



Mapping of the Luhur Puncak Les Temple, Angseri Traditional Village, Angseri Village, Baturiti Subdistrict, Tabanan Regency, Bali

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Abstract. Pura Luhur Puncak Les is located in the traditional village of Angseri, Baturiti Subdistrict, Tabanan Regency. Its topography is classified as mountainous. During the rainy season at the end of 2024, extreme weather conditions including several days of heavy rain and strong winds occurred, ultimately causing a landslide on the western slope adjacent to the temple and along Dekah River to the east of the temple grounds. To support mitigation efforts and protect the river and spring areas, slope stabilization was carried out through the construction of a retaining wall and river normalization. The area surrounding the landslide site is a sacred zone, home to spring, and the existing road infrastructure serves as the access route to the temple grounds. The retaining wall construction process, topographic mapping using Total Station and GPS/GNSS equipment and soil testing were conducted. The plan for constructing the retaining wall must be accompanied by proper planning in the form of design drawings and supporting documentation. Prior to planning the retaining wall, topographic mapping and soil testing were conducted to obtain information on soil layer conditions and soil parameters. Outputs of this activity include topographic maps and basic technical designs for retaining walls. This activity provides tangible benefits for partners through the availability of accurate technical data for infrastructure planning, enhanced capacity of temple management in utilizing topographic information, and support for disaster risk mitigation and sustainable preservation of the sacred area.

Keywords: Landslide Mitigation, Topographic Mapping, Retaining Wall, Soil Investigation, Pura Luhur Puncak Les

1 Introduction

This community service activity was carried out at Pura Luhur Puncak Les, which is officially located within the traditional village of Angseri, Baturiti Subdistrict, Tabanan Regency. The area's topography is classified as mountainous, situated approximately 22 km north of Tabanan City or about 42 km from Denpasar City. Due to its location in a valley along the Dekah River basin surrounded by steep slopes, the site is highly vulnerable to hydro-meteorological hazards, particularly rainfall-triggered landslides and slope erosion (Hardiyatmo, 2020; Zakaria et al., 2021). During the rainy season at the end of 2024, extreme weather conditions including heavy rain and strong winds over several days ultimately caused a landslide on the western slope adjacent to the

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temple, as well as along the Dekah River to the east of the temple grounds. Because Pura Luhur Puncak Les is situated in a valley or within the area of the Dekah River, it is highly vulnerable to landslides from the surrounding slopes.

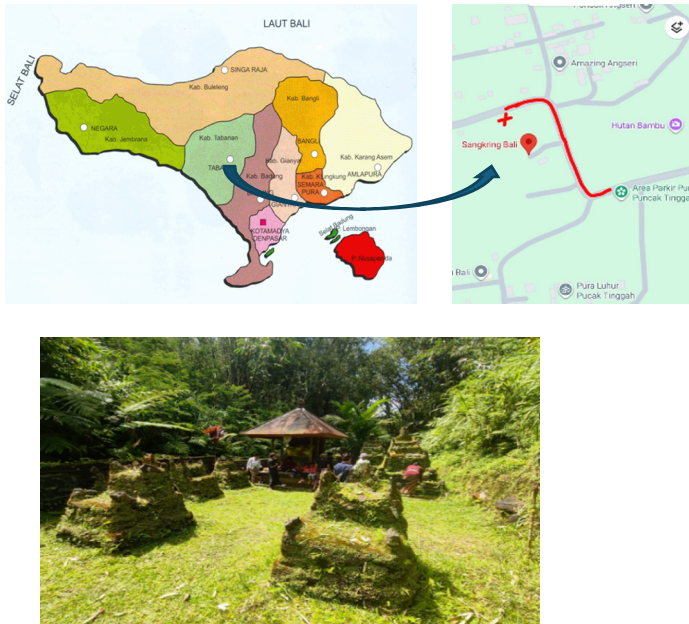


Figure 1. The site of Pura Luhur Puncak Les in the traditional village of Angseri, Baturiti Subdistrict, Tabanan Regency, Bali Province

In the built-up area of the temple, several primary pedestrian circulation paths and open spaces are located near steep cliffs without permanent retaining structures or integrated drainage networks (Suryolelo & Rifa'i, 2021). Uncontrolled surface runoff during high-intensity rainfall rapidly degrades slope stability and exacerbates soil movement risks (Pramusinto et al., 2022). Furthermore, during major Hindu religious festivals, high pilgrim density significantly increases human exposure to potential slope failures, threatening both public safety and cultural heritage structures (Utama & Putra, 2020). Despite these geotechnical risks, the temple grounds hold vital strategic value as a center for spiritual education, cultural preservation, and community-based heritage tourism.

