MinEx CRC - unlocking prospectivity through cover

Chris Yeats, Executive Director Geological Survey of NSW

SMEDG Meeting, Sydney, 22 November 2018

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The discovery challenge

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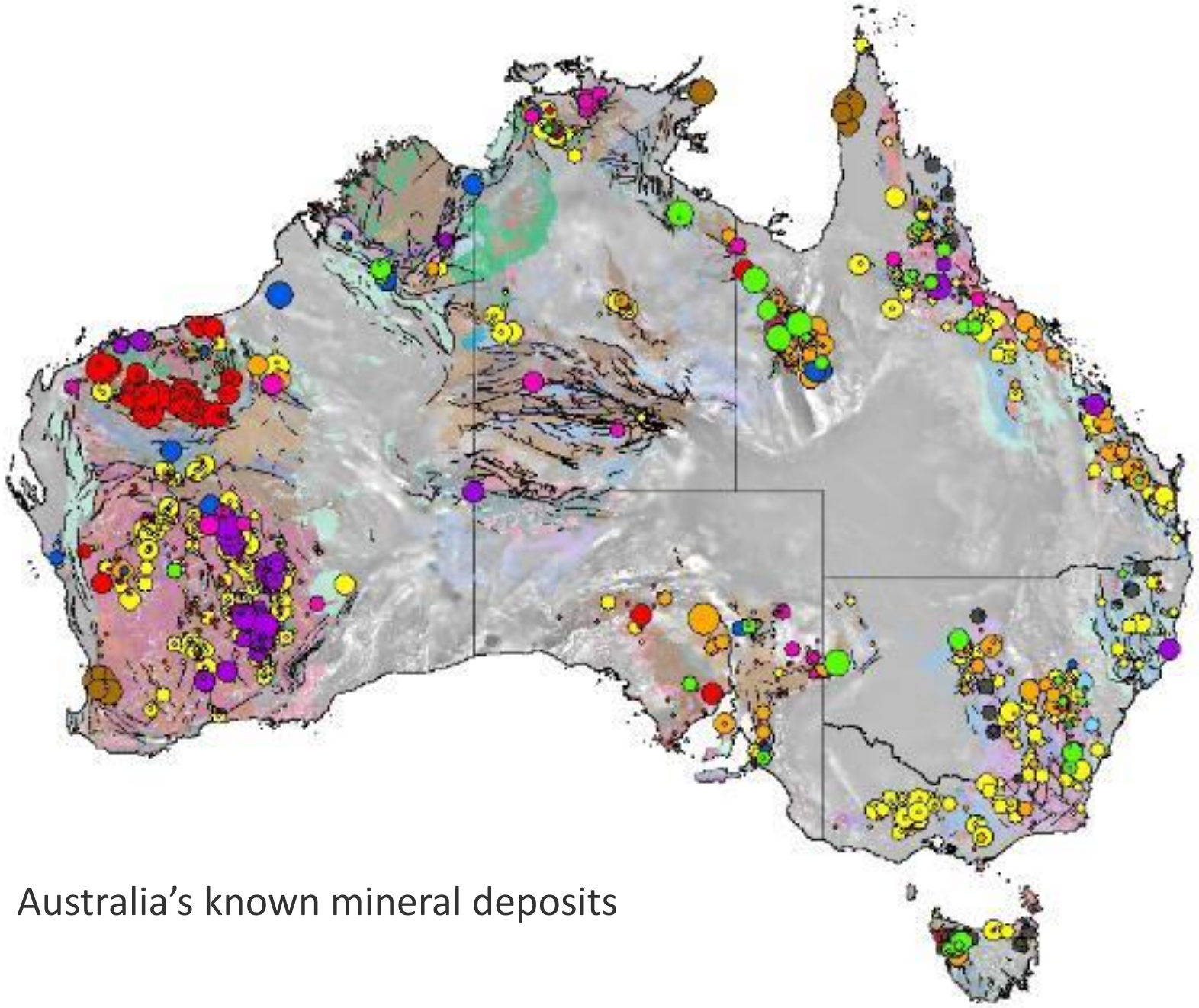
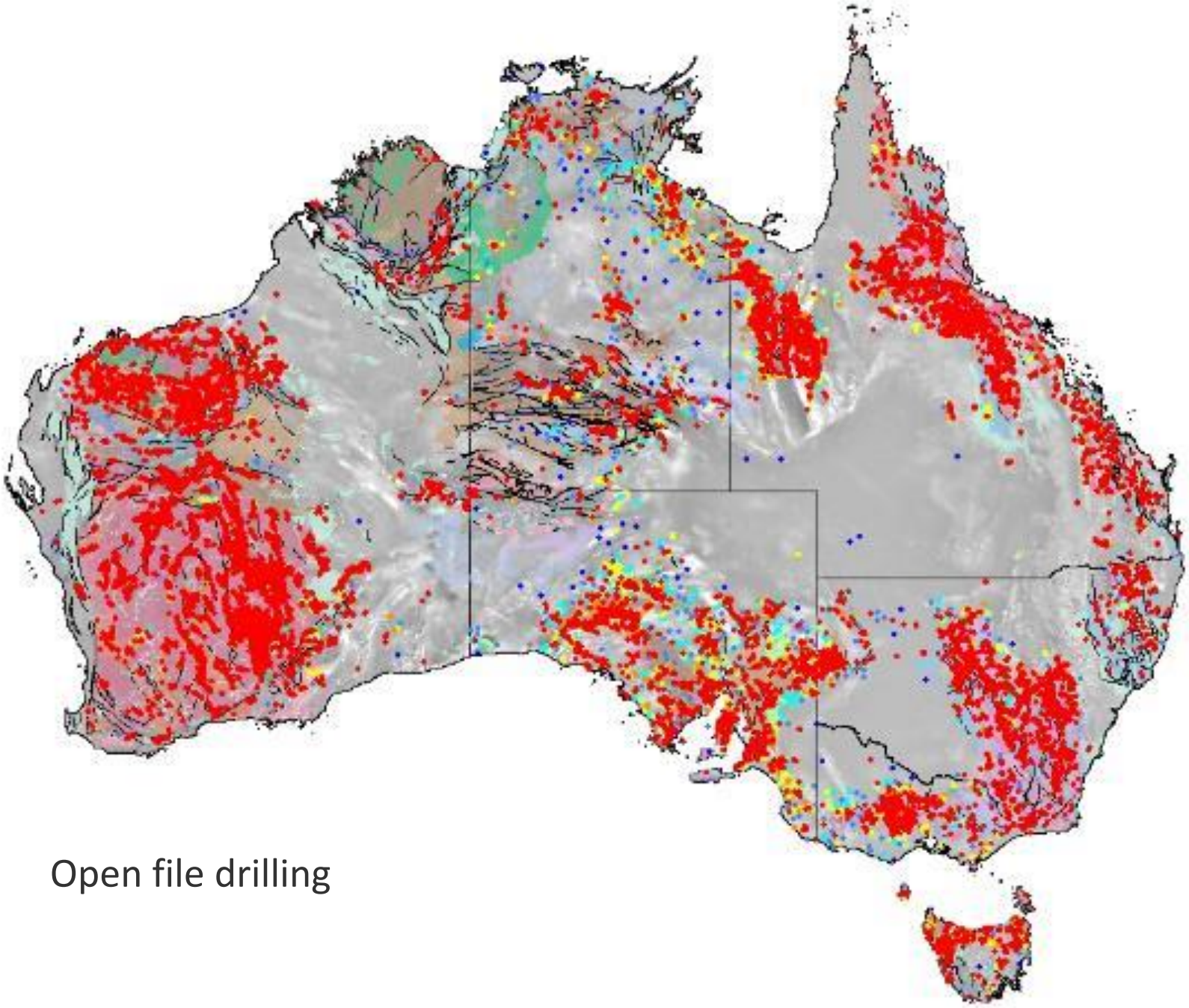


Australia’s known mineral deposits



Open file drilling

What is MinEx CRC?

MinEx CRC – launched 15 October 2018

- **$217.8 million, 10 year investment in mineral exploration R&D**
  - $41.0 million cash contribution from industry partners (participants and affiliates)
  - $126.8 million in-kind contribution from industry partners and research participants
  - $50.0 million cash contribution from Commonwealth Government Department of Industry, Innovation and Science CRC Program
- 36 organisations involved including
  - 4 Major miners (Anglo American, BHP, Barrick, South32)
  - METS providers
  - All Australian geological surveys (4 participants, 4 affiliates)
  - CSIRO and 7 Australian universities

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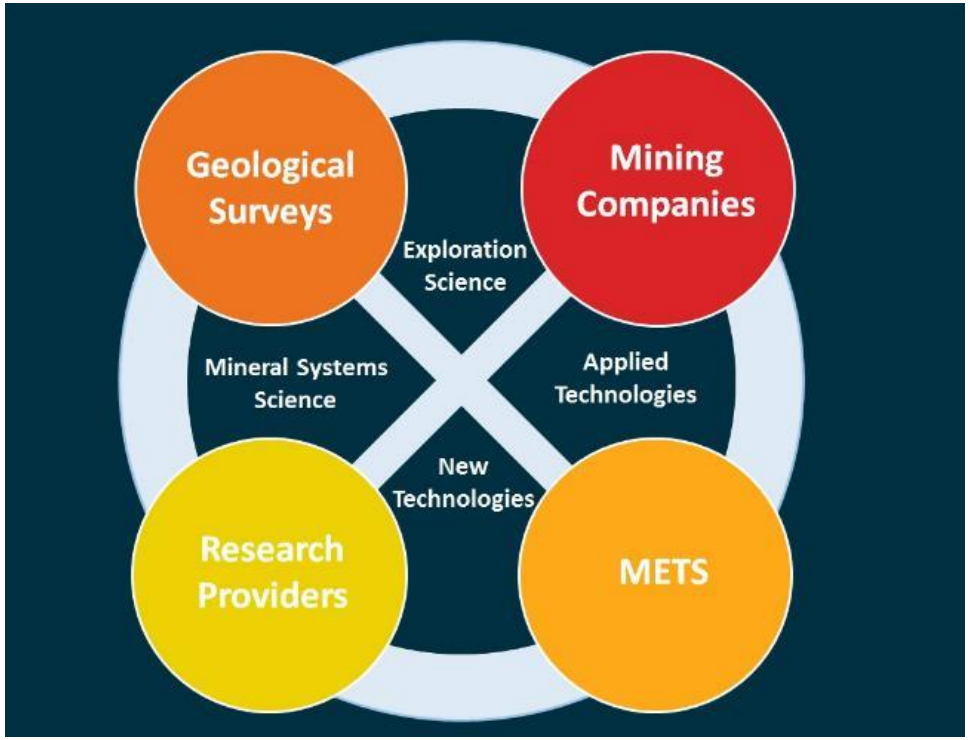
MinEx CRC 3D DRILLING

Three programs

- **Program 1 – Improved drilling efficiency**
  - Developing more productive, safer and environmentally-friendly drilling methods to discover and drill-out deposits, including coiled tubing drilling technology.

