

# BULLETIN

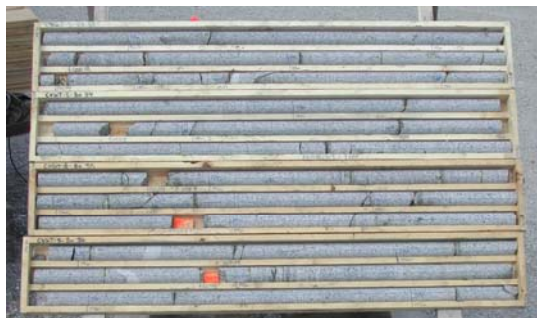
News from SubTerra, Inc.®

## 4-meter Diameter Raise Bore Design Kimberlite Diamond Mine, Canada

**SubTerra, Inc** worked with one of its Associates, **Zostrich Engineering**, to evaluate the potential risks associated with constructing three up to 325 meter, 4-meter diameter raises to be drilled at declinations ranging from 72 to 85 degrees (from horizontal) in granite. The raises were required to route fresh and return air to and from the underground mine.

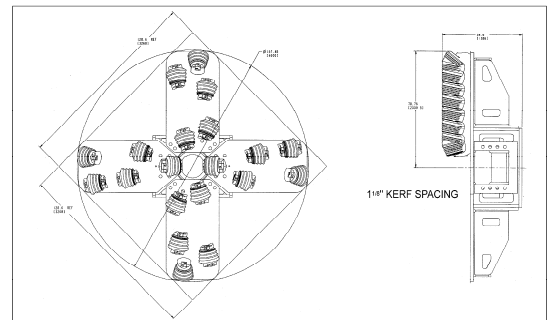
**SubTerra's** scope of work involved reviewing the supplied data and information, developing recommendations for additional data gathering and analysis, if warranted, and developing recommendations to manage project risks.

Zostrich performed an analysis of potential rock failure zones and developed estimates of the maximum rock block size that could be released from the raise sidewalls.



The Owner's plans included utilizing a 4-meter diameter cutter-head manufactured (see Figure). Cutters would be installed on a crosshead to provide a kerf spacing (i.e., the space between adjacent cutter paths) of just over 25 mm. A Robbins 123RM, DC drive raise bore drill rig equipped with a

327-mm (12.875-in) diameter drill string would be used to drive the cutter-head.



**SubTerra** prepared a penetration rate estimate and potential geotechnical and operational risk.

### Geotechnical Risk

1. Sidewall and face instability was of concern for the upper 20-30 meter, weathered zone in each raise.
2. Rock blocks up to 1-meter in size could be released from the raise sidewalls.

### Operational Risk

Areas of potential catastrophic failure were identified and methods for risk mitigation developed.

Our analysis of the data indicated that potential operational and long term risks could be minimized and managed using ground pre-treatment (e.g., grouting) for anticipated areas of structural weakness, installing ground support in near-surface problem areas (e.g., top 20 to 30 meters of each raise) and the use of modern raise drilling equipment and procedures.