CASE STUDY

Stream C
Pieman River Pipelines Monitoring with UDM Group
MMG is in the process of replacing the main pipeline that supplies water to the surface and underground operations from the Lake Piemen. The pipeline line is buried below the surface and is almost 1.5 km long and follows a service road for most of the route.

MMG contracted UDM Group to locate as much of this pipeline as possible along the suspected route. UDM Group was supplied with a design plan from 1970 which showed the Approximate route of the 15” Asbestos Cement Rising Main and Access route from the Pieman River to the Rosebery Mine.
Due to the material of the rising main being Asbestos Cement (AC) it cannot be traced by traditional methods of Electromagnetic Location (EML). Due to these factors Stream C by IDS GeoRadar was utilised.

This Ground Penetrating Radar (GPR) works by sending a signal into the ground and listening for reflections from that signal, and contains its own transmitter and receiver within the unit.
Ground Penetrating Radar is a non destructive technique that provides high resolution reflection profiles of the subsurface.

The technique works by pulsing electro-magnetic energy in the form of radio waves into the subsurface material with a transmitting antenna.

Reflection of energy occurs at boundaries between media which have contrasting electrical properties such as underground utilities, structures and tree roots, within soil/rock which are detected by a receiving antenna.

The equipment that was used for this survey was an IDS GeoRadar Stream C GPR System. Stream C is a massive array system with 32 channels @600MHz, able to collect dense high quality data.
Survey control was established on site to convert the GPR data back to MGA/AHD Datum.

The position of the Stream C was then tracked with a GNSS and/or Total station throughout the GPR survey to ensure accurate positioning and depths were recorded.

GPR acquisition occurred on March 2019 along as much of the 1.5 km access road as possible in varying weather conditions.
Much of the pipeline route sits within the Mt Read Volcanic Belt, thus geological conditions range from minor siltstone and volcaniclastic conglomerate, typically quartz-feldspar-rich, within Tyndall Group.

These changes in geological conditions make any GPR Survey challenging in determining an utility's depth and location.
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Electrical Properties Relating to GPR

Electrical Conductivity of common materials
The Attenuation Losses: a rule of thumb

- Low conductivity - excellent radar conditions (cond. < 10-7S/m)
  - Air
  - Dry granite, dry limestone
  - Concrete, asphalt

- Medium conductivity - medium radar conditions (10-7 cond. < 10-2S/m)
  - Freshwater, freshwater ice, snow
  - Sand, silt, dry clay, basalt, seawater ice

- High conductivity - poor radar conditions (cond. > 10-2S/m)
  - Soaked clay, soaked shale
  - Seawater

Water content (grams H₂O/grams soil)
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GPR Survey Acquisition

To determine the position and depth of the AC pipeline, **over thirty separate projects** in three days were conducted along the route.
In some sections along the pipeline route the asset was easily identified and verified on screen. However other areas were more difficult to trace and required further investigation during post-processing. This was dependent on either the depth of the service or the ground conditions at the time of survey.
Post-processing was completed to join all the surveys data together to assist in target acquisition. Tomography, slice data and videos were prepared to assist in visualizing the possible targets at differing depths.
In the **3D Viewing software (GRED HD)**, Cut 1, Cut 2 & Cut 3 were used to pick the target (pipe obvert) simultaneously.

This was traced approximately every **4-6 meters** where possible.

The depth of the pipeline varied from **1.6 meters** to **2.5 meters** deep.
Once the target was verified within each project area, the 3D pipes were exported to CAD. The approximated design pipeline was then digitised from the original 1970’s drawing and then compared to actuals.

Where there is no as-built data due to change in ground conditions and/or depth greater than 3 meters, assumptions should be made as to where the position/depth of the pipeline lies. The as-built GPR Surveyed pipeline was then overlaid onto the existing LIDAR and aerial photography of the Rosebery mine supplied in 2018.