- **Program 2 – Real-time data collection and analysis**
  - Developing new technologies for collecting data while drilling, bringing forward mine production.



- **Program 3 – National Drilling Initiative (NDI)**
  - A world-first collaboration of Geological Surveys, researchers and industry that will undertake drilling in under-explored areas of potential mineral wealth in Australia.

Project 7 – Maximising the value of data and drilling through cover

Project 8 – Geological architecture and evolution

Project 9 – Targeting mineral systems in covered terranes

GSNSW involvement

MinEx CRC – a step change in exploration technology

- Deployment of coil-tube (CT) drilling
  - Developed in DET CRC (GSNSW an affiliate)
  - Safer, cheaper, faster, less environmental impact
- Optimisation of conventional drilling
  - Metrics and control
- Real-time analysis
  - Lab-at-Rig
  - Down hole sonde(s)
    - Petrophysics, geochemistry, camera

Source: detcrc.com.au

Research, education and training

- ~60 postgraduate projects (PhD or Masters)
  - ~30 to 35 for NDI
  - ~8 to 12 on NSW geology
  - Prospectus due early-December 2018

- ~200 vocational education and training students

- GSNSW to get embedded researcher
  - Via Uni of Newcastle
  - Regolith/sedimentary geologist/geochemist?
  - Advertising and appointment in 2019

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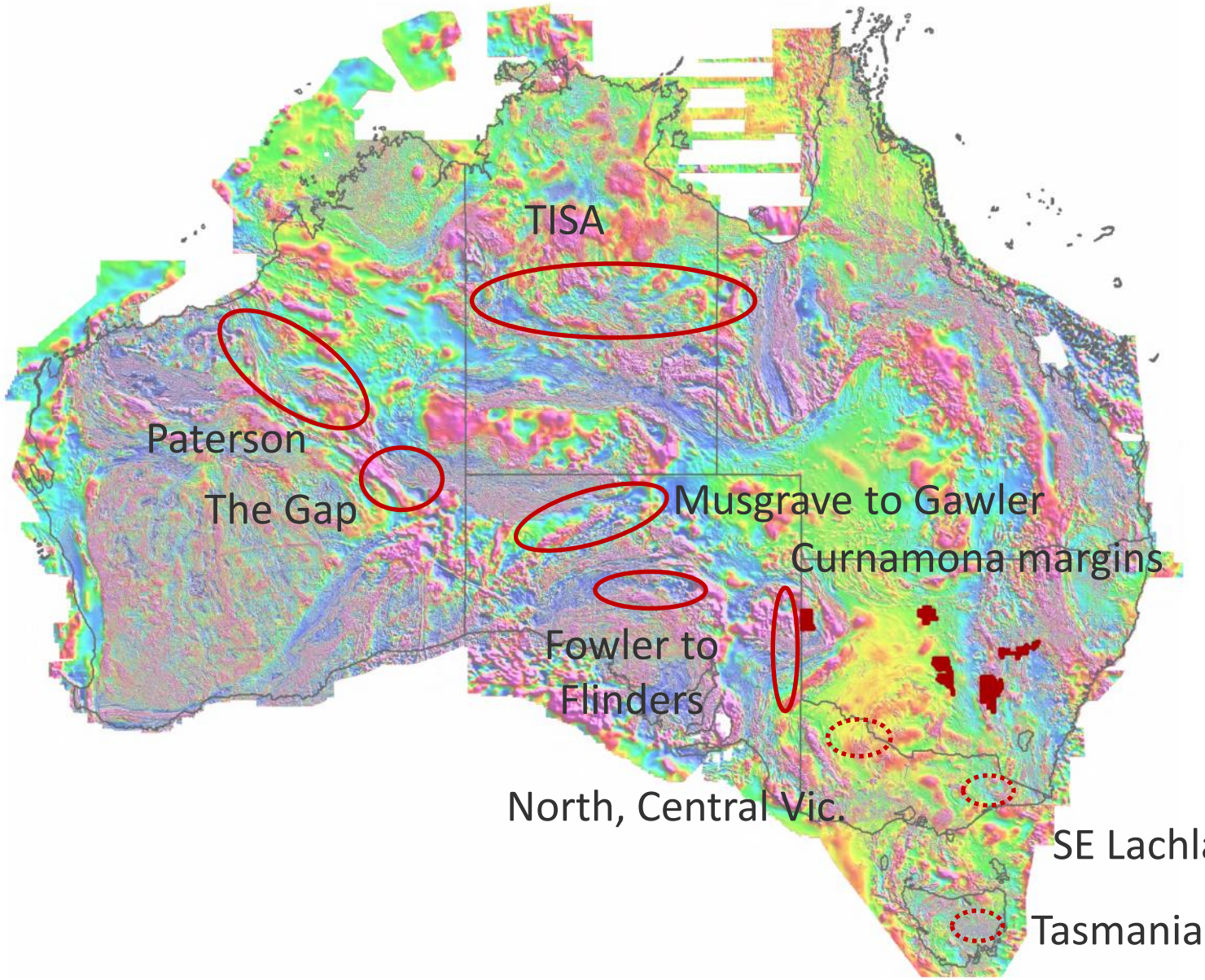
Source: thesurlybiker.wordpress.com, legomyphoto.wordpress.com

MinEx CRC National Drilling Initiative

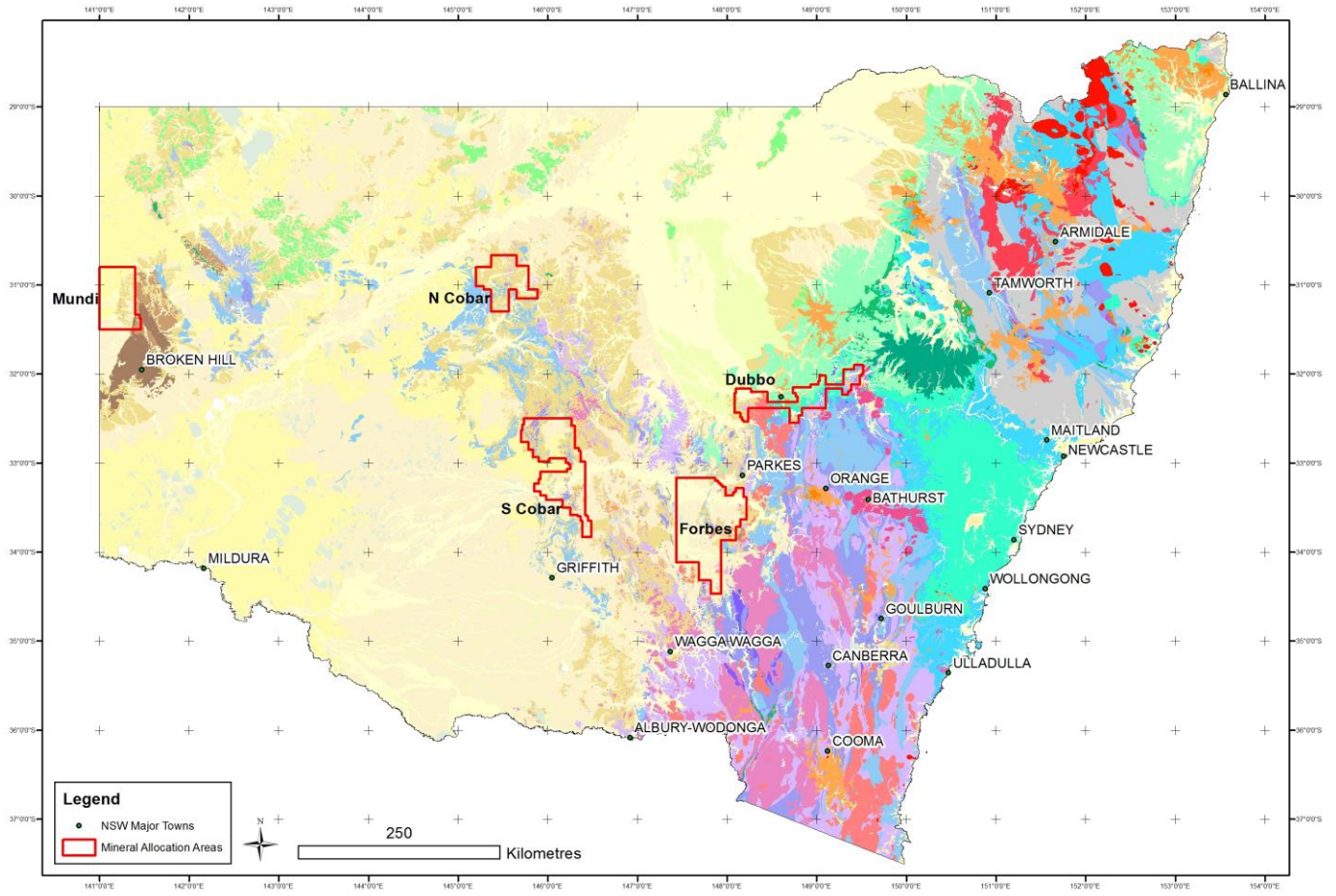


National reach

- Participants
  - GSNSW
  - GSSA
  - GSWA
  - GA
- Affiliates
  - GSV
  - MRT
  - NTGS
  - GSQ
- Research Participants
  - CSIRO
  - UoA
  - Uni SA
  - Curtin
  - UoN
  - UNSW
  - ANU

