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September 2017

Temporary Rockfall Mitigation System - Bellwood Quarry Reservoir Tunnel - Atlanta, GA

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The City of Atlanta's raw water system infrastructure, like many cities, is well over 100-years old. Capacity demand, as a result of population growth, places stress on the system to a point that raw water reserves amount to about three days. To expand storage of raw water drawn from the Chattahoochee River, an abandoned quarry that was active for approximately 100-years is being transformed into a 2.4 billion gallon reservoir, which will provide a minimum 30-day backup supply to the City. The project includes the construction of a five-mile long, 10-ft diameter partially-lined rock tunnel that will start at a portal mined into the wall of the Bellwood Quarry. Other project components include pump stations constructed within shafts and control devices. Two of the pump station shafts were excavated within 200-ft of the tunnel portal slope face, and a series of adits will be excavated, which will connect the main tunnel to the pump station shafts.

Preparing the Bellwood Quarry to serve as a construction staging area and tunnel portal had challenges associated with prior drill and blast mining activities that resulted in steep pit slopes, some locally as high as 350-ft. These exposed slopes have an abundance of loose rock, which generally consist of highly fractured, very hard silica-rich granitic gneiss. Brierley Associates and Scarptec teamed to design a temporary rockfall mitigation system that was installed by Apex Rockfall Mitigation, LLC. Critical elements of the temporary system included post-scaling design and construction of draped netting, rock dowels, and two rockfall canopies.

The netted segment of slope above the tunnel portal is about 315-ft high and 365-ft long. G65/3mm Tecco® Mesh by Geobrugg was selected for temporary and permanent rockfall mitigation purposes. The netting is supported at the crest by a series of ¾-in diameter wire rope anchors and a top rope. The temporary draped netting was locally tied into the canopy system. The intent of the connection between canopy and drape was to create a "slot", which falling rock would be retained within the system and would not exit the netting limits. Our design team opted for the rockfall canopy arrangement, which could be adapted to the field conditions and not restrict construction access by the tunneling crews.

Design of the temporary canopy-drape netting system required the Brierley-Scarptec team to estimate the range of rock block sizes and energies which could potentially compromise the system. Rock blocks greater than this critical size required bolting if they appeared to be loose. Based on kinematic calculations of rock block free fall and rockfall analyses from a slope that is 285-ft in height or similar, the critical rock block size that could exceed the maximum barrier deflection criteria was estimated to be approximately 2.5-ft (or the equivalent of 15-c.y.). Loose rock blocks greater than this size required rock reinforcement to arrest potential movement.

Although most surface and underground blasting is now complete, additional destabilizing forces from construction vibrations (e.g. TBM advancement), surface and fracture-controlled drainage, and weathering may result in periodic rockfall at the site, all of which underscores the importance of this temporary rockfall mitigation system. To-date, the system has performed as intended and will be maintained through the end of the 2018 to mitigate the frequency and effects arising from potential rockfall events.