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Characteristics and Risk Analysis of Qinglin Debris Flow induced by "5.12" Wenchuan Earthquake in Beichuan County, Sichuan, China

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Abstract：The "5.12" Wenchuan Earthquake, an intensive earthquake of 8.0 on the Richter scale, occurred in western Sichuan, China on May 12, 2008. This quake induced a lot of geo-hazards and caused devastating damage to people's lives and property in the quake-hit areas. At the same time, abundant potential geo-hazards induced by the earthquake were developing, which tremendously affected the post-disaster restoration and reconstruction in the quake-hit areas.

In order to study the influences of potential debris flow disasters on post-disaster restoration and reconstruction, taking the Qinglin gully as an example, the research of its characteristics was conducted by using GIS technology based on field survey and image data of remote sensing. Qinglin gully (31°55′32″N, 104°34′55″E) is located in Beichuan County, Sichuan province, which has no recorders of debris flow before the earthquake and has been one of the most typical serious debris flow gullies after the earthquake in this area. The length of its main gully was 10km and the average longitudinal slope was 110‰. Its catchments covered a total area of 23.4km^2 and its altitude ranged from 650m at mouth of the gully to 1750m at the highest point of the basin. According to the geological environment condition of this gully, it was divided into water section, source & flow section and deposits section. The altitude of water section was over 1100m where the vegetation was lush. The altitude of source & flow section ranged from 1100m -670m and deposits area was about 670m-650m. The research results showed that three large-scale landslides with 0.76million m^3, 0.94million m^3 and 12million m^3 in volume, respectively, induced by the earthquake, were the main sources of the debris flows. The storage capacity of loose deposits was up to 13.7 million m^3.

With regard to the debris flow disaster in Qinglin gully on September 24, 2008, its dynamic

characteristics were analyzed using the super-elevation-in-bend method. Calculating results showed that the total volume of the debris-flow was 750,000 m^3 for one time and the average thick of accumulation was up to 3.5m. The peak flow was $62m^3 \cdot s^{-1}$ and maximum velocity of debris flow was about $7m \cdot s^{-1}$. The density of debris flow was $1.6g \cdot cm^{-3}$, as indicated that the Qinglin Gully was a turbulent debris-flow gully.

According to analysis, there were a lot of loose deposits in this gully induced by the earthquake. So when rainstorm is coming, a big debris-flow disaster must be developed in the gully even though no more landslides occurred on both sides of the gully. And it will destroy the farmlands and infrastructures around the accumulation area of Qinglin gully. Therefore, the risks of this gully were evaluated based on the risk assessment model of site-specific debris flow. Evaluate results showed that the Qinglin gully had the characteristics of high frequency and large scale and it was a potential giant risk debris-flow gully after the earthquake.

Through this study, it was also found that big debris flows would occur with the change of hazard-forming of debris-flow even if vegetation was lush in that area. Consequently, the research of potential debris flow should be intensified in the quake-hit areas, which is of great significance to the post-disaster restoration and reconstruction.

Key words: “5.12” Wenchuan Earthquake; potential debris flow; risk Analysis; GIS technology