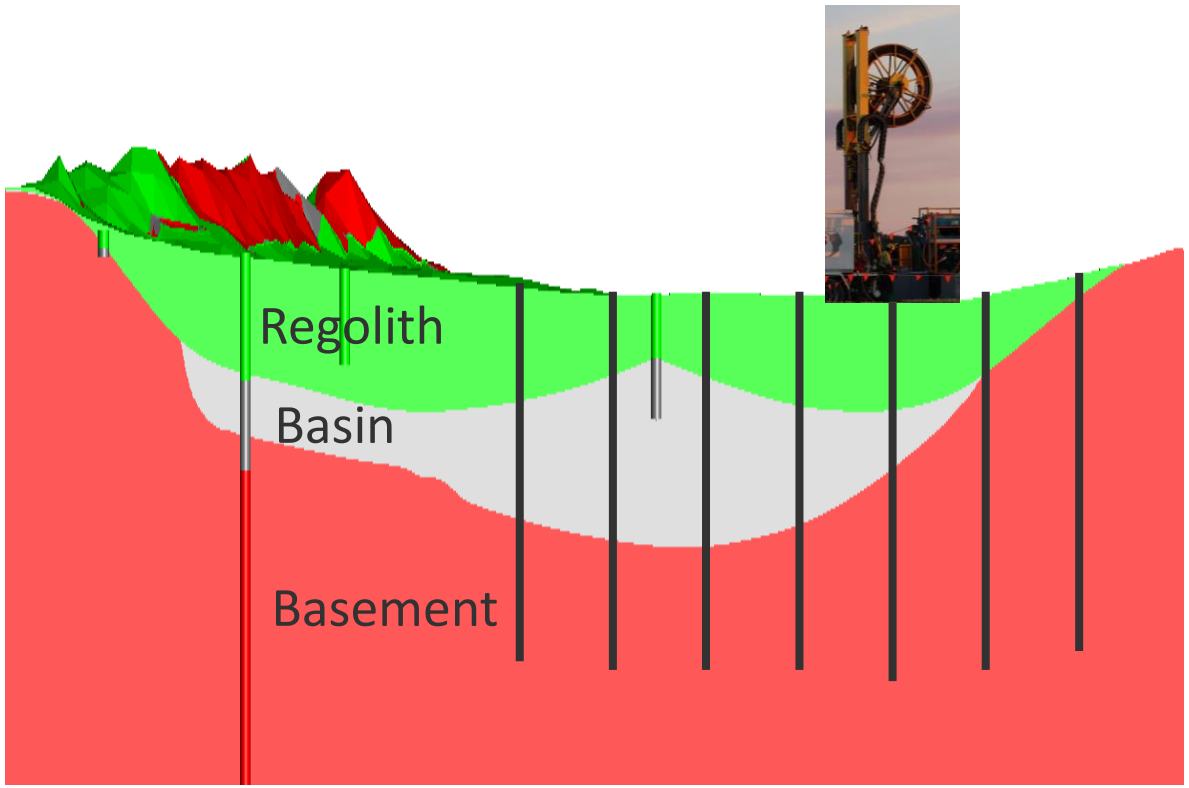
National Drilling Initiative (NDI) in NSW

- Focus for GSNSW will be on pre-competitive data acquisition including drilling in five areas.
- These areas are undercover extensions to knowr mineralised terranes.
- GSNSW will assess legacy materials and data, and undertake targeted geochemical and geophysical surveys prior to drilling.
- The data collected will also provide information on potential groundwater resources in the areas (collaboration with NSW Office of Water)



NSW Area selection

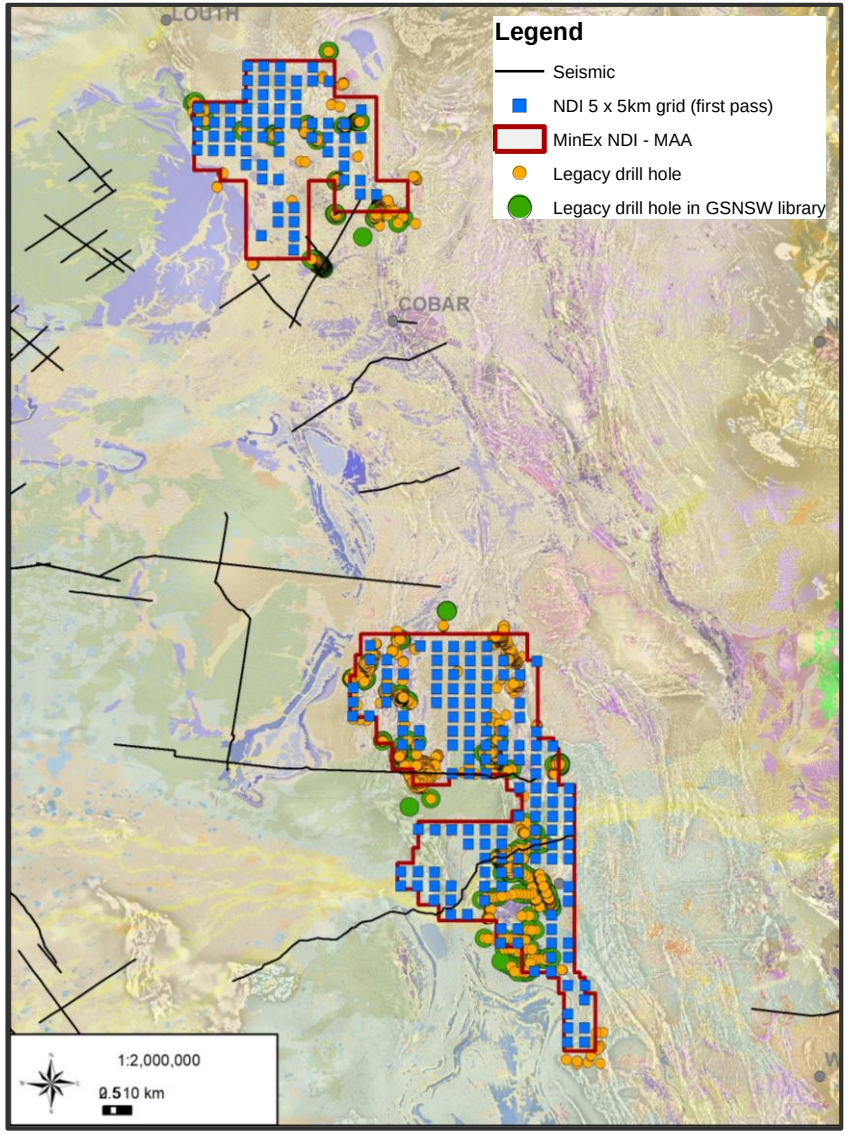
- Constraints (first pass)
  - Define cover and basement
  - <500m (all) cover to basement
  - Outcrop areas excised
  - Avoid sensitive land (National Parks, aquifers)
- Grid approach (first pass)
  - ~ 5 x 5 km spacing
  - Max hole depth = 500m (incl. 40m into basement)
  - RoXplorer® cost of $50/m
  - Lab-at-Rig® cost of $25/m
- Refine grid (next step)
  - Away from previous (deep) drilling
  - Geophysics
  - Land clearances (environment, cultural, access)



Source: detcrc.com.au

North and South Cobar Basin

- Target basement
  - Siluro-Devonian basin, Ordovician?
- Cover
  - Cenozoic, Mesozoic?, Late Devonian
- Potential mineralisation
  - ‘Cobar’ style – basin opening / inversion
- Pre-drilling work
  - Geophysics (AEM, gravity, magnetics, rads, MT?)
  - Mapping (including analytical)
  - Legacy drilling (including analytical)
  - Biogeochemistry
  - Hydrogeochemistry
- NDI drilling (2022-2023)
- Key issues
  - Map the geology under cover
  - Controls on mineralisation
  - Basement signature in cover?
    - Biogeochemistry
    - Hydrogeochemistry



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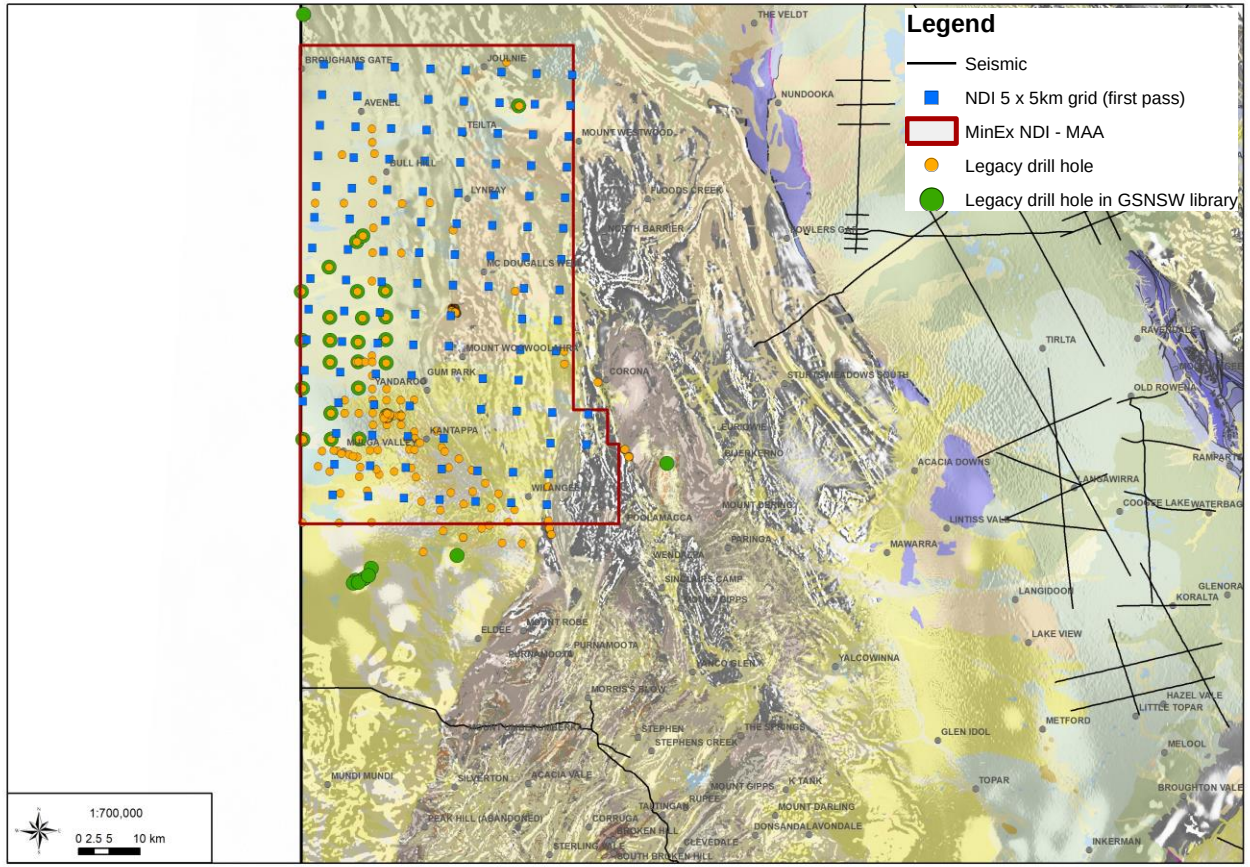
Mundi

