

Site Characterization and Geophysical Estimates of Waste Rock and Tailings, Black Mountain Open Space Preserve, San Diego, California

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Results

Introduction

- Abandoned mines have been identified as a human and ecological health hazard at multiple locations around the world.^{1,2,3}
- With over 50,000 abandoned mine sites in California (CDC), abandoned mine programs within state agencies are crucial to ensure proper protection of ecological and human health.
- Initial assessment of these sites involves Site Characterization and Geophysical surveys to estimate the volume and concentrations of remaining mine waste.



Study Area

- Arsenic mining from 1923 through mid 1930's.
- Two main adits, a pit mine, and a partially filled shaft.
- Remnants of mine equipment (Figures 2-4).
- An unknown quantity of processed ore, waste rock, and mine tailings remain in the canyon.
- The purpose of this study was to quantify the remaining volume of mine waste within the canyon area.

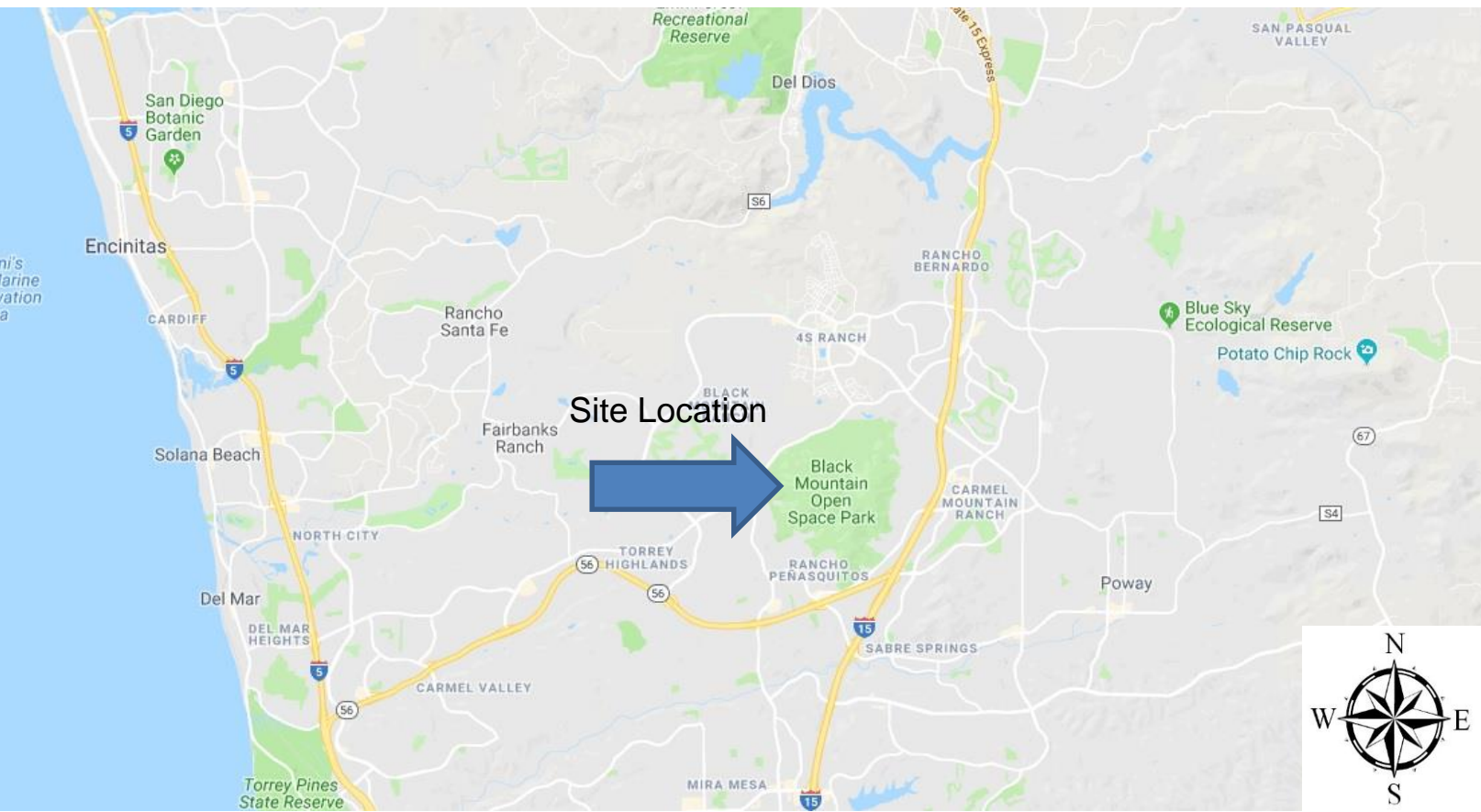


Figure 1: General site location map.

