Water studies to inform the new water supply pipeline – Grand Canyon National Park

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Grand Canyon National Park (GRCA) relies exclusively on a karst spring to supply water to both the North and South Rim communities and approximately 5 million visitors per year. This spring, Roaring Springs, is fed entirely from focused, ephemeral snowmelt that sinks into the karst landscape above the rims and emerges in the canyon walls 3,500 feet below. Current water infrastructure that pipes this water from the spring back to the rims has far outlived its life expectancy. The National Park Service is preparing to replace one of the Service's largest and most complex civil engineering works: Grand Canyon's TransCanyon Pipeline (TCP).

The TCP was built in the 1960's to provide potable water to Phantom Ranch, Indian Garden, and the South Rim village by conveying water from Roaring Springs on the North Rim via a gravity assisted feed through 24 km of waterline. The infrastructure is decades beyond its design life and fails annually, occasionally causing severe water shortages. The TCP will be either replaced in-kind or with an in-take structure and pumphouse near the confluence of Bright Angel Creek (BAC) and the Colorado River. Park hydrologists, and consultants, have been conducting hydrologic, geophysical, and geotechnical studies to inform the decision on the future TCP. This presentation provides a brief overview of the water studies related to the TCP decision and how this may be of interest for your river clients. Studies associated with replacement in-kind include a dye trace project delineating the recharge area of Roaring Springs Cave, paleontologic risk assessment utilizing geomorphic variables, and a risk assessment of mass movement along the current pipeline footprint. Studies associated with moving the in-take to near the terminus of BAC include an analysis of the increased flow (+1.5 cubic feet per second) through the majority of the creek as the in-take is moved from Roaring Springs (at the upstream extent of BAC) to the lower end of the creek. Increased flow from the spring will change the temperature of BAC (~ 2 C warmer) and pH as flow is restored to the majority of the creek as well as provide more water for aquatic habitat. A flood risk analysis using HEC-RAS was also completed through Phantom Ranch, alluvium depth determined using geophones, and a study of hyperheic exchange rates at select locations in BAC. Studies serving both design options include an analysis of environmental flows for native fishes, long-term hydrograph analysis (1923-present), nutrient cycling in tributary creeks, and the maintenance of 4 NPS streamgauges. These concurrent studies provide the most comprehensive analysis of Grand Canyon tributary streams to date and should inform future management and tributary science endeavors.