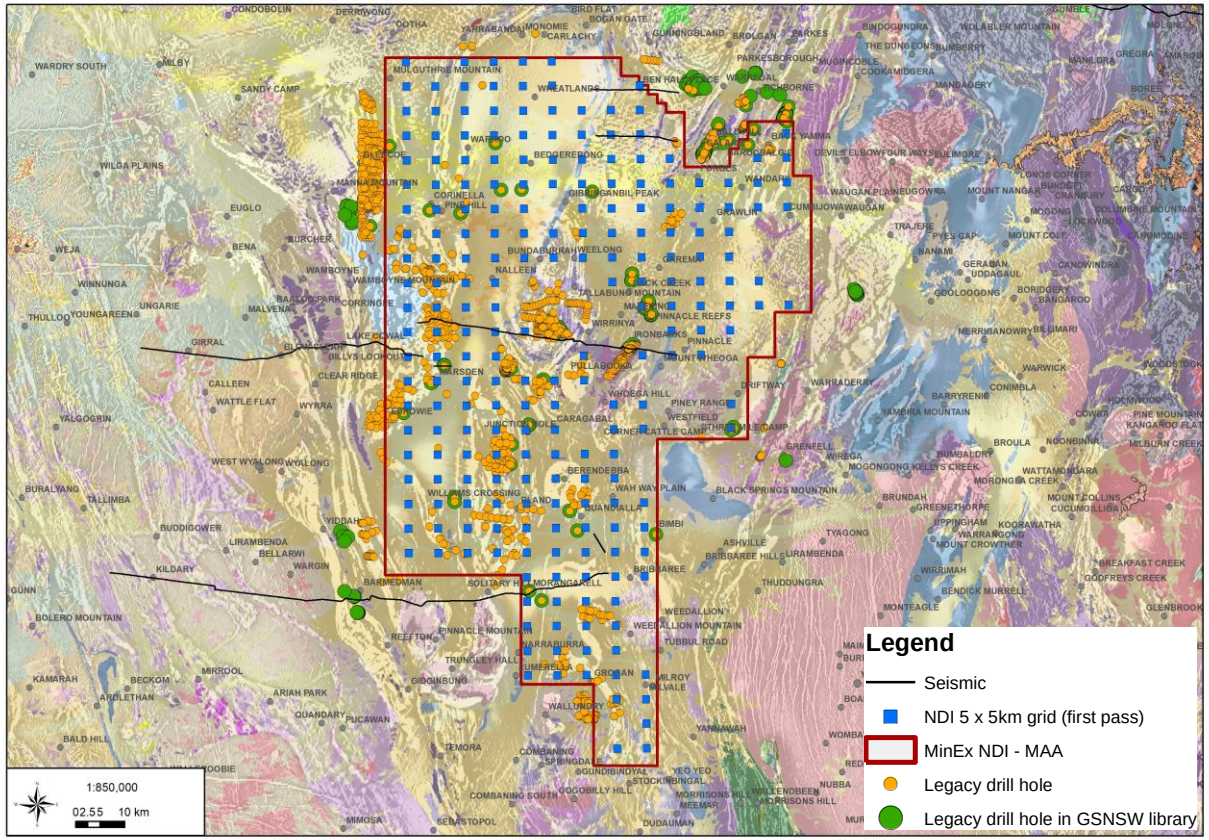
- Target basement
  - Willyama Supergroup, ~1590 Ma igneous
- Cover
  - Neoproterozoic-Devonian, Eromanga Basin, Eyre Basin, Quaternary
- Potential mineralisation
  - BHT, IOCG, MVT, unconformity, magmatic?
- Pre-drilling work
  - Geophysics (AEM, gravity, MT)
  - Mapping (including analytical)
  - Legacy drilling (including analytical)
  - Biogeochemistry
  - Hydrogeochemistry
- NDI drilling (2024)



- Key issues
  - Map the geology under cover, key time slices / interfaces
  - Basement signature in cover?
  - Correlation – Willyama Supergroup? ~1590Ma magmatism?
  - MT conductivity anomaly at depth
  - Re-run mineral potential models with under cover data

Forbes

- Target basement
  - Ordovician to Early-Middle Devonian
- Cover
  - Cenozoic, GAB, Late Devonian
- Potential mineralisation
  - Porphyry Cu-Au systems, plus epithermal, VMS, orogenic and magmatic systems?
- Pre-drilling work
  - Geophysics (AEM, gravity, MT)
  - Mapping (including analytical)
  - Legacy drilling (including analytical)
  - Biogeochemistry
  - Hydrogeochemistry
- NDI drilling (2025)



- Key issues
  - Map the geology under cover
  - Can we see basement signature in cover?
  - Geodynamic history – thermal history, basin fill, multiple deformation
  - Ordovician focus (mineral chemistry)

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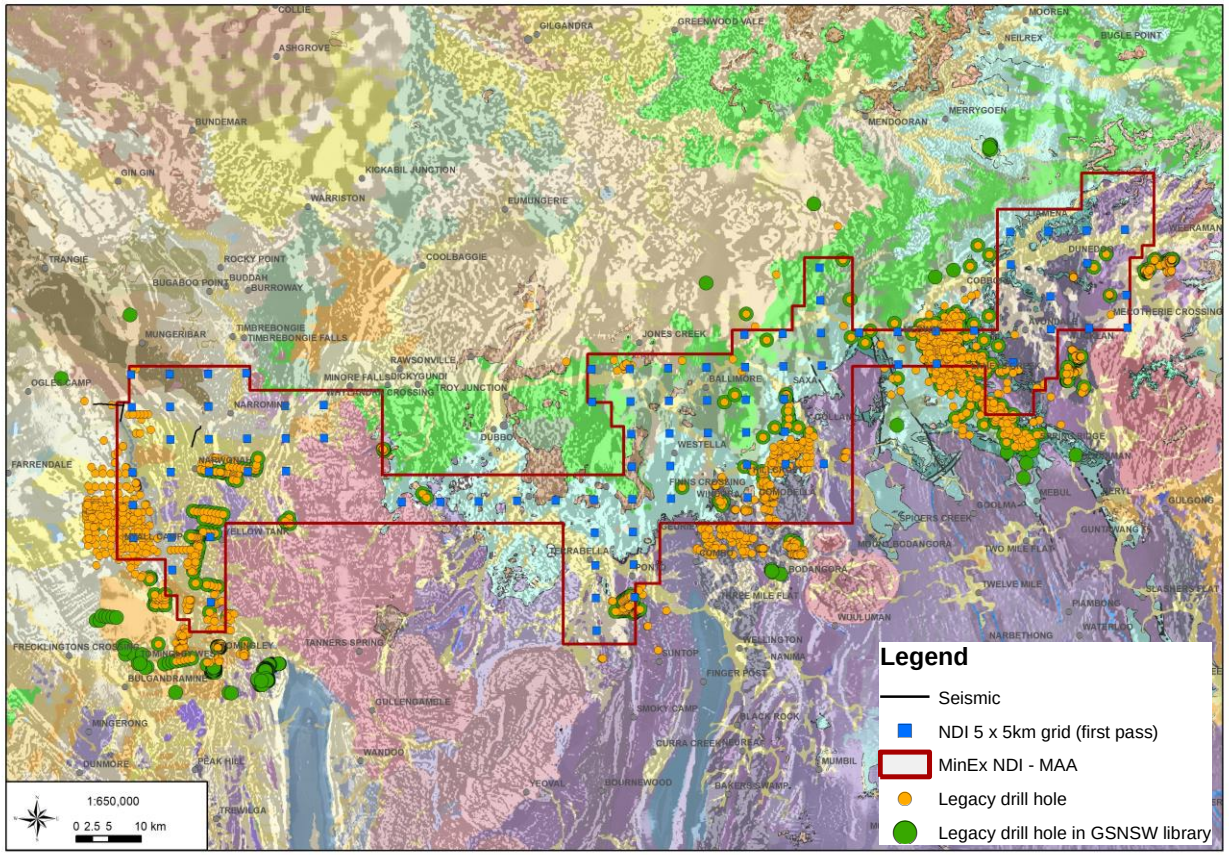
Dubbo

- Target basement
  - Macquarie Igneous Province (MIP) , Sil-Dev basins
- Cover
  - Cenozoic, Surat Basin, Sydney Basin
- Potential mineralisation
  - Porphyry Cu-Au plus epithermal, VMS, orogenic, magmatic systems?
- Pre-drilling work
  - Geophysics (AEM, gravity, MT?)
  - Mapping (including analytical)
  - Legacy drilling (including analytical)
  - Biogeochemistry
  - Hydrogeochemistry
- NDI drilling (2026)



- Key issues
  - Location and nature of MIP under cover to north?
  - Can you identify MIP through cover?
  - Possible PhD – MIP synthesis from drilling, mapping, geochem, correlations, mineral chemistry … 2025-27?
  - Sil-Dev basin opening, strain mapping of inversion

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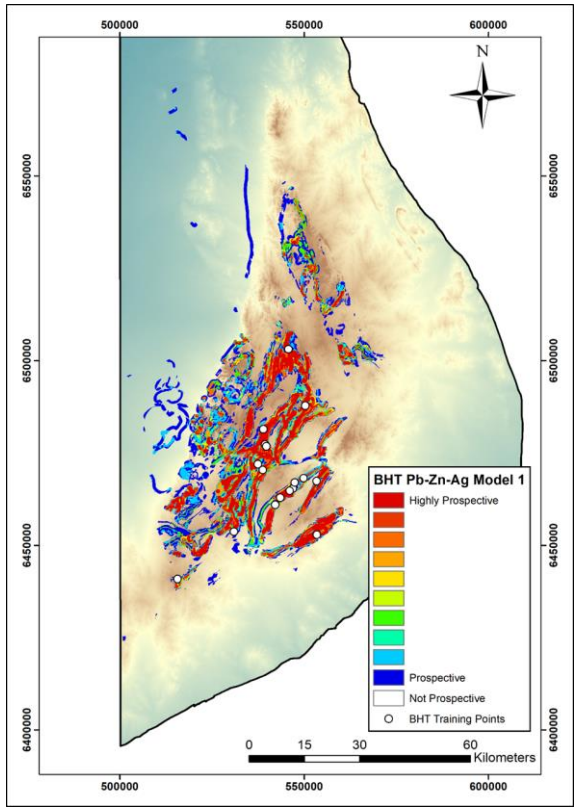
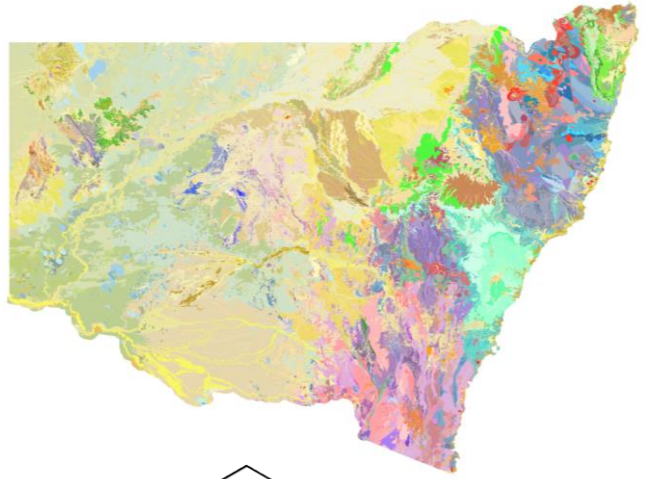
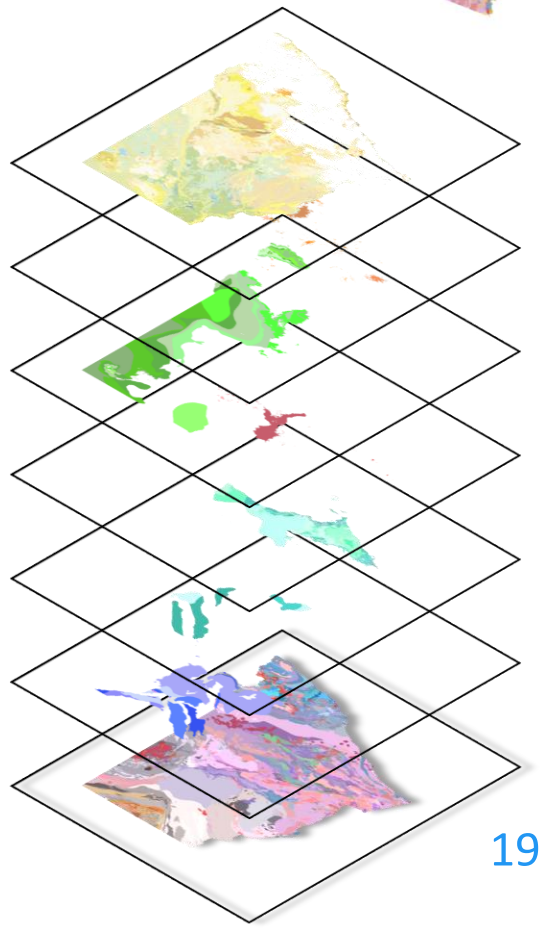
Why these areas? Mapping with a drill rig!

