade manganese at the W2 prospect (Wandanya Project), intersecting up to 48.7% Mn. Mineralisation has been mapped within a 3 km long corridor. This represents a new exploration model in the area

557 140 t
Tonnes sold



8th
Production
world ranking



5–7.5%
Royalty
rate



\$257 m*
Investment
projects



(2023–24 financial year)

* Includes projects planned, possible, committed or under construction as of September 2024



Department of Energy, Mines,
Industry Regulation and Safety

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Geological Survey of
Western Australia



Projects with manganese resources >9% Mn – ranked by contained manganese

Mineral Resource Estimates reported in accordance with JORC (2012) unless otherwise stated

Project	Status	Owner	Resources (Mt)	Grade (% Mn)	Contained Mn (kt)	Resource date
Balfour Mineral Field ^Δ	Scoping	Black Canyon / Carawine	314.0	10.50	33 100	12/12/2023
Butcherbird	Operating	Element 25	273.5	10.00	27 354	29/10/2024
Oakover	Scoping	Firebird Metals	176.7	9.87	17 432	23/03/2023
Woodie Woodie ¹	Operating	Consolidated Minerals*	44.6	31.29	13 960	23/03/2018
Hill 616	Exploration	Firebird Metals	57.4	12.25	7 030	01/12/2021
Balfour South – Woodie Woodie [#]	Exploration	Consolidated Minerals*	21.6	19.40	4 190	10/12/2018
Ant Hill – Sunday Hill	Exploration	Resource Development Group	13.6	17.94	2 437	20/11/2024
Nicholas Downs	Exploration	Hancock Prospecting	8.8	23.80	2 094	28/02/2016
Hendeka	Exploration	Trek Metals / Edge Minerals / Planet Mining	11.3	14.95	1 690	14/03/2012
Earaheedy	Exploration	Zenith Minerals	4.0	20.04	802	30/04/2015
Bryah Basin	Exploration	Bryah Resources / OM Holdings	2.4	20.46	495	24/08/2023
Woodie Woodie North ²	Exploration	Accelerate Resources / First Development Resources	1.2	19.10	237	30/11/2023
Elsa Mary [†]	Exploration	Sinosteel Midwest	0.9	21.91	208	01/07/2009
Horseshoe Range [†]	Scoping	Esploratore	0.9	20.83	178	14/04/2011
Horseshoe	Exploration	Bryah Resources	0.6	19.96	129	03/03/2022
TOTAL			931.6		111 336	

Resource estimates have been rounded

^Δ Mineral Resource is not JORC 2012 and not CRIRSCO compliant

[†] Mineral Resource is JORC 2004 compliant

* Parent – Ningxia Tianyuan Manganese Industry Co.

^Δ Balfour Mineral Field comprises the Balfour South, Pickering Creek (100% Black Canyon) and Flanagan

Bore (75% Black Canyon, 25% Carawine) Projects

¹ Most recent open file resource from WAMEX

² Woodie Woodie North comprises the Braeside West and Barramine Projects

Spatial and resource estimate data sourced from WA Mines and Mineral Deposit database (MINEDEX)

	Supergene/residual Mn		Sedimentary or carbonate rock
	Vein and hydrothermal		Mn–Fe

Properties and uses

- Manganese is a metal that has important metal alloy uses, particularly in stainless steel
- Manganese has traditionally been used in steel manufacturing with manganese alloys added to prevent corrosion, resist abrasion, and increase hardenability. This consumes approximately 90% of the manganese produced globally. The balance is used in a number of different applications such as HPMSM, a critical raw material in the production of cathodes for lithium-ion batteries used in electric vehicles (EV). Other uses include, in dry cell batteries and as a black–brown pigment in paint. Steel contains 1% manganese to increase strength and improve workability. Manganese steel has 13% manganese which is very strong and used for railway tracks, rifle barrels, safes and prison bars
- High-purity manganese products are essential materials needed by the EU's fast-growing electric vehicle and lithium-ion battery industries. High-purity manganese (HPM) refers to a suite of highly refined finished products that are critical to most lithium-ion batteries. Its use and demand are increasing rapidly, particularly in Europe, China and the USA. The electric vehicle market has witnessed remarkable growth in recent years, driven by increasing environmental awareness, government incentives, and technological advancements. EVs are becoming an increasingly popular choice among consumers, leading to a surge in demand for lithium-ion batteries, in which HPMSM plays a vital role. As the EV market expands, so will the demand for these batteries. The choice of battery technology platform by EV manufacturers can influence demand for manganese sulfate, with the manganese contribution varying between 8% and 60%
- Europe, North America, Japan, Korea and many other countries import 100% of their manganese requirements, including high purity electrolytic manganese metal and HPMSM, which are essential materials used in the production of lithium-ion EV batteries

For more information

MINEDEX is a spatial and textual database of mining and exploration activity

MINEDEX www.demirs.wa.gov.au/minedex

GeoVIEW.WA is a free GIS-based spatial viewer

GeoVIEW.WA www.demirs.wa.gov.au/geoview

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The DEMIRS MINEDEX, Statistics, and Titles and Geoscience Services teams have contributed to the production of this flyer



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