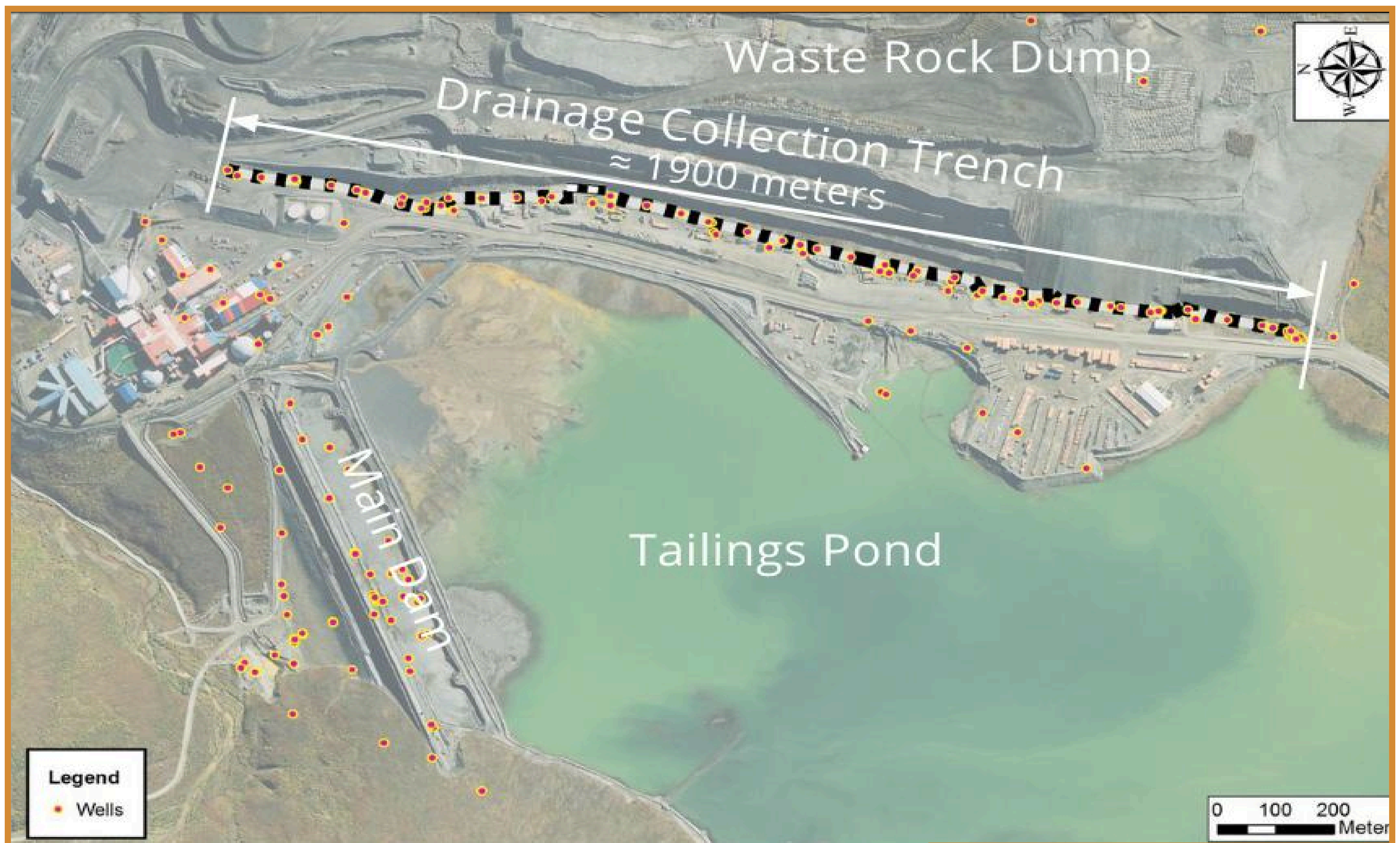
CASE STUDY: Alaska Zinc Mine - Preferential Flow Paths Identified