Methods

- The mines were surveyed using standard geologic mapping and survey techniques with a Brunton Compass and a Laser distance meter.
- A Trimble GPS was used for high resolution mapping of the mine waste areas.

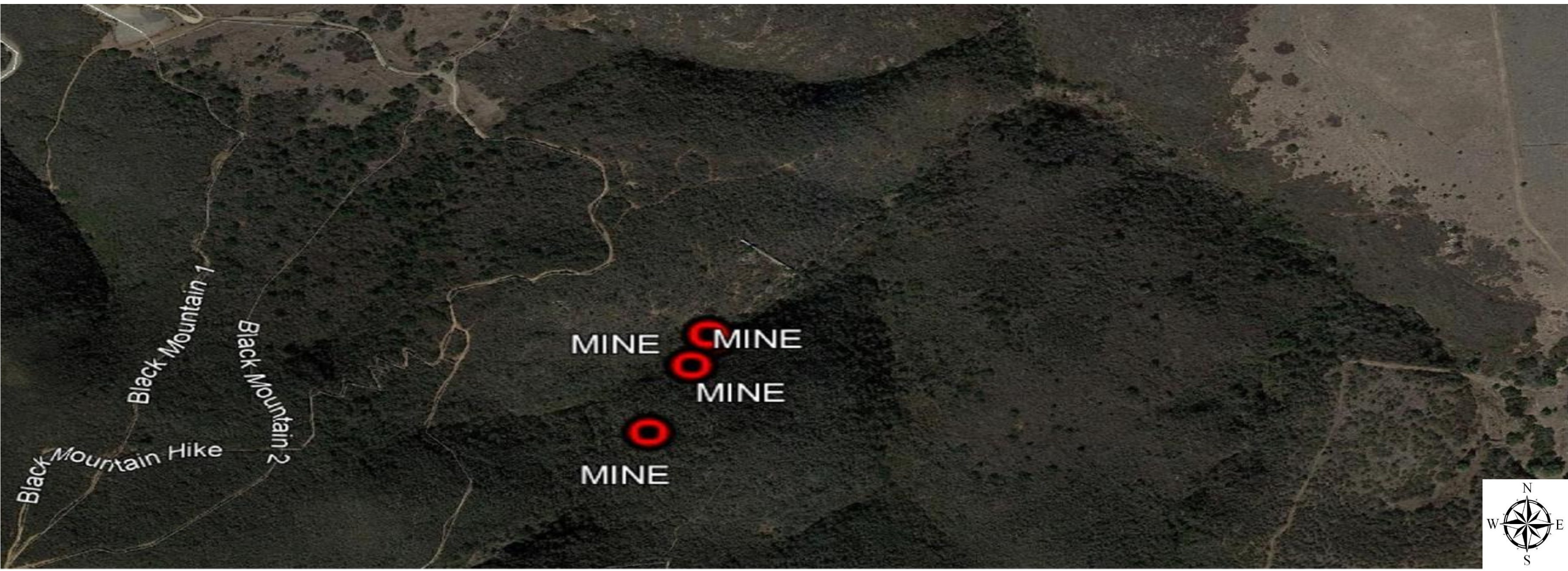


Figure 2: Regional site map of Black Mountain mine sites.

