

Overview

An airborne electromagnetic (AEM) survey measures natural variations in the electrical properties of soil, rocks and water. Surveys are conducted by government agencies and companies using a light aircraft or helicopter operated by a specialist contractor.

Current focus

AEM surveys are planned as part of the MinEx Cooperative Research Centre's (MinEx CRC) National Drilling Initiative (NDI) – a national collaboration to further our understanding of the geology and metal deposits in areas where rocks aren't exposed at Earth's surface. The survey will also help identify and map groundwater resources in these areas.

In NSW, work associated with the MinEx CRC is focussed on the North Cobar, South Cobar, Mundi, Forbes and Dubbo areas. The largest AEM survey ever acquired in NSW was completed in the greater Cobar area in 2019 as part of MinEx CRC activities.

About surveying

In NSW, the Geological Survey of New South Wales (GSNSW – a state government agency) collaborates with Geoscience Australia (GA – a federal government agency) to fly AEM surveys through a specialist contractor. The data is then processed, modelled and interpreted by geoscientists.

The natural variations in the electrical properties of soil, rocks and water can be used to identify conductive materials such as red soils, salt, saline water, clays, porous rocks and aquifers, fractured rocks in fault zones, shale, graphite, sulfides.

We can also use it to identify non-conductive rocks/soils such as:

- granite
- basalt and other volcanic rocks
- quartzite
- sand.



A helicopter towing an AEM transmitter and receiver (Source: Geotech Airborne).

Survey process

Surveying is done by using a fixed-wing aircraft or a helicopter, with equipment mounted on or under it. The most visible part of the equipment is a loop of cable around the fixed-wing aircraft, or towed beneath the helicopter.

Electromagnetic measurements

The equipment used is like a large, sophisticated metal detector. A transmitter emits an electromagnetic (EM) signal from the device attached to a fixed-wing aircraft or helicopter. The signal induces currents in the earth, producing a secondary EM field which is measured by a receiver. The receiver is towed behind a fixed-wing aircraft or below a helicopter on a device called a 'bird' (see photograph below). Measurements from the receiver are recorded with GPS readings.

As the receiver measures the natural electrical conductivity of the surface and subsurface of the Earth, the composition of soil, rocks and water in the subsurface can be interpreted based on their physical properties.

Flight logistics

A professional and experienced AEM company will be contracted by GSNSW and GA to conduct the survey. They will make every effort to ensure that there is minimal impact on the environment and community. The contracted company will adhere to strict aviation protocols (regulated by the Civil Aviation Safety Authority).



A fixed-wing aircraft with the AEM transmitter inside the aircraft and the receiver loop fixed to the outside (Source: CGG).

The fixed-wing aircraft or helicopter flies daily (weather permitting) during daylight hours, typically at 30–120 m above the ground, on parallel lines at a regular spacing. For example, the survey may be flown along approximately east–west lines at either 2.5 km or 5 km line spacing. Selected areas may be flown with lines closer together over areas of interest.

The aircraft will fly outside the survey boundaries when it is:

- flying to or from an airfield outside the survey area
- turning around at the end of a survey line.

During surveying, the aircraft will divert from planned flight lines to:

- avoid towns, built-up areas, buildings such as houses/homesteads/sheds, construction sites, stock concentrations at watering points and yards, and steep terrain.
- fly over existing water monitoring boreholes, mineral drillholes and seismic lines. The information collected at these locations will be used to correlate the AEM data with other data sources.

Survey results

The survey results are used by a wide range of people, including:

Agronomists: to examine the nature and type of soil in three dimensions (3D) and the implications for soil fertility.

Geoscientists: to interpret the nature and thickness of soil and sediments over bedrock. They can also interpret bedrock under cover, and identify geological features such as faults.

Landholders: to identify areas with potential groundwater and to evaluate soil suitability for cropping or grazing.

Local governments: for land use planning and to help identify potential water resources.

Water resource scientists: to investigate potential groundwater and fractured-rock aquifers in 3D.

The data will be available to view as images and for download from MinView after surveying, processing and quality checks are completed, a process that generally takes around six months.

Interpretation of AEM data is complex and time-consuming. A report summarising the outcomes of the survey data will be prepared once initial interpretation is completed. However, it is likely that interpretation and report preparation will take at least 12 months, following release of the data. You will be able to access a copy of the report once the data has been processed and publicly released. You will also be able to access models and interpretation of the data when completed.

More information

Landholders and local communities will be notified in advance of AEM surveys. A hotline is available for government AEM and other geophysical survey enquiries – phone 1800 960 522. Information including flight plans will be updated regularly during AEM surveys on our website:

To learn more about MinEx CRC and how we will use the results, please visit:

Email: minex.crc@planning.nsw.gov.au

Website: www.resourcesandgeoscience.nsw.gov.au/minexcrc

What does this mean for me?

The electromagnetic fields emitted by the AEM transmitter are similar in amplitude to those produced by power lines.

The height and speed of the fixed-wing aircraft or helicopter will limit any exposure to you or your livestock.

The noise of the aircraft will be similar to a low-flying crop duster.

© State of New South Wales through Regional NSW 2020. The information contained in this publication is based on knowledge and understanding at the time of writing (September 2020). However, because of advances in knowledge, users are reminded of the need to ensure that the information upon which they rely is up to date and to check the currency of the information with the appropriate officer of Regional NSW or the user's independent adviser.