NON-INVASIVE TECHNOLOGY TO FIND PREFERENTIAL FLOW PATHS IN MINE WASTER ROCK DUMPS

Willowstick LLC



Zinc Mine Located In Alaska

Introduction

Contaminated seepage flow paths entering and/or exiting tailings impoundments are a major headache for mine owners and regulators. These preferential seepage flow paths are difficult and expensive to find and they often follow paleochannels. Traditional methods, which often include drilling several boreholes, that are expensive, time-consuming and inexact. A much better alternative is the MagnetoMetric Resistivity (MMR) method, which can be used to identify the exact location of preferential groundwater flow paths. The method uses electrodes that are placed strategically upstream and downstream of the area of investigation, and the water between them is energized with a low voltage, low amperage, alternating electrical current with a 380 Hz frequency. The current creates a distinctive magnetic field that represents the location and character of the groundwater flow occurring between the electrodes. This magnetic field can be measured from the surface using a Willowstick instrument–specially tuned magnetic receiver.

The collected magnetic field data is used to render two- and three-dimensional (2D and 3D) maps and Electric Current Distribution (ECD) models of seepage paths. Through this technique, investigative teams have accurately diagnosed seepage and groundwater problems for over 300 projects in locations around the world.

SUMMARY

LOCATION

Alaska, USA

CHALLENGE

Contaminated groundwater from the waste rock dump was bypassing a drainage collection trench into the tailings pond, and the client wanted to know where the water was bypassing the drainage collection trench.

SOLUTION

A Willowstick groundwater investigation was performed and identified several referential flow paths that by passed the drainage collection trench

BENEFIT

Several preferential flow paths were identified and many of them followed paleochannels, this allowed the client to begin targeted remediation

