

Exploration Methods Explained: Geophysical Surveys

Geophysical surveys can help identify resources without the need for sampling and are usually undertaken with minimal surface disturbance. Different geophysical surveys measure various physical properties of the Earth and have different applications and equipment. Geophysical surveys can be conducted from the air, on the ground or down drill holes.

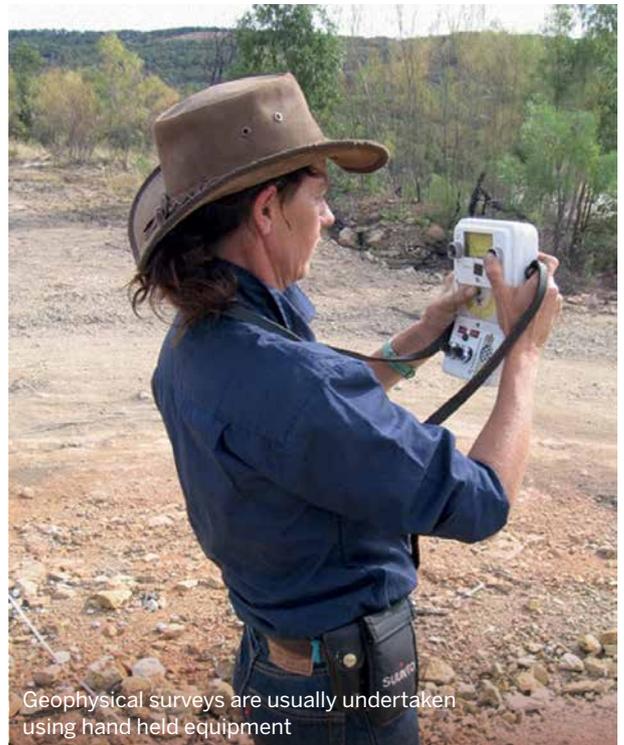
Airborne geophysical surveys

Airborne geophysical surveys may comprise magnetic, radiometric, gravity or electromagnetic surveys. These surveys provide general geological information for an area and are often used in the initial stages of exploration. These surveys are typically undertaken using low flying helicopters or light aircraft which fly in a grid pattern. The instruments may be either mounted on the aircraft or towed underneath. Depending on the type of survey, the aircraft may fly between 25 and 60 metres above the ground, with flight lines spaced between 25 and 200 metres apart. Companies planning airborne surveys are required to notify landholders before the survey begins.

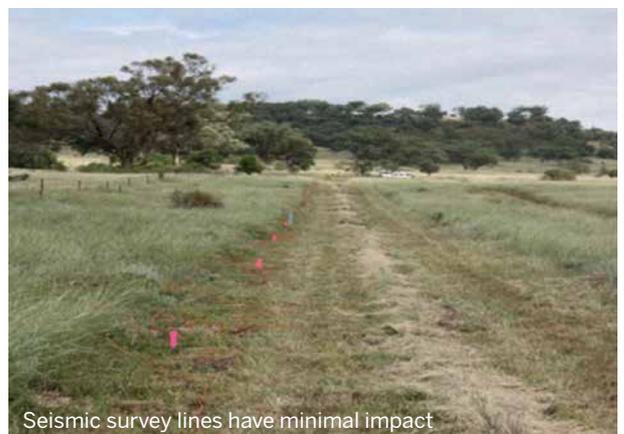
Ground based surveys

There are a number of types of geophysical surveys which are undertaken on the ground. These include:

- **Seismic surveys** – Seismic surveys measure vibration as it passes through the Earth. This is done using a series of geophones (sensors connected to wires) placed using hand-held tools and arranged in an array or specific pattern. This gives information about the properties of the rocks, often down to depths of several kilometres. The vibrations may be induced using truck-mounted vibrating weights or small explosives. Seismic surveys are particularly suited to specific geological forms including flat-lying sedimentary basins.

