

Landslides: The low hillslope gradient and the thin soil preclude the occurrence of landslides. Slopes at the site range from 5° to 15° and are armored with basalt and/or andesite with very little soil. We observed no evidence of preexisting landslide topography there, hence landslide hazard at this site is low to nonexistent.

Flooding: The site is located in the upland area and is considered adequate from a flooding perspective. Structures that allow conveyance for localized drainage will be required. Population should not be allowed to encroach on channels that drain the Laguna de Pedregal.



The Las Trancas site in Tegucigalpa.

Water Supply: Due to the high elevation and limited extent, wells drilled in the basalt flows west and southwest of Tegucigalpa generally produce less than 15 gpm, and multiple wells would interfere with each other. Therefore, groundwater is not considered to capable of being a primary source of water at this site. Most, if not all, of the water will have to be trucked or piped to the site from other sources. Also, in the highly fractured basalt, which underlies the site, wells and latrines are not compatible. The cost for a well at the site

would be about \$13,000. The cost for water delivered to the site by commercial sources is approximately 10 cents per gallon. For 16,000 people using 30 gallons per day each, the commercial cost of water delivered to the site would be \$48,000 per day.

Sanitary: Latrines are not compatible with wells on the highly fractured basalt, which underlies the site. An oxidation pond is considered to be the best alternative.

Environmental: Development of this site will remove the existing vegetation and increase the runoff from the site due to construction of impervious surfaces. Additionally, due to the reliance on wood for fuel, the increased population in this area can be expected to utilize the forested areas in the vicinity as a source. This practice will further increase runoff in the watershed and increase flooding downstream. Unless sanitary sewage is highly treated, water quality of nearby streams will be degraded.

Site Access: Access to this site is via a series of neighborhoods located on the western side of Comayaguela, and north/northwest of the airport. Roads to the site are generally in poor condition. The following cost factors can be used for road construction if upgrade to the roads is considered due to the proposed population increase with Las Trancas.

| Road Type | Repair Cost (\$ / km) |
|----------------------------|-----------------------|
| 2 lanes (paved, 4 m/lane) | 520,000 |
| 2 lanes (unpaved, 4m/lane) | 500,000 |
| 1 lane (paved, 4m/lane) | 260,000 |
| 1 lane (unpaved, 4 m/lane) | 250,000 |

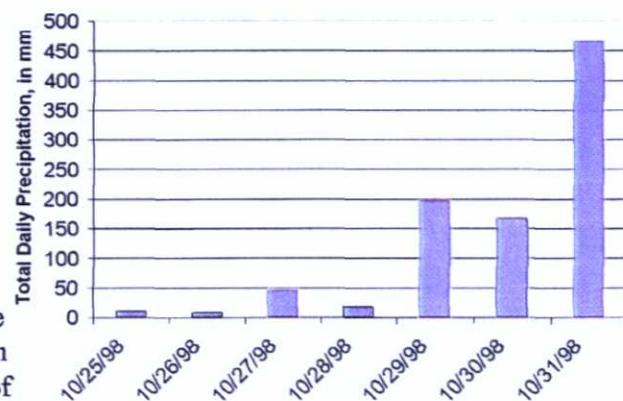
Choluteca

General

The City of Choluteca lies in the southern part of Honduras near the Pacific Ocean (Gulf of Fonseca) within the Department of Choluteca. The City of Choluteca contains approximately 113,000 people, and total population in the Department of 377,241 as of 1997. The City of Choluteca is located primarily along the left bank of the Rio Choluteca, which drains an area of approximately 8,150 square-kilometers (3,143 square-miles). Average rainfall in the basin is 1,300 mm (51 inches) producing a mean annual flow of 84 cubic-meters per second (2,967 cubic feet per second).

Description of Problem

During the period of 27 – 31 October 1998, Choluteca received 893 mm (35 inches) of rainfall associated with Hurricane Mitch, most falling on the 29th – 31st. The heavy rainfall caused extensive flooding, erosion, and sediment deposition in the Choluteca area. In addition to the loss of many bridges and roads, it is estimated that 4,400 homes were destroyed and 6,600 homes damaged in the Department of Choluteca.



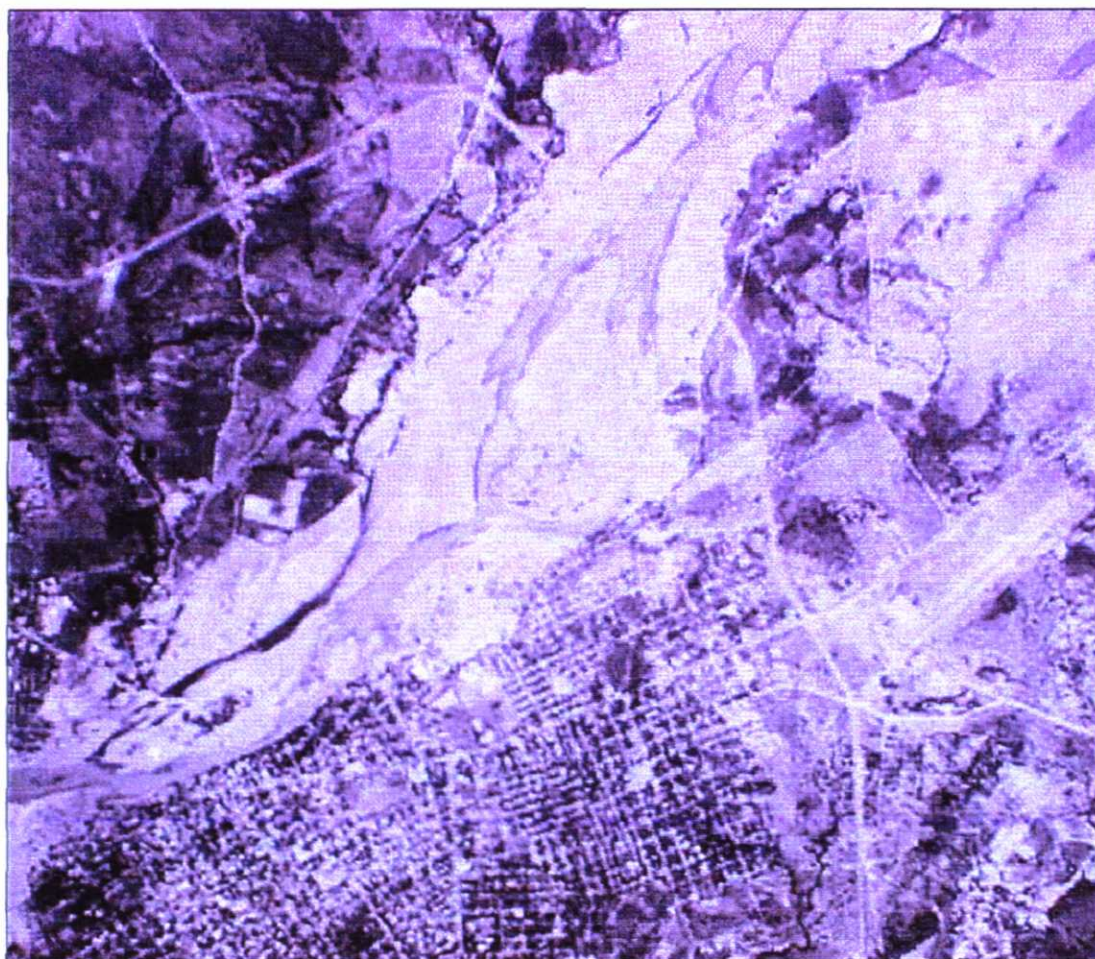
Landslides

Landslide concentrations triggered by Hurricane Mitch in southern Honduras were the highest observed in Honduras. Sediment produced by landslides may provide a significant influx to the Rio Choluteca floodplain. These sediments contributed by landslides adjacent to the river basin may continue to provide high sediment loads during future flood seasons. The contribution of sediment to the Rio Choluteca has not yet been completely assessed.

Flooding

According to local authorities, the Rio Choluteca peaked sometime Friday evening, 30 October 1998. Floodwaters remained high for several days causing substantial lateral scour of channel margins, and aggradation of sediment in the Rio Choluteca, as well as the surrounding floodplain. In Choluteca there were 260 registered deaths, 400 persons missing, and approximately 2,500 homes destroyed, primarily along left bank of the River. Local authorities also estimate approximately 2-3 meters of sediment deposition throughout the Rio Choluteca channel. Two bridges cross the Rio Choluteca in the vicinity of Choluteca, and both were extensively damaged. The newer bridge located upstream of the city and built by the Japanese, lost both its right and left embankments when severe lateral erosion of channel boundaries occurred. The older bridge,

located in the city of Choluteca, and built by the Army Corps of Engineer's, lost a substantial amount of its right approach embankment. Temporary access has been restored to the Corps of Engineer's bridge.



Clearly visible in this view of Choluteca is the extremely wide floodplain.

Mitigation Measures

- *(Intermediate Term)* Both bridges should be re-built with provisions for additional flow relief openings for the safe passage of flood flows. Both bridges provide a clear span over the low flow channel only, and provide little or no overbank flow capacity for flood flows. When the river floods, water can back up on the upstream side of the bridges, such that when the



The entire left abutment of the bridge north of Choluteca was destroyed.