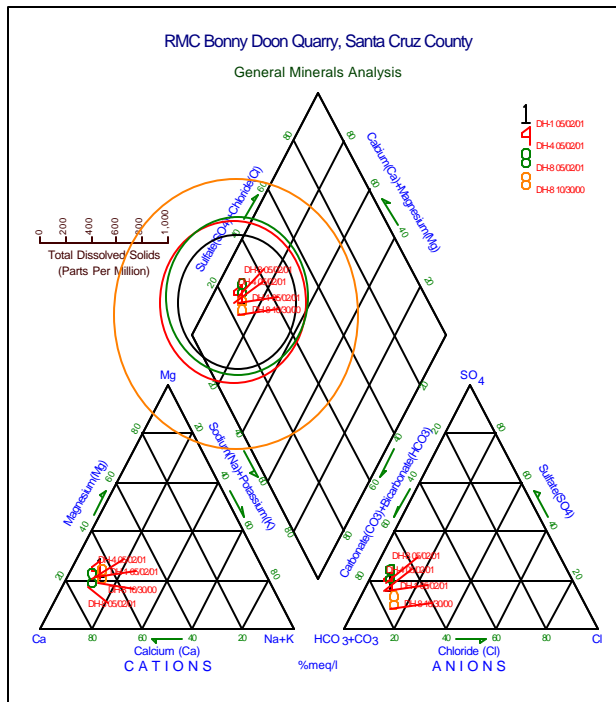


Karst Hydrology

In conjunction with Pacific Geotechnical Engineering, Balance Hydrologics was asked to conduct a hydrologic investigation of the Liddell Spring landslide and local area. The purpose of the investigation was to describe the hydrology of the landslide and to explore potential hydrologic linkages between the landslide, Liddell Spring #1 and the East Branch of Liddell Creek, both features of which are located below the landslide. Liddell Spring #1 has been a key water source for the City of Santa Cruz since 1913 and is one of many karst springs found along the western slopes of the Santa Cruz Mountains. A key question addressed by the investigation was whether the Liddell Spring landslide could be a source of turbid material to Liddell Spring #1. Since at least the 1960's, spring water quality has been compromised during winter storm events due to spikes in turbidity. Overall, Liddell Spring #1 is the City's least turbid source and is disproportionately important during periods of high runoff. Therefore, protection of this water source for the City of Santa Cruz was the principal objective of the investigation.



The investigation included 1) continuous monitoring of streamflow, specific conductance, and water temperature in the East Branch of Liddell Creek, receiving waters for Liddell Spring #1, 2) continuous monitoring of water level, specific conductance, and water temperature in two wells drilled in Liddell Spring landslide, 3) geochemical characterization of spring and creek discharge, and ground water sampled from the wells in the landslide, and 4) mineralogic analysis of turbid material discharged from Liddell Spring #1. In conjunction with the hydrologic investigation, Pacific Geotechnical Engineering characterized the nature of landsliding at the site and investigated the stability of the Liddell Spring landslide. Hydrologic and geotechnical monitoring continues at the site to assess what conditions trigger movement of Liddell Spring landslide. In the event that landslide movement is triggered in the future, Balance Hydrologics and Pacific Geotechnical Engineering have developed a suite of mitigation alternatives to help protect existing water diversion infrastructure and ultimately the water supply.