- Response to MinEx CRC vision
  - ‘acquisition of previously unobtainable data on prospective rocks under deep, barren cover’
- The logical step in developing our statewide framework
  - Seamless geology
  - Mineral potential mapping
- NDI critical to progress 2D into 3D, and from outcrop to covered areas







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GSNSW planning for MinEx CRC

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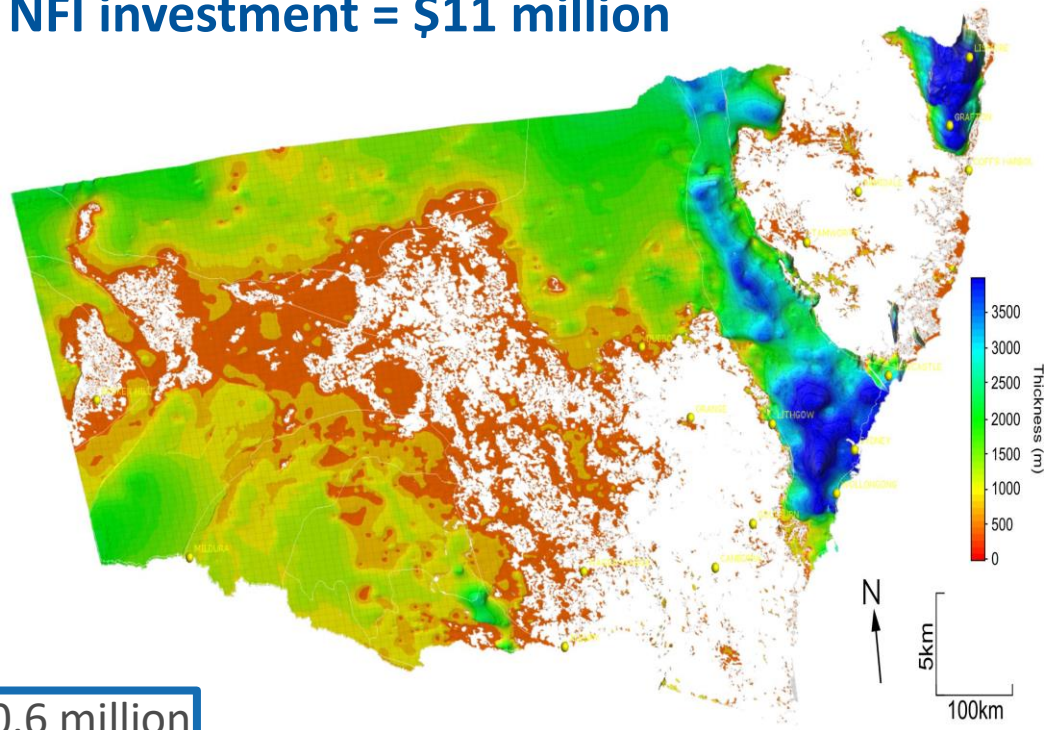
MinEx CRC will be the focus of the New Frontiers Initiative for 10 years

- ~$16m investment over 10 years
  - Brings leverage – CRC fund almost doubles it

- $4.4m cash
  - = subscription fee to CRC – spent entirely on drilling
  - $440,000 per year for 10 years

- $11.5M in-kind
  - Est. value of existing data - $2.4 million
  - Acquisition - geophysics - $3.5 million
  - Analysis - geochronology, (bio) (hydro) (geo) chemistry - $0.6 million
  - Staff time – 2 FTE x 10 years – valued at $5 million
    $2.5 million

Actual NFI investment = $11 million



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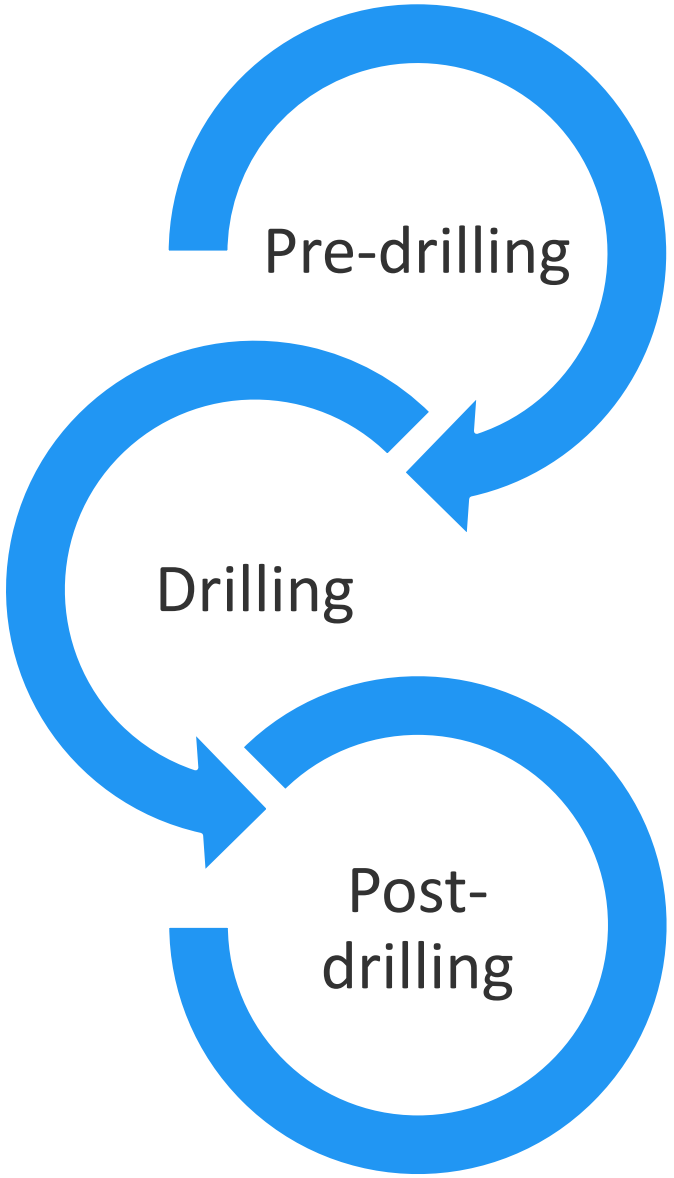
NDI programs in NSW

- Pre-drilling phase
  - Audit and gaps of legacy data
  - Geophysical acquisition and modelling
  - Mapping, logging, sampling, analysis
  - Biogeochemistry, hydrogeochemistry

- Drilling phase
  - Data handling, computation
  - Analysis (e.g. HyLogger, isotopic)