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Heading 2

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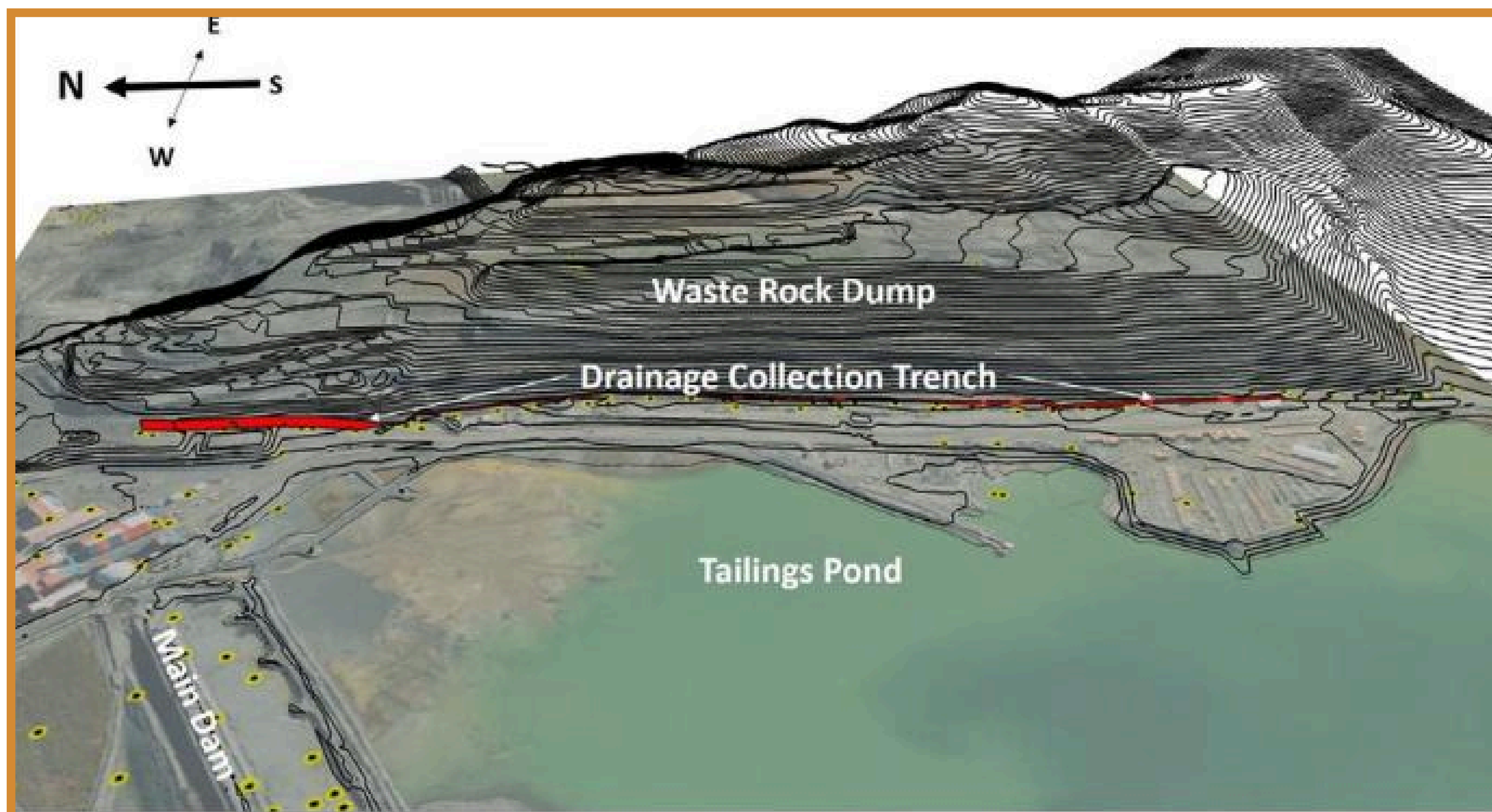
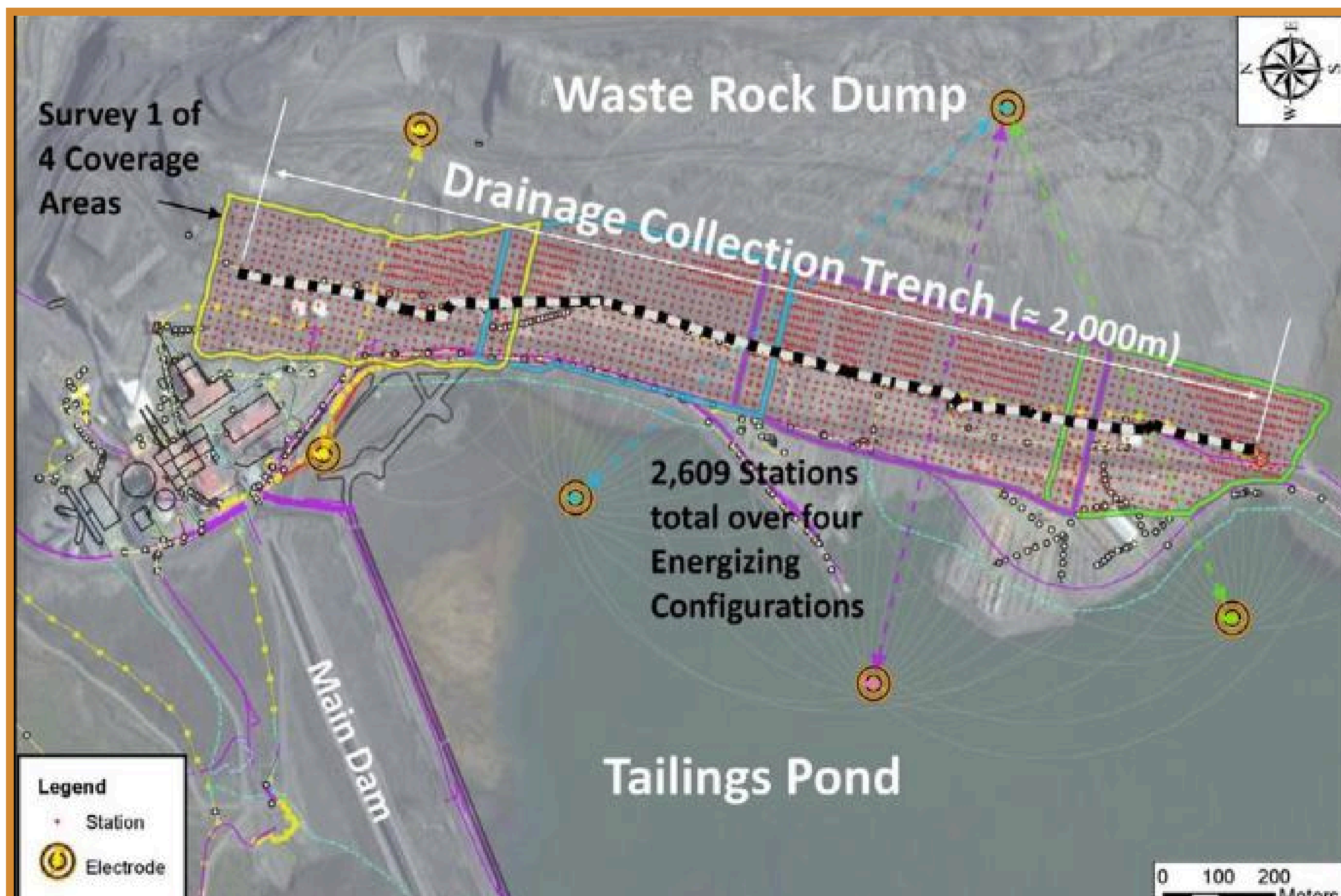


