TOORONGA RESOURCES Pty.Ltd.

Procedure for Detailed 3D Induced Polarisation Survey

This procedure enables rapid coverage of an area with deep penetration. The following description presumes the lines are surveyed north south.

1. Place remote transmitter electrode. This should be at a distance of at least 2 times the maximum distance from the moving transmitter electrode to the receiver dipole. In this case the remote electrode should be at least 2.4km from the near edge of the survey. The remote electrode should preferably be in a direction roughly perpendicular to line direction and for best contact should be placed in standing water such as a creek or dam if possible. Two or three separated small alfoil pits in the wet mud on the side of the dam will make better contact than a single large electrodes. If possible wires should be concealed (shallowly buried?) near the water to discourage curious cows as the remote will need to stay in place for the duration of the survey.

2. Run wire from remote. The remote wire should not cross the central part of the survey area if possible and if it does it should cross the line of receiver dipoles at close to perpendicular. I suggest for this survey that around the southern edge of the central part of the survey area may be appropriate. It is not necessary for the remote wire to be outside the area of transmitter locations, it is only important that this wire is kept away from any receiver electrode locations.

3. Mark out locations of receiver electrodes. If a grid is not in place then it may be necessary to survey out locations for receiver (and transmitter?). This can happen at the same time as the remote is being put in if enough people are available.

NOTE - For points 4 through 9 repeat for each line. Try to survey one receiver line per day. I suggest that this survey start where the terrain is flatter so that the crew can become familiar with the survey procedure before getting into rougher country. See attached diagram for a detailed layout of the survey.

4. Place receiver line. 17 electrodes and connecting cables make 16 dipoles to be read with two lines of transmitter poles 200m offset from the receiver line. Make sure the receiver pots are well watered as they are required to operate all day.

To speed up the survey, you can use 4 receivers, the next 2 on the next receiver line over. This lets you collect 32 receiver positions at once greatly speeding up the survey. If this procedure is used then you need only transmit on the transmitter line once. The drawback is that if the operator has difficulty on one of the receiver setups then it will hold up the whole survey. If the equipment is properly maintained and care is exercised in the layout of the spread then these problems can be minimised.

5 Run a remote wire along the first transmitter line. This should only be necessary on the first day as the wire will be in place from the previous day on other lines. (If using 4 receivers then you only transmit on this line once and the first transmit line is inside the receive line. See diagram).

6. Set up receiver operator(s) in center of receiver spread(s) and check contacts.

7. Run transmitter along the first transmitter line. I suggest in this case that the transmitter be moved from the north end of the line to the south for the first (western) transmitter line of each receiver line, and that for the second (eastern) line the transmitter is moved from the south to the north. That way the remote wire will be in place for the start of the next days survey and the last six or so electrodes (depending on how many stainless electrodes are available) can be left in place for the next day.

Off the end of the receiver array the transmitter pole separation is 200m and in the centre of the array it is 100m, directly in line with the receiver electrodes. This gives 25 transmitter locations per transmitter line, or 50 per day.

I suggest that the procedure with moving the transmitter would be to have the transmitter on the back of a vehicle and that this be moved along the remote wire. An assistant will be in front of the vehicle 100m and will be putting in the current electrodes. As he is close to the vehicle he can use a reasonable amount of water for each electrode and come back to the truck for more water or electrodes as necessary. The transmitter operator will cut the remote wire and connect it to the transmitter. The closest electrode (next to the vehicle) will also be connected to the transmitter. When the receiver operator is ready the transmitter will be turned on. With the transmitter next to the operating electrode, the risk of accidents is reduced, the operator will not try to remove the electrode while transmitting. The receiver operator will then record on all 16 of the receiver dipoles and will let the transmitter operator know when he has finished via radio. When the transmitting is complete, the transmitter operator reconnects the remote wire removes the near electrode and drives to the next location. Every few hundred metres he does not reconnect the wire but ties it off to the back of the truck so that it will all be at the end of the line ready to be pulled out on the next transmitter line.

In areas where it is not possible to drive the transmitter along the line it will be necessary to have the transmitter stationary and the assistants connect the wire to each electrode in turn. In this case, strict procedures will be necessary to ensure that the assistant is clear of the electrode before it is energised. Methods similar to these were successfully implemented a trial survey similar to this but it is very important that the person moving the electrodes is in clear radio contact with the transmitter operator and that a secure system of checks is in place to prevent the electrode mover going near a live electrode.

8 If using one set of recievers:Move wires. When the first transmitter line is complete, the wires attached to the transmitter vehicle can be pulled out along the next transmitter line.

9. Move transmitter along second line. Similar procedure as for the first line but the wire is reconnected and not moved so it will be ready for the next day. At the end of the second line, as many electrodes as are available can be left in place for the next days operations.

If using 4 receivers, ie 2 receiver lines, you will move the outside receiver setup across 400m and the transmitter line across 400m.

10 At the end of the survey the wire for the remote electrode can be brought in.

Notes on this procedure: This survey technique is designed to efficiently collect as many readings as possible. When the transmitter pole is a very long way from the receiver dipole the signal levels can fall below 10mV making the collection of IP data difficult. This is particularly a problem where the moving current pole is in rocky ground and so current levels are down. Because the system collects a large number of readings (800 per day versus 60 or 70 for a standard dipole-dipole survey) it is reasonable to allow a few bad readings to come through. Before processing I will delete bad readings based on three criteria, being that the SD of the chargeability should be no more than 25% of the chargeability reading, Isolated negative chargeabilities are deleted and any reading where the decay signal is not monotonically decreasing are deleted. In the trial survey these criteria deleted about 8% of readings. For this reason it is not essential that every reading be perfect. Up to 10 or 15% bad readings are tolerable without greatly affecting the results so long as these are not all in one location. If more than 15% of bad readings are detected it may be

necessary to try to increase the transmitter current by using more than one electrode plate at each transmitter location. These should be separated from each other by a few metres.

Of course if the survey is proceeding well it will be worth spending time to get as many good readings as possible. The main consideration is that, wherever possible, the survey covers one complete line in a day.

For 1 receiver line setup, if on any day (possibly excluding the first day where there will be startup delays) it appears that it will not be possible to complete the second transmit line, then it is reasonable to use less electrode locations for the second transmitter line by for instance taking the transmitter separation to 200 meters through the centre of the array (which will save 8 transmitter locations).

Try, however, to have all the 100m separated transmitter locations for the first transmitter line as the inversion program likes to have as many different electrode locations (both receiver and transmitter as possible). If the survey line is completed well within a day, the additional time should be taken up by recording some transmitter locations on the line 600m from the receiver array (i.e. the second transmitter line for the following day).

It will probably not be necessary to have an accurate grid in place for this survey. Errors of location up to about 10 metres are tolerable as this is well within the resolution of the system. I recommend that a base line be flagged and it may be a good idea to have the receiver electrode locations reasonably well marked. It would be feasible to have a 100m chain on the front of the transmitter truck, which the current electrode digging assistant can pull along and use with a compass/GPS to locate the transmitter positions. (So long as the transmitter operator stops the vehicle at the same location relative to the electrode every time.)

Survey Setup for 100m Reciever Electrodes