Field observations and coordination with local traditional authorities (banjar) revealed critical infrastructure challenges, including the absence of measured topographic maps, lack of slope stability assessments, and unmitigated landslide risks (Prasetyo et al., 2023). To address these issues, detailed topographic mapping using high-precision Total Station and GNSS technologies alongside geotechnical soil testing was essential (Subagio & Setiawan, 2022). These technical measurements provide the empirical baseline required to design optimized retaining walls, normalize river

channels, and plan a safe, resilient, and sustainable sacred complex (Kurniawan et al., 2023).

The target partners for this community service activity are the managers and traditional community members in the Pura Luhur Puncak Les area, Angseri Traditional Village, who belong to a group of the general public that is not economically productive, with primary needs focused on enhancing safety in the sacred area and organizing socio-culturally based public service facilities. Based on the results of coordination and agreements with the partners, the priority issues to be addressed include:

1.1 Infrastructure Safety Aspects

Main issue is the vulnerability of slopes and soil structures around the temple grounds, which could potentially cause landslides and endanger worshippers and sacred buildings, Sub-issues such as lack of topographic maps of the area, absence of slope stability analysis as a basis for disaster risk mitigation, lack of permanent retaining walls at critical slope locations.

1.2 Aspects of Social Facility Services and Temple Area Planning

Main issue is the spatial layout and service facilities in the temple complex are not yet optimal, thereby reducing comfort, safety, and the quality of religious services. Sub-issues are functional zoning within the complex is not clearly defined between sacred areas, circulation routes, and spaces for supporting activities, pedestrian paths and courtyards are located near cliffs without adequate safety measures, the management of open spaces and emergency access has not been planned in accordance with safety standards and limitations in the technical foundations of area planning based on geotechnical conditions.



Figure 2. The access road to the temple is still a narrow, uneven dirt path with a fairly steep slope, making it unsafe and hindering the mobility of worshippers, especially when the ground is wet or the temple is crowded with visitors.

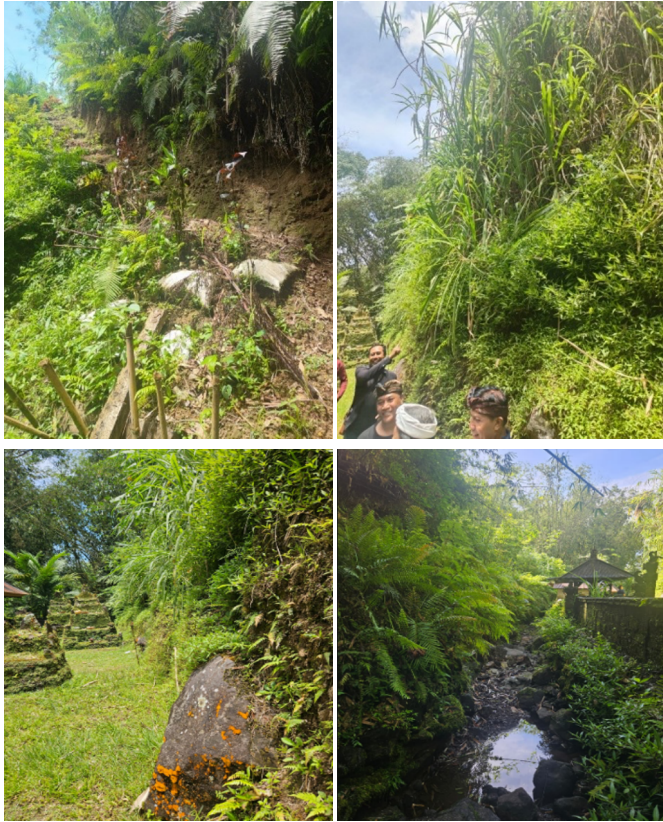


Figure 3. A step, exposed slope with wild vegetation indicates potential for erosion and landslides; the construction of a retaining wall is necessary to ensure the stability and safety of the surrounding area.