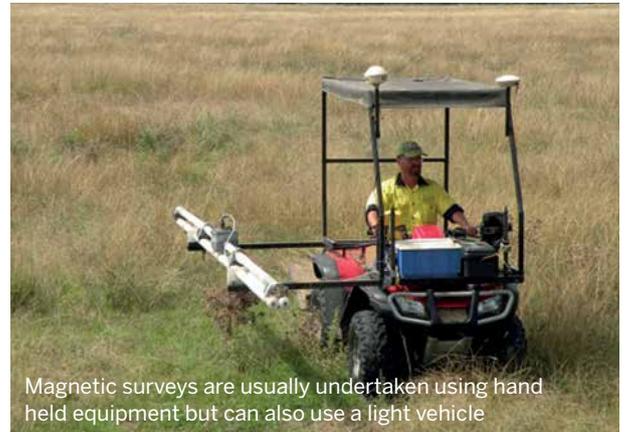


Geophysical surveys are usually undertaken using hand held equipment



Seismic survey lines have minimal impact

- Magnetic surveys** – Magnetic surveys measure the variations of the Earth’s magnetic field due to the presence of magnetic minerals. Subtle variations in the abundance of magnetic minerals are used to interpret rock types and can assist in identifying resources. These surveys are typically undertaken by a geophysical technician on foot carrying a magnetometer and a sensor on a pole. They are most often used in metallic mineral exploration.
- Radiometric surveys** – Radiometric surveys measure gamma rays which are continuously being emitted from the Earth by natural decomposition of some common radiogenic minerals. Most gamma rays emanate from the top 30 centimetres of rock or soil which can be detected by airborne surveys or on surface rocks using a hand-held spectrometer. These surveys are most often used in metallic and industrial mineral exploration.
- Gravity surveys** – A gravimeter measures the gravity field to determine variations in rock density in the Earth’s crust. Ground gravity surveys require a geophysical technician to take gravity measurements at set intervals of distance and record the precise height at each location. Access to the recording sites can be by vehicle or helicopter, depending upon remoteness. These surveys are used in mineral and energy exploration.
- Induced Polarisation (IP) surveys** – IP surveys induce an electric field in the ground and measure the chargeability and resistivity of the subsurface. The technique can identify changes in the electric currents caused by different rocks and minerals. Readings are taken by a small crew who shift a ground array or pattern of transmission and receiver cables. These surveys are most often used in metallic mineral exploration.
- Electromagnetic (EM) surveys** – EM surveys induce an electromagnetic field and measure the three dimensional variations in conductivity within the near-surface soil and rock. Conductive units can be studied to locate metallic minerals, and to understand groundwater and salinity. Ground readings are taken by a small crew who shift a ground array or pattern of transmission and receiver cables.



Magnetic surveys are usually undertaken using hand held equipment but can also use a light vehicle



IP survey equipment



IP surveys measure resistivity to help identify different minerals

Down hole surveys

These geophysical surveys involve putting geophysical equipment down exploration drill holes to gather magnetic, radiometric or electrical information from the rocks adjacent to the hole. The surveys may also be used to determine the exact path of the drill hole. They require a small truck or simply a winder on a tripod and a range of down hole tools. Occasionally tools with a small radiometric source may be used and a detailed risk assessment is required to ensure the tool is not lost down hole.

Regulation of Geophysical Surveys

Geophysical surveys are strictly regulated in the conditions of all exploration licences. As most survey work has minimal, if any, surface disturbance, further approvals for this work are only required in sensitive areas. On private land, this work must be included in an access agreement prior to commencement.



Down hole geophysical surveys use existing holes

Rehabilitation of Geophysical Surveys

Rehabilitation is a condition of every exploration licence and undertaken as soon as practical following surface disturbance. Planning for rehabilitation is undertaken prior to surface disturbance and occurs in consultation with the landholder.

Surface disturbance from most geophysical surveys is minimal and rehabilitation is usually undertaken straight after the survey. Any disturbed soil is replaced, reseeded and fertilised as appropriate to the surrounding area.

Further information:

NSW Trade & Investment – Division of Resources and Energy www.resources.nsw.gov.au

NSW Minerals Industry Exploration Handbook www.nswmining.com.au/menu/media/publications

For additional Exploration Fact Sheets, see www.nswmining.com.au/menu/media/fact-sheets

These descriptions are primarily provided for those who may not be familiar with exploration operations. As a result they are, by their nature, general. The descriptions have been written in consultation with the NSW Trade & Investment – Division of Resources and Energy. Our thanks to Malachite Resources Limited, Oakland Resources Limited and Alkane Resources Ltd for contributing photos to this fact sheet.

Disclaimer: This fact sheet is intended to provide general information only. It does not intend to be comprehensive or to provide specific legal advice. Given the changing nature of legislation, regulations, program rules and guidelines, there is a potential for inherent inaccuracies and potential omissions in information contained in this fact sheet. All information in this case study is provided 'as is' with no guarantee of completeness or accuracy and without warranty of any kind, express or implied. In no event will New South Wales Minerals Council Limited, any related members, consultants or employees thereof be liable to anyone for any decision made or action taken in reliance on the information in this paper or for any consequential damages.