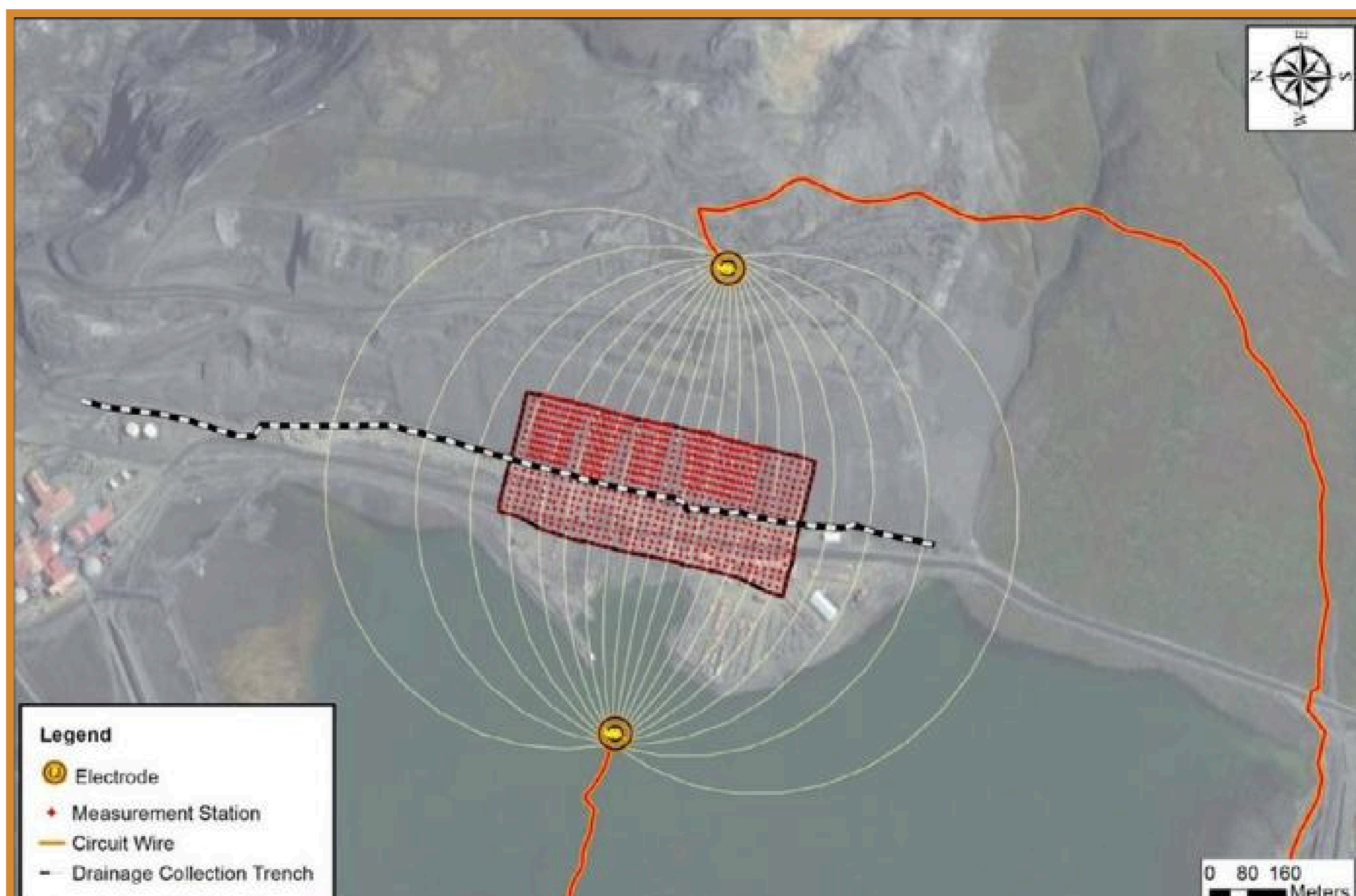
Topography of the study area (looking East from above) showing the position of the drainage collection trench at the bottom of the waste rock dump