2 Methodology

The stages or steps involved in implementing the solution proposed in this community service program include:

2.1 Problem Solving Steps

The Community Service Program with partners begins by gathering information about the partners' issues and disseminating the purpose and objectives of this Community Service Program, which include implementation schedule, capacity of the implementation team, funding model, procedures for implementing the Community Service Program, and discussions will focus on the various problems faced by the partner.

2.2 Problem Solving Steps

The implementation method involves conducting activities organized into several work phases to facilitate implementation and evaluation. These phases are as follows:

Site Survey. Conducting a site survey related to plans for the construction of a retaining wall. The site survey process begins with preparation, which involves collecting preliminary data such as topographic maps, satellite imagery, rainfall data, and information on land use in the surrounding area. At this stage, coordination with area managers or the local community is also carried out to obtain permits and preliminary information regarding site conditions. The next stage is field observation, which involves a direct inspection to identify existing conditions such as slope gradients, surface soil conditions, erosion potential, natural drainage channels, and the presence of cracks or indications of ground movement. This is followed by measurements and documentation, including measurements of site dimensions, elevation, slope gradients, and the recording of critical points using simple measuring tools or GPS, accompanied by photographic documentation. The next stage involves collecting soil samples at points representative of site conditions for laboratory testing. The final stage consists of analyzing the data and preparing a survey report, which includes the results of observations, an interpretation of the initial geotechnical conditions, and technical recommendations to serve as the basis for planning site remediation.

Preparation of Materials and Surveying Equipment. Preparation of materials and supporting equipment for topographic mapping of the land at Pura Luhur Puncak Les in the traditional village of Angseri, Baturiti Subdistrict, Tabanan Regency, including Total Station (TS), survey stakes, and measuring tape.

Public Awareness Campaign. Disseminating the results of topographic mapping is a crucial step in community service activities, aimed at conveying technical information to local stakeholders in a clear and easily understandable manner. This activity is carried out through meetings with temple administrators, traditional village officials, and the local community to present the results of the topographic mapping that has been conducted at the site. Conveying technical information to the community is part of the knowledge transfer process, ensuring that the community understands the scientific basis for each proposed development recommendation. Thus, the results of soil testing serve not only as technical documents but also as the foundation for collaborative decision-making that supports safe and sustainable regional development.

Internal Monitoring of Activities at Partner Sites. Monitoring by the P3M internal team at partner sites in accordance with the activity proposal funded under the contract, including sharing of internal monitoring information by the P3M of the Bali State Polytechnic with the activity implementation team and conducting internal monitoring by the P3M of the Bali State Polytechnic at partner sites.

Program Implementation Evaluation and Sustainability. Monitoring and Evaluation by the Program Implementation Team, the P3M PNB Internal Team, regarding the Community Service Program assistance was presented to the partner such as announcement of the P3M PNB Internal Monitoring and Evaluation Team for Community Service Program activities carried out at the partner's site, monitoring and evaluation of Community Service Program activities at partner locations and discussion, Question and Answer session between the Community Service Program Team and partners.

Monitoring and Evaluation of the Program Implementation Team for the Community Service Program grant provided to the partner such as following implementation, monitoring, and evaluation, the P3M PNB internal team will continue to conduct internal monitoring, preparation of a final activity report by the Implementation Team and a seminar on the results of the activities by the Implementation Team at P3M PNB, to be held at a date to be determined.

3 Result and Discussion

3.1 Result

In general, the topographic mapping process is carried out through the following stages such as field data collection are photogrammetric drones and GNSS RTK / Geodetic GPS or Total Station. Data processing is photogrammetric software and Geographic Information System (GIS). And the output are topographic maps, digital elevation models (DEM), contour maps and 3D models of temple complexes.