- Post-drilling phase
  - Interpretation, integration and 3D modelling



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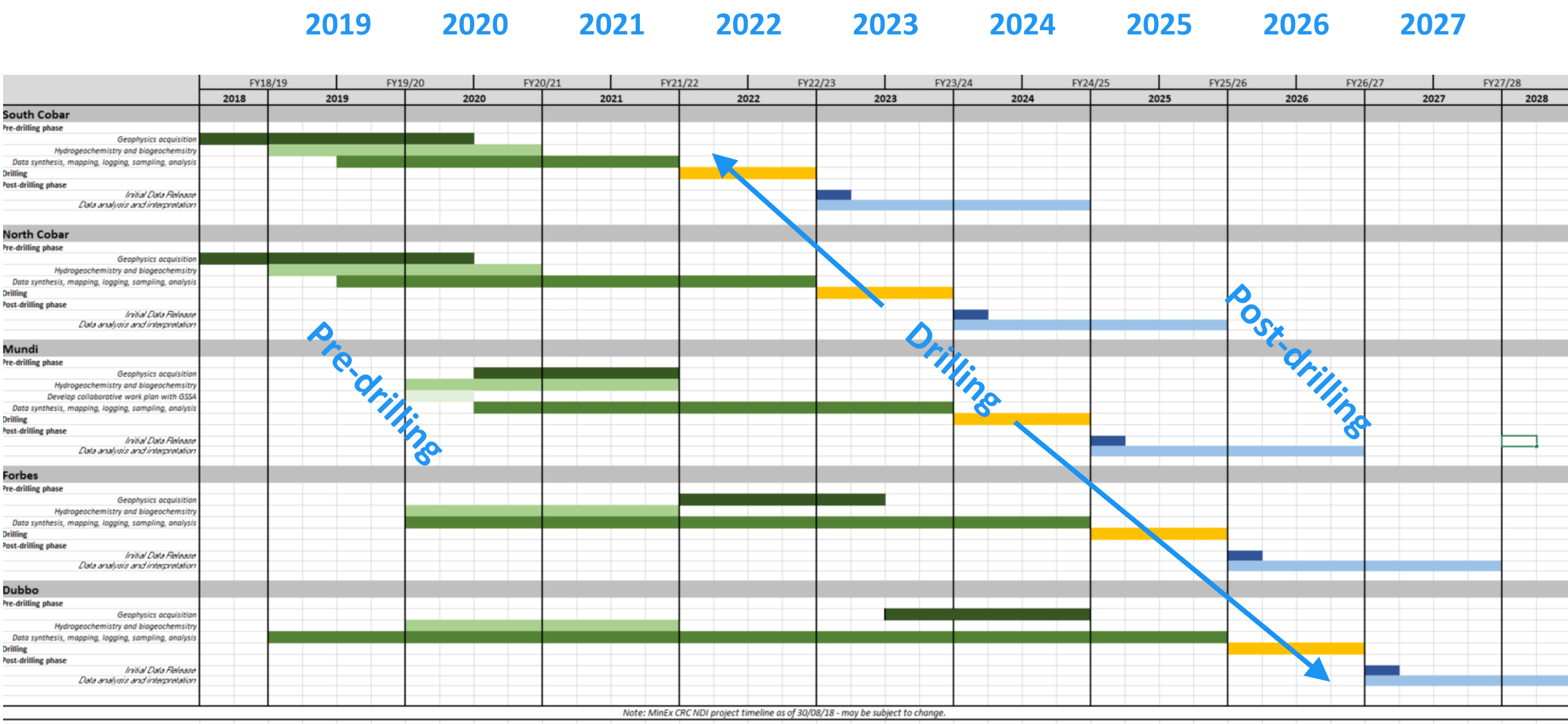
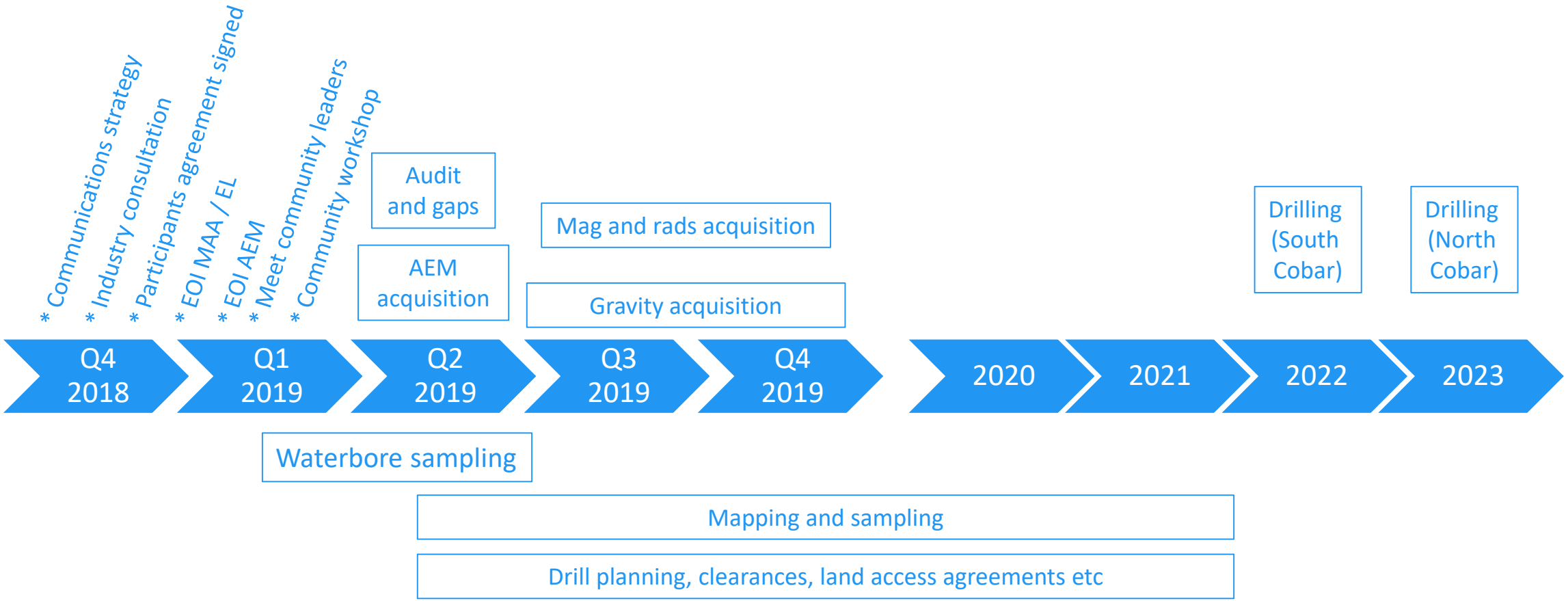
A ten-year plan



North and South Cobar basin timeline



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Cobar AEM acquisition

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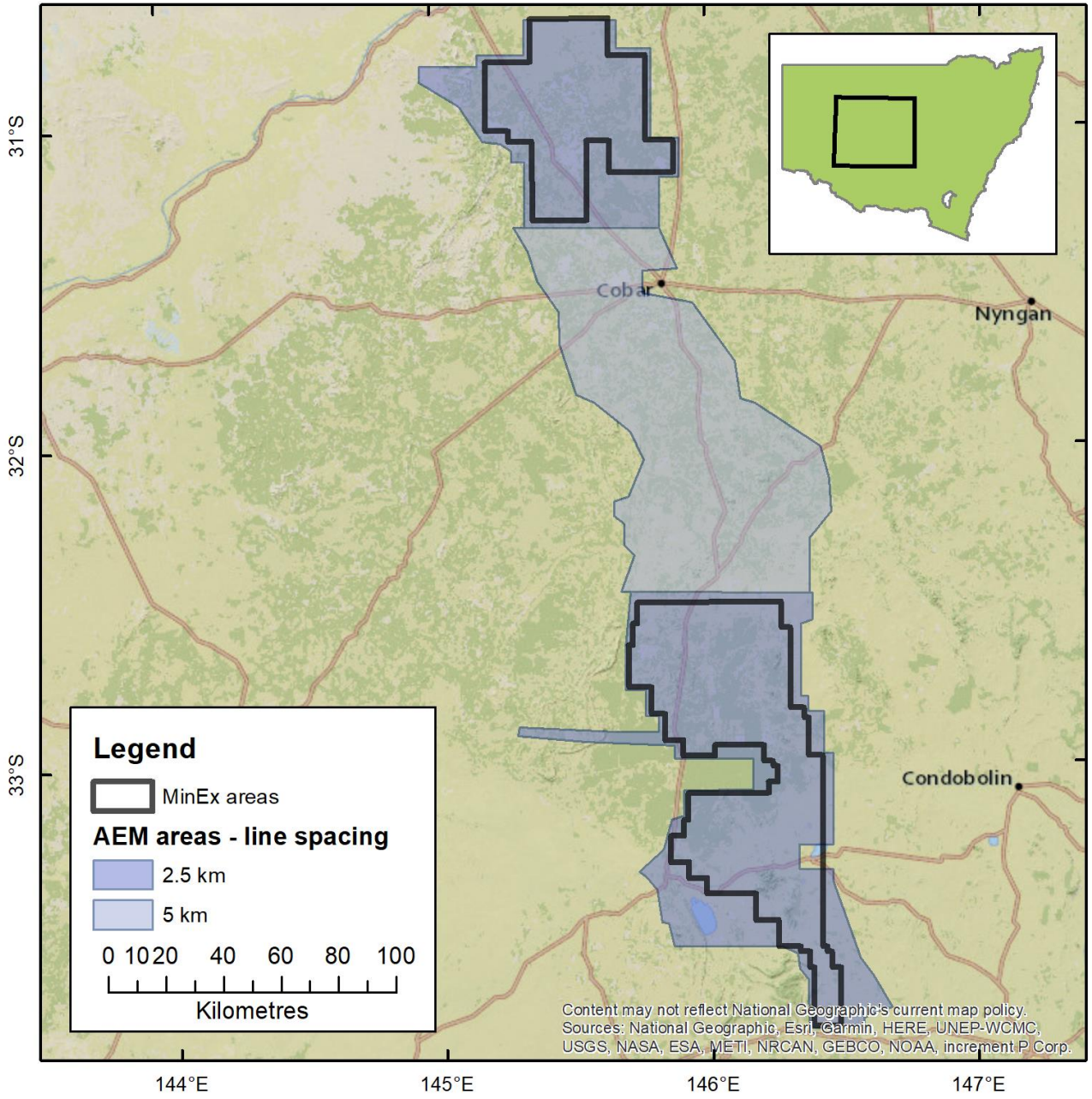

Cobar MinEx AEM

- GSNSW and GA are collaborating to acquire airborne electromagnetic data between April and June 2019.
- This survey will aid interpretation of:
  - Basement geology
  - Thickness of cover sequences
  - Potential groundwater sources.
- Survey specifications:
  - East-west flight line orientation
  - 2.5 km line spacing over MinEx areas
  - 5 km line spacing between MinEx areas.
- The largest AEM survey ever flown in NSW.

Cobar MinEx AEM

We are currently working on:

- Procurement
- EOI for industry infill
- Community consultation
- Survey design.

Image credit: Spectrem Geophysics

Image credit: CGG Airborne

Image credit: Geotech

Cobar MinEx AEM – EOI industry infill

GSNSW is approaching industry for EOIs via

- Articles in *On the Outcrop* and *Preview.*
- Letters to title holders in the survey area.
- Webpage with details on how to apply.
- Presentations and other media.

Infill area requirements

- Minimum area 5×5 km.
- Lines must be oriented east-west.
- Applications close 24/12/18.

Cost:

- Cost of infill to be funded by the interested party
  - Calculated on an *infill line kilometre rate*
  - *Infill line kilometre rate* will be known after supplier is accepted.
- Interested parties will be informed of the *infill line kilometre rate* and given the opportunity to proceed.

What will you get for your money?

- All logistics and community consultation handled for you.
- AEM line data that meet QA/QC requirements of GA and GSNSW.
- Copy of the logistics report.
- One year confidentiality for your infill lines.
- Best practice conductivity-depth images produced by GA.