The field work took about two weeks to complete. Given the length of the drainage collection trench (approximately 1900 m long), four separate survey configurations were employed to energize the different segments of the trench. For every survey an electric current is placed in the ground and the resulting magnetic field is measured using the Willowstick instruments.



Survey 3 survey configuration with 908 measurement stations

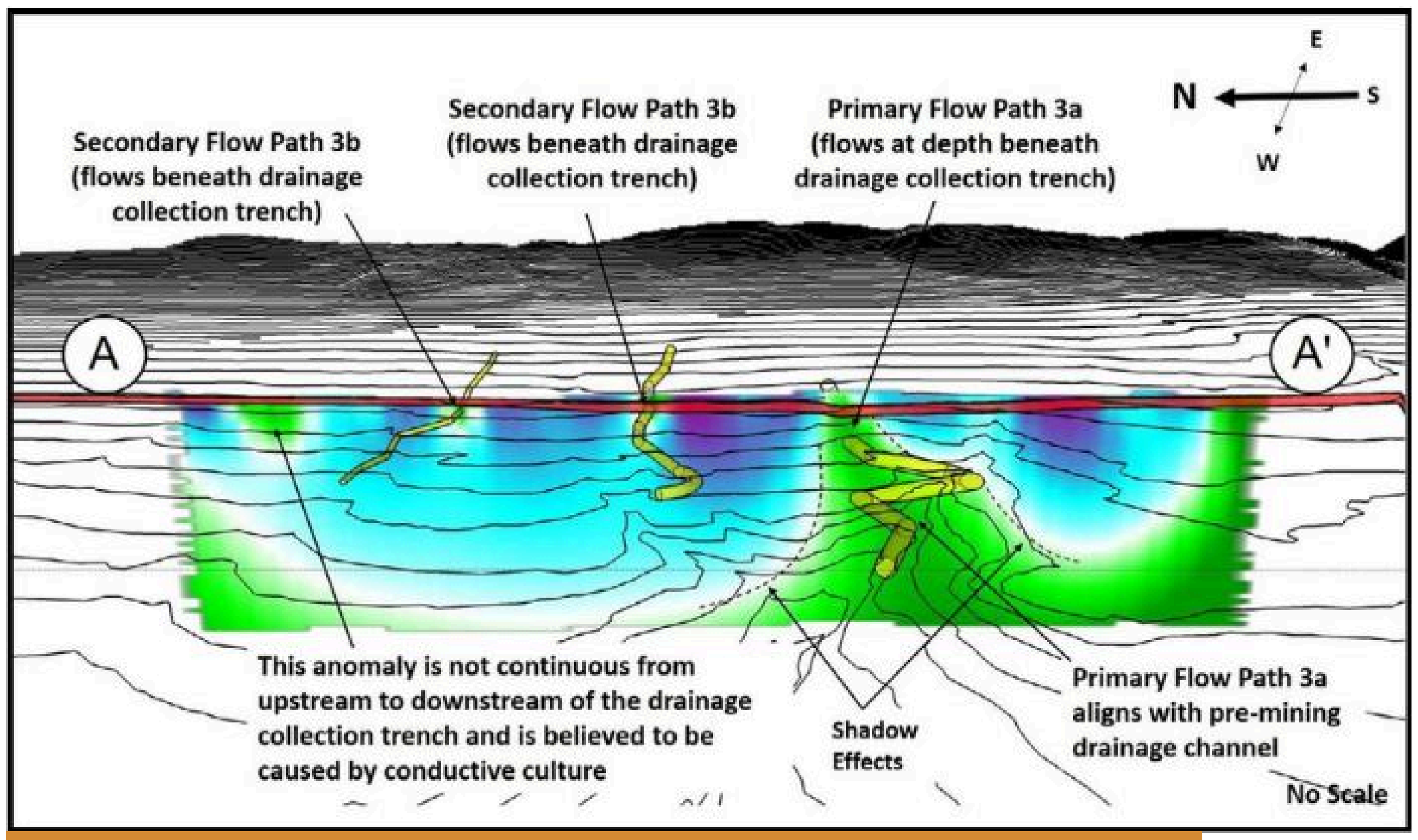
Once the field work is completed, the magnetic field is used to create a 3D ECD model. The preferential groundwater flow paths were identified within the ECD model.



The investigation area is divided into 4 sub-surveys S1 to S4

Over fifty wells were drilled in the area of the drainage collection trench, however, the wells alone couldn't provide an explanation of where water bypassed the trench. Thirteen preferential flow paths of electric current were identified which were caused by groundwater passing beneath the drainage collection trench.

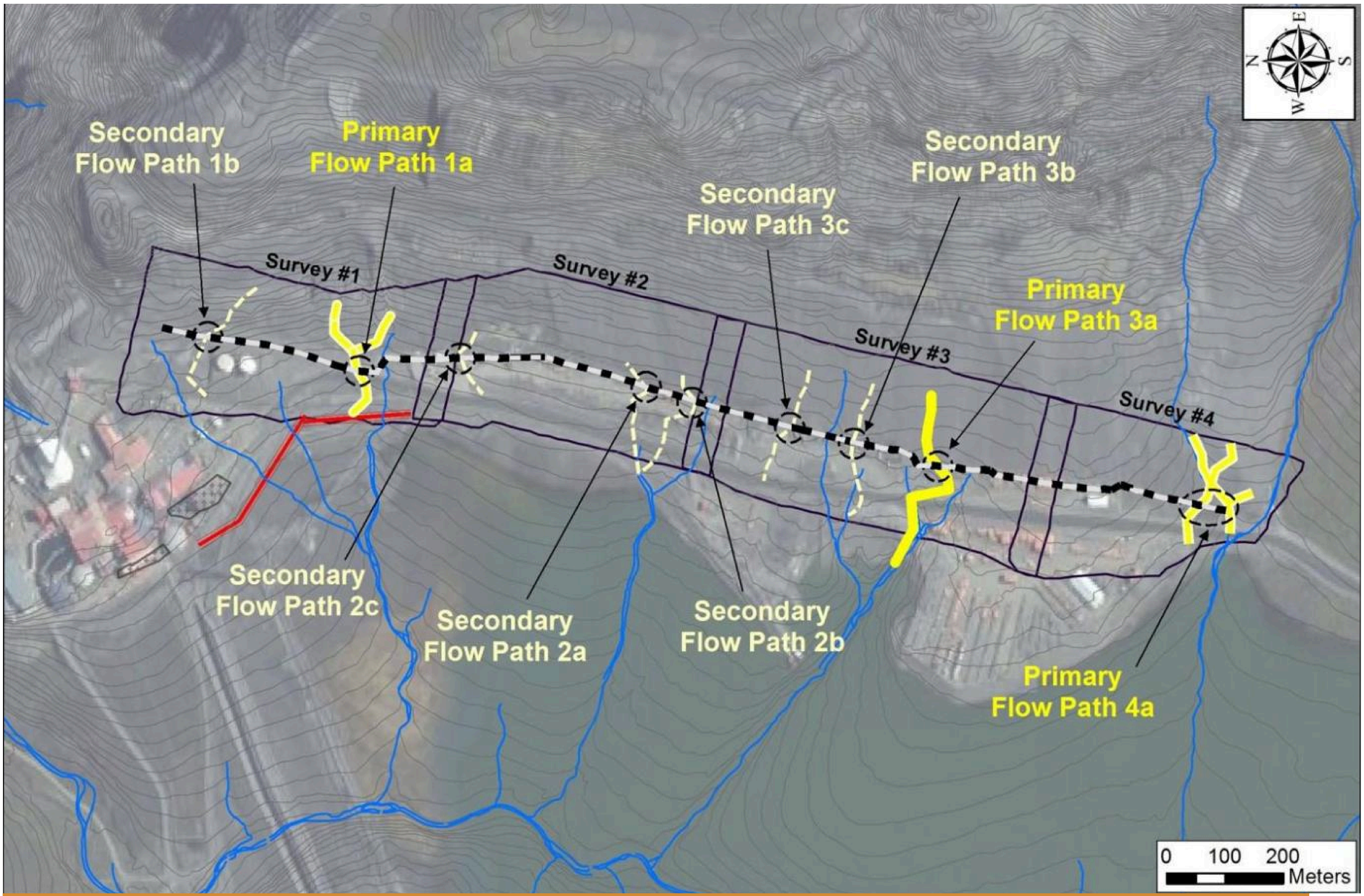
After comparing the locations of the flow paths to pre- mining contours, we determined the contaminated water was following paleochannels. With this information, the mine showed regulators they understood the situation and they began targeted remediation.



Profile view of Survey 3's ECD model slice, the yellow tubes represent preferential groundwater flow paths

Conclusion

Contaminated seepage flow paths entering and/or exiting tailings impoundments are a major problem for mine owners and regulators. Finding the exact location of these flow paths can be a difficult process when employing traditional methods. A better alternative is the MMR method, which can be used to identify the exact location of preferential groundwater flow paths, without the need to drill "trial and error" boreholes. This method was used at a mine in Alaska to successfully identify water bypassing a drainage collection trench between a waste rock dump and tailings pond. This allowed the mine to show regulators they understood the situation and begin targeted remediation, saving the mine a significant amount of time and money.



Summary of the investigation, the contours shown are pre-mining elevation contours, the blue lines represent paleochannels, the yellow lines represent the preferential flow paths identified by the MMR investigation, many of the flow paths follow paleochannels

GUARDIAN RESOURCES

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