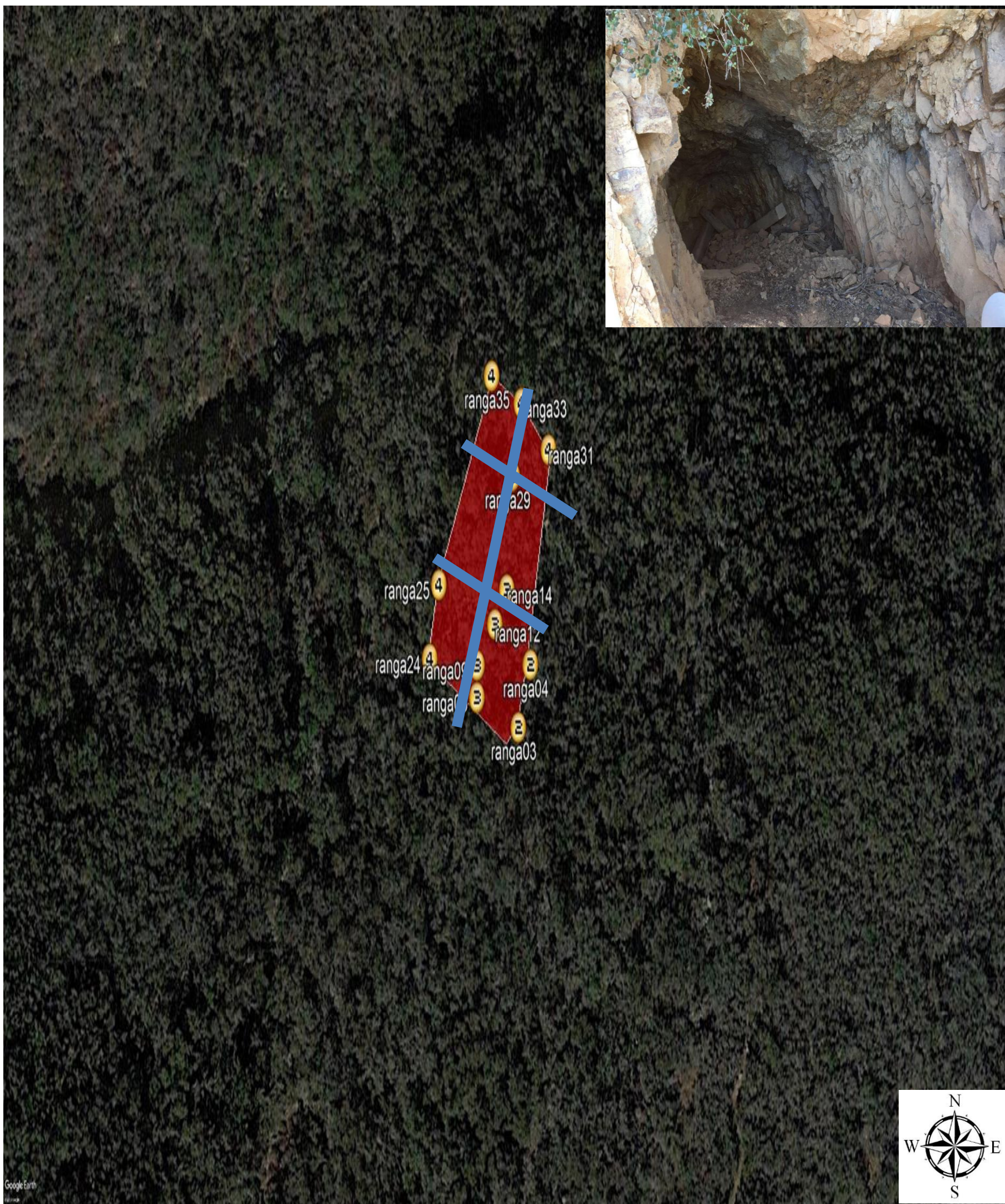


Figure 3: Waste rock surface area and GPS shots for the Ranga shaft. Inset is picture of Ranga mine. Proposed seismic transects in blue.



Figure 4: Waste rock surface area and GPS shots for the Koala and Hobbit deposits. Inset is picture of Koala mine adit. Proposed seismic transects in blue.

Discussion

- Mine survey volumes and waste rock thickness calculations do not agree with field observations within the canyon.
- Multiple portions of the canyon have at least 10 feet of fill material that either relates to other (now buried) shafts, road cut debris, and / or natural alluvium.
- Generally, mines sites are assessed using an excavator or drill rig to determine the thickness of deposits. However, this site is inaccessible to large machinery without significant modification to the canyon.
- In order to obtain a more accurate estimate of the thickness of fill material, a seismic survey will be performed at multiple transects across the canyon.
 - An accurate volume estimate is required to perform a site characterization following EPA Method SW846 prior to implementing remedial options.
- As human population continues to increase more mines that were previously isolated from human contact will be accessible due to new land development. This proposed seismic confirmation method will offer a viable and cheaper alternative to traditional characterization practices.

Literature Cited

¹M.A. Rosa, J.A. Egido, M.C. Marquez. Enhanced Electrochemical Removal of Arsenic and heavy Metals from Mine Tailings. 2017. (409-415).

²M. Garcia-Carmona, A. Romero-Freire, M. Sierra-Aragon, FJ Martinez Garzon, Martin Peinado. Evaluation of Remediation Techniques in Soils affected by Residual contamination with Heavy Metals and Arsenic. 2017. (228-236).

³Tomas Martin Crespo, David Gomez-Ortiz, Silvia Martin-Velazquez, Pedro Martinez-Pagan, Cristina de Ignacio, Javier Lillo, Angel Faz. Geoenvironmental characteristics of unstable abandoned mines tailing combining geochemical Methods. 2018. Elsevier. (135-146).

Table 1: Summary of Mine Survey Data.

Mine	Surface Area of Waste Rock (sf)	Volume of Mine (ft3)	Calculated Thickness of Waste Rock (ft)
Ranga	5887	1659.0	0.3
GH	345	638.2	1.8
Koala	13290	4351.4	2.5
Hobbit Hole		996.6	