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Physical vulnerability of the city of Arequipa - exposed to volcanic flows and flash floods

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More than 860,000 inhabitants in Arequipa are threatened by the active El Misti volcano, earthquakes and flash floods. A population increase of approximately 40% since 1949 has led to significant urban growth on the southwest flank of the Volcano, on the Rio Chili River terraces and adjacent to streams within 9 to 17 km of El Misti. Floods have occurred on average every 10 years, causing building and infrastructure damage, and three casualties in 1997. Lahars volumes during the Holocene range from $0.01x10^6m^3$ to $11x10^6m^3$. Multi-risk scenarios for volcanic flows will be developed from former and current geological studies; simulation codes; and building and infrastructure studies.

An accurate 10 m DEM of the channel and four main terraces (area of approximately 5 km^2) of the Rio Chili River was computed using a DGPS, aerial photographs and control points. The DEM was used in Titan2D flow simulations. The behaviour of debris flows simulated with Titan2D was more realistic than LaharZ simulations. Flows were better confined with an improved DEM, and the unrealistic ponding of material was overcome. Land-use and building type surveys conducted within the same area identified nineteen different land-use patterns and ten main building types. Building types were defined according to the dominant building material (ignimbrite brick, red brick, adobe); number of floors; building reinforcement; roof type and style; opening type and quantity; and overall building structural integrity. Type A buildings (solidly built from brick or concrete and well maintained) represented 30% of buildings surveyed. Conversely, Type F buildings (assortment of building materials, often illegal

with no structural integrity) represented 5% of buildings surveyed.