This technology enables the creation of detailed and accurate topographic maps more quickly than conventional methods. Drones capture hundreds of aerial photos, which are then processed into precise maps and 3D models of the area.

3.2 Discussion

Topography plays a very important role in assisting people when planning development or land use. In addition, topography serves as a guide for routes and navigation. This is because it provides data on road routes, distances, locations, and so on (Das, 1993).

A distinctive feature of topographic maps is the presence of contour lines that indicate variations in elevation, terrain features, and elevation levels. Topographic maps generally have a detailed and large scale.

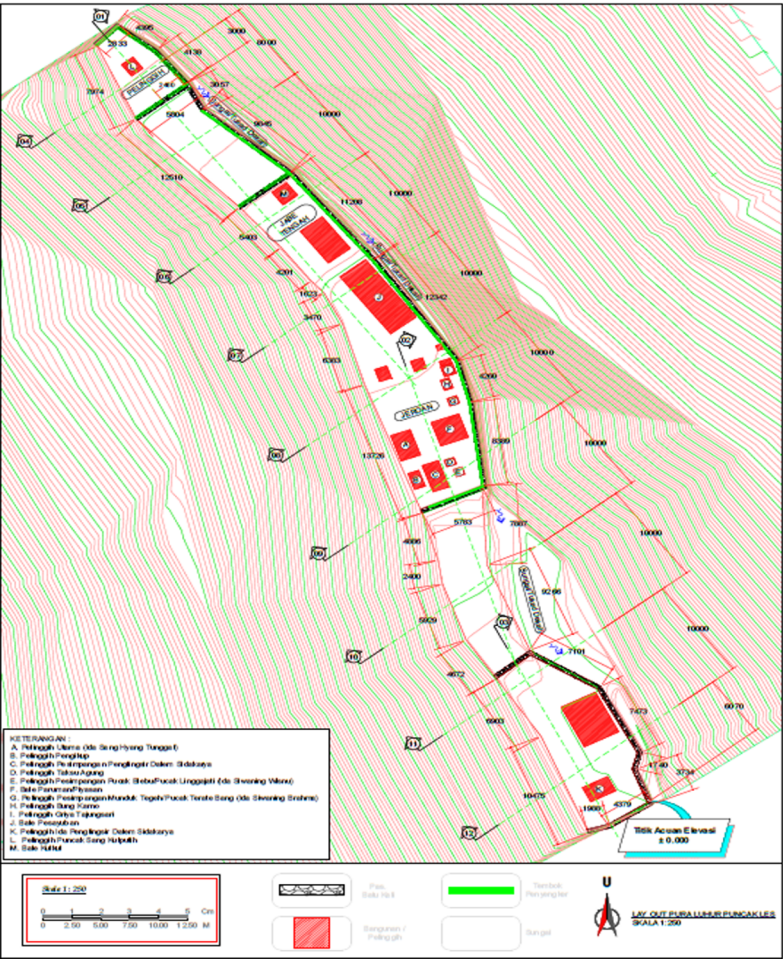
Understanding the benefits and functions of topographic maps makes it essential for everyone to develop the skills to read them to derive their full benefits. The following are some important methods for reading topographic maps (Rostianingsih et al., 2004):

Looking at the Contour Lines. The first step in reading topography is to look at the contour lines on a photographic map. Each contour line has its own meaning. Therefore, a thorough understanding of contour lines is the first step toward being able to read topography.

Understanding Contour Lines. The next step in reading topographic maps is to understand the meaning of contour lines. Contour lines have various meanings, such as elevation contour lines or landform contour lines. Contour lines representing different elevation levels can be interpreted based on the scale. The same applies to contour lines that indicate landform characteristics.

Contour lines spaced far apart indicate a gently sloping terrain, while closely spaced contour lines indicate a steep slope. A good understanding of these contours lines can facilitate the interpretation of topographic maps for all purposes (Sutarman & Triyanto, 2006).

Based on the results of previous surveys, a topographic map of the Pura Luhur Puncak Les area has been produced. This plan will serve as the basis for determining the design of the earth retention wall to be constructed along the river at Pura Luhur Puncak Les.



