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Reference	Explanation of the Methodology used to derive rock properties for Tal
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This memo is written to provide an explanation of the methodology used to derive the rock mass strength for the Apache Leap Tuff (Tal). The strength properties of the Tal were derived using a combination of data obtained from laboratory strength testing (UCS and Triaxial data) and the Geological Strength Index (GSI) measured in the core and during sinking of No. 10 Shaft. The sections provide some details and justification of each of the data used to derive the rock mass strength properties of the Tal as used in the subsidence model.

1. Geological Strength Index

The geological Strength Index (GSI) values for the Tal were estimated using the methodology proposed by Cai et al. (2004). This methodology allows the calculation of GSI based on in situ block volume and joint condition factor. In order to estimate block volume, it was presumed that the in situ blocks at RC are relatively uniform (cubic) in shape and that the spacing between open joints inferred from geotechnical core logging provides a reasonable estimate of the side length of the blocks.

The average values of GSI get used in the calculation and estimation of the rock mass strength. In the subsidence model, an average value of GSI 64 was used for the Tal which is within the range of the average GSI of 60 as measured during sinking of the No. 10 Shaft.

Both drill core and No. 10 Shaft mapping data show that the Tal is mainly composed of two joint sets and a bedding plane (See Figure 1). Figure 2 shows a picture of the Tal encountered in the No. 10 Shaft.

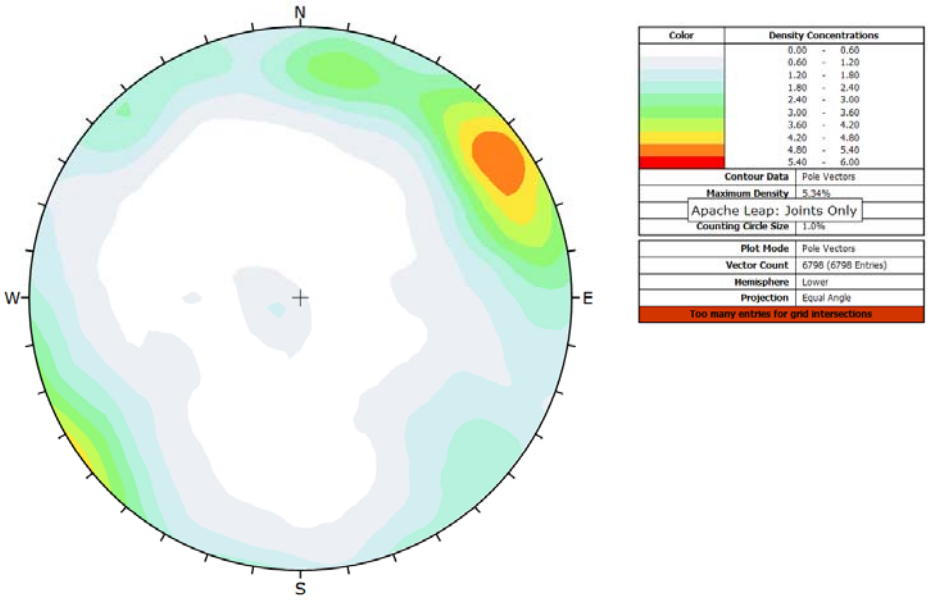

Figure 1 Stereonet of joints in Tal

Figure 2 Examples pictures of Tal observed in No 10 Shaft

2. Laboratory Strength Data

To date there are 22 UCS data and 23 triaxial data tested from independent laboratories (CANMET, TerraTek, and CNI. Inc.). All tests were conducted following the industry approved standards for testing of rock materials. A detailed statistic distribution of the strength data was presented in the geotechnical characterization report that was submitted earlier this year. The average UCS of the Tal is 85MPa.

The Generalized Hoek-Brown failure criteria from Hoek et al. (2002) was followed to derive the rock mass strength values based on laboratory strength data and GSI values. The Generalized Hoek-Brown criterion leads to the determination of intact rock properties σ_{ci} , mi , a and s.

3. Tal Behavior during Sinking of No 10 Shaft

Resolution Copper has successfully sunk the No 10 Shaft to a total depth of approximately 6943 ft of which 1700ft was sunk through the Tal unit. Prior to sinking the Shaft RC has conducted predictive numerical modeling stability of the Shaft during sinking in the different lithological units. The Tal unit was previously predicted to perform significantly better than the Tw. The numerical models predicted that the displacements in the Tal will be in the elastic range and therefore no ground support issues were expected. As predicted, the No. 10 Shaft was sunk through the Tal with no ground support related issues.