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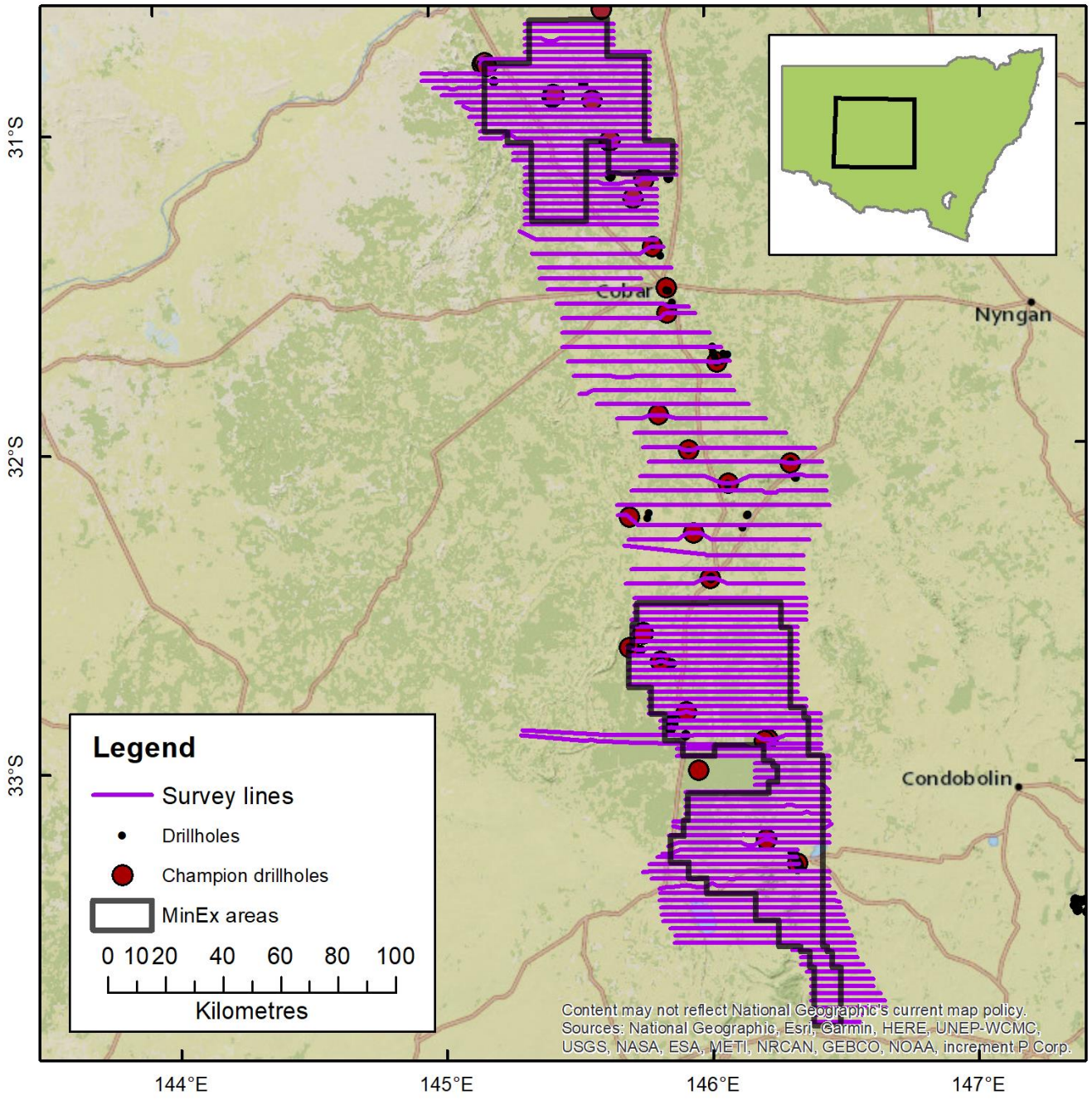


Cobar MinEx AEM survey design

To help correlate the results and aid interpretation the flight line path is designed to go over:

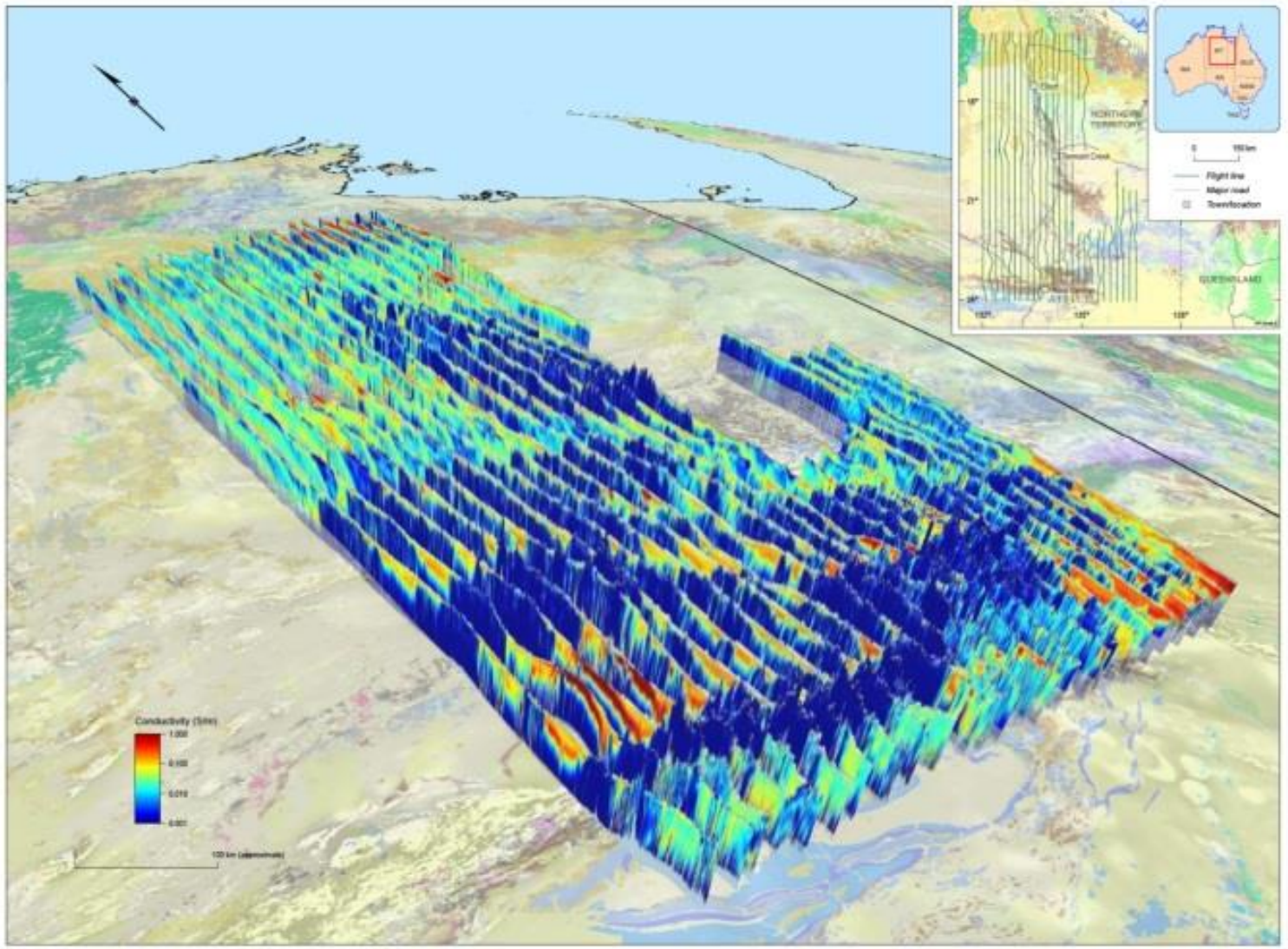
- Faults and geological boundaries
- Existing seismic coverage
- Water monitoring bores
- Regular waterbores
- Mineral boreholes + 'champion' holes (core stored at Londonderry, >200m).

We will be avoiding towns, infrastructure, dwellings, mines & agricultural buildings.

Cobar MinEx AEM

Data delivery in December 2019.

The final product will be similar to AusAEM.



Preliminary electrical conductivity model for the first Tranche of AusAEM (courtesy of GA)

MinEx CRC Mineral Allocation Areas

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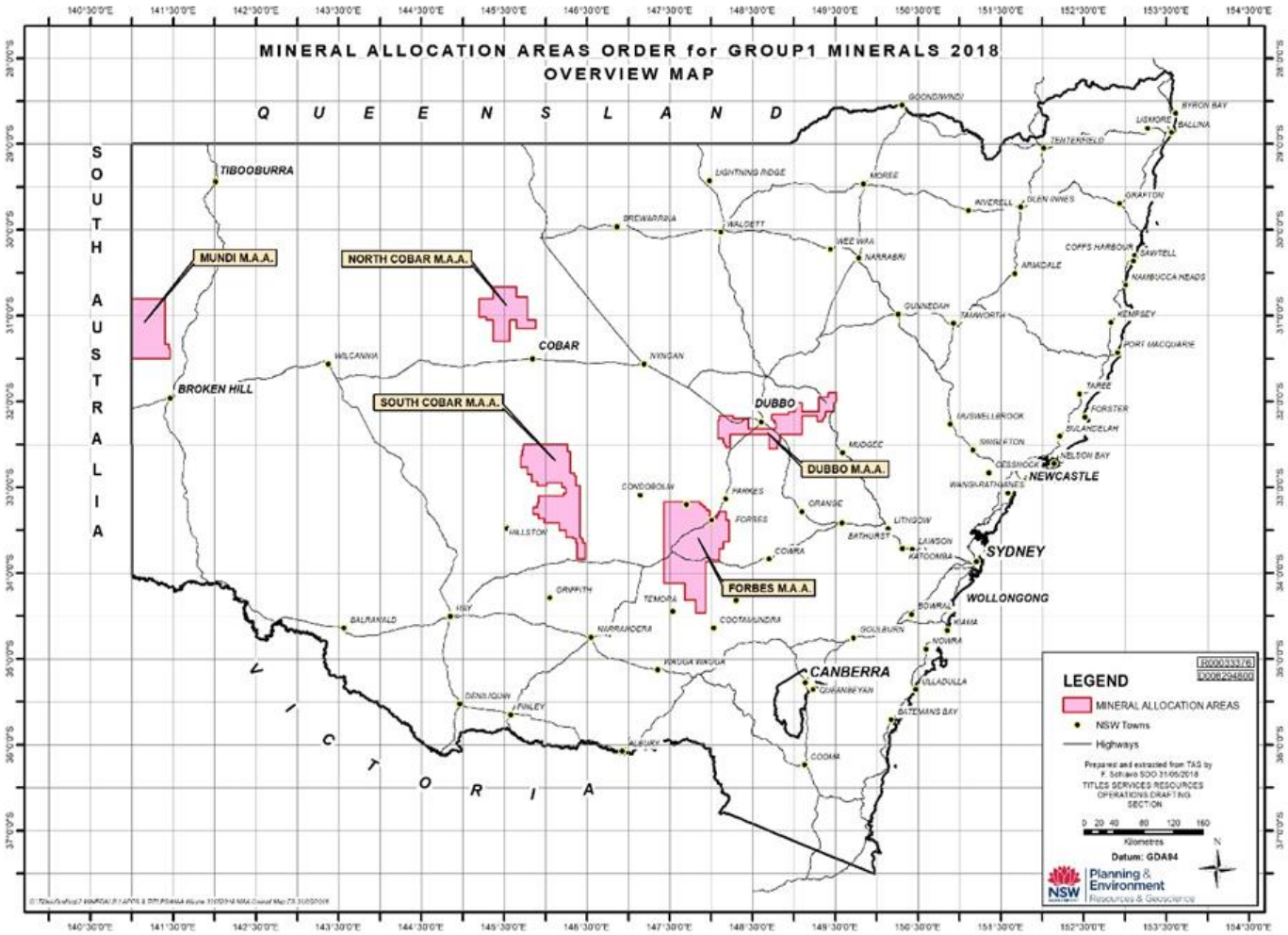
Impact of MAAs

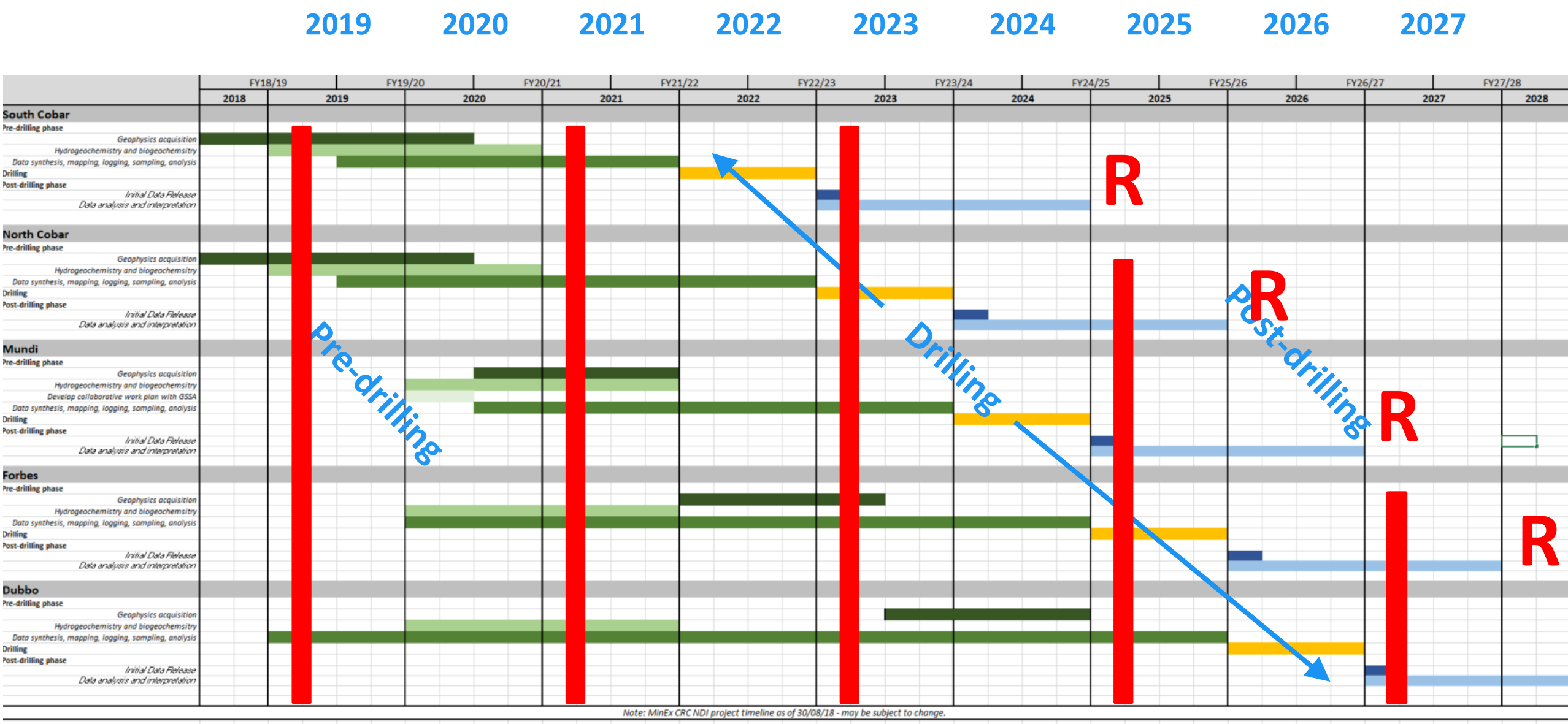
- Gazetted on 10 August 2018
  - Combined area represents 2.59% of NSW.
- No new Group 1 ELAs within MAAs without Ministerial consent.
- **NO IMPACT ON EXISTING TITLES/APPLICATIONS**
- Constituted to allow open discussion of NSW MinEx CRC NDI program, without the risk of speculative exploration title applications and land banking.
- GSNSW will work with the industry to develop an agreed process for grant of Group 1 ELs within the MAAs.



Options for release - 1

Option	Explanation	Positives	Negatives
1	Invite tenders for exploration licences on all MAAs as soon as possible, with further periodic tender release dates (for example every 2 years) across all areas. Consider imposing additional conditions of title (e.g. fixed terms, enforceable work program, prohibition of special circumstance renewal, only one renewal allowed etc.).	Allows assessment of tenders for controlled release, ensuring the best interested explorers obtain exploration licences in the MAAs. Allows GSNSW to ensure that exploration work programs are aligned to NDI work and goals.	Good explorers may still be locked out by early movers in the tender process, as some may want to wait until they see the value generated by the NDI before tendering for ground. Will require ongoing administration and probity oversight which could be difficult to resource and manage.

Options for release - 1



Options for release - 2

Option	Explanation	Positives	Negatives
2	Invite tenders for exploration licences on all MAAs as soon as possible, with one further tender release date for each MAA at the end of each NDI data release. Consider imposing additional conditions of title (as above), although potentially on the initial round of licences only.	Gives explorers an initial chance to gain ground in MAA areas, with their renewal periods timed to coincide with the second round of tenders. Allows GSNSW to ensure that exploration work programs are aligned to NDI work and goals.	Good explorers may still be locked out by early movers in the tender process. Will require ongoing administration and probity oversight which could be difficult to resource and manage. Some areas of the Dubbo and Forbes MAAs may be “locked” for an extended period of time.

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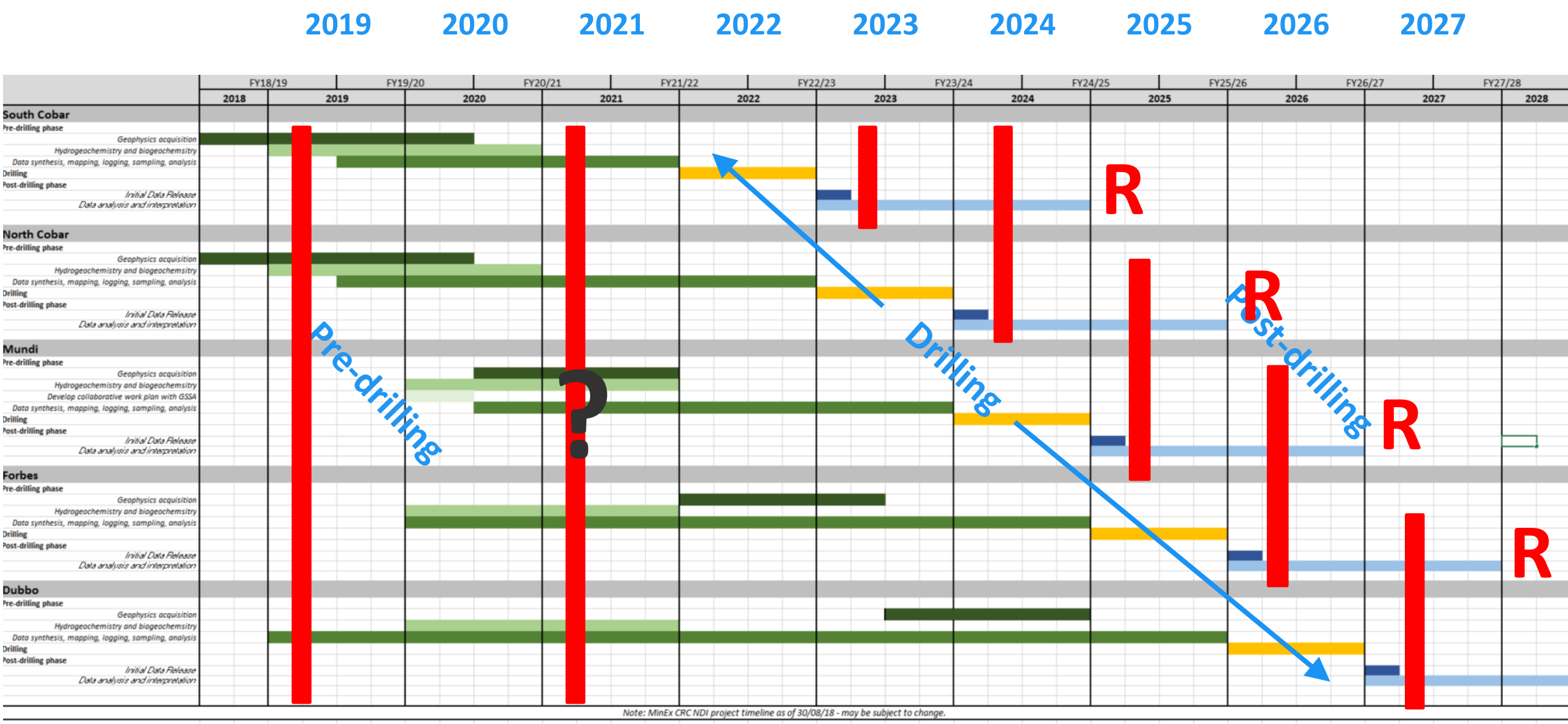
Options for release - 2



Industry consultation timeline

8/9 November 2018	Consultation paper sent to NFILC and David Salim, HEMTS
14 November 2018	Discussion of consultation paper at NFILC, including composition of the Working Group
20 November 2018	GSNSW Presentation on MinEx CRC to NSWMC Exploration Committee
22 November 2018	GSNSW Presentation on MinEx CRC to SMEDG

NSWMC and AMEC to circulate paper to members, along with a call for nominees

14 December 2018	Nominees to be submitted to the Department
Late January 2019	First meeting of Working Group
April 2019	Target date for first tender process

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Upcoming activites

Upcoming activities

- 23/11/18 - Execution of Participants and Affiliates Agreements
- Late November - Commence EOI process for Cobar AEM infill
- 5/12/2018 – EGM
  - Adoption of Constitution
  - Installation of MinEx Board
- Early/mid December 2018 – GSNSW MinEx information hub to go live
- 14/12/18 – Industry nominations for MAA consultation due
- 24/12/18 – EOI process for Cobar AEM closes
- January 2019 – Commencement of MinEx CRC research projects
- Late January 2019 – First meeting of MAA consultation committee
- April 2019 – MAA ELA process commences, Cobar AEM commences

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