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PRIORITIZATION CRITERIA FOR DEBRIS FLOW ENGINEERING WORKS TO PROTECT PIPELINES IN THE BRAZILIAN SERRA DO MAR REGION, SÃO PAULO

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ABSTRACT

Pipelines traversing mountainous regions are vulnerable to soil and rock mass movement risks associated with the geological-geotechnical characteristics of the area. In the state of São Paulo, Brazil, a crucial pipeline runs through the coastal region, connecting the country's largest marine oil terminal to a strategic refinery. This pipeline's route passes through the Serra do Mar region, a tropical mountainous area along the South and Southeast coast of Brazil. The Serra do Mar frequently experiences heavy rainfall events that trigger landslides and debris flows. In February 2023, the region encountered the most extensive rainfall event ever recorded in Brazil, with rainfall reaching 684 mm within 11 hours. A total of 52 geotechnical events, ranging from low to high risk for the pipelines, were detected. Debris flows were identified as the primary cause of these incidents along the pipeline's right-of-way. To mitigate the risk, a study focused on hydraulic basins prone to debris flows was conducted. This study aimed to identify critical areas along the pipeline's route and establish a prioritization process for necessary engineering works to prevent pipeline failures. The prioritization process led to the identification of two regions requiring immediate mitigation measures to safeguard the pipelines from future damage. During the intense rainfall event in February, one of these regions experienced a debris flow incident that caused significant destruction to the surrounding community and the road crossing the river. However, due to the completion of engineering works a year prior to the rainfall event, the pipeline remained intact and unharmed. This paper focuses on the prioritization process employed to identify critical hydraulic basins prone to debris flows. It further provides details on the engineering works that effectively prevented pipeline failure due to the implementation of the prioritization process. The findings underscore the significance of proactive measures and prioritization criteria in mitigating risks associated with debris flow and ensuring the integrity of vital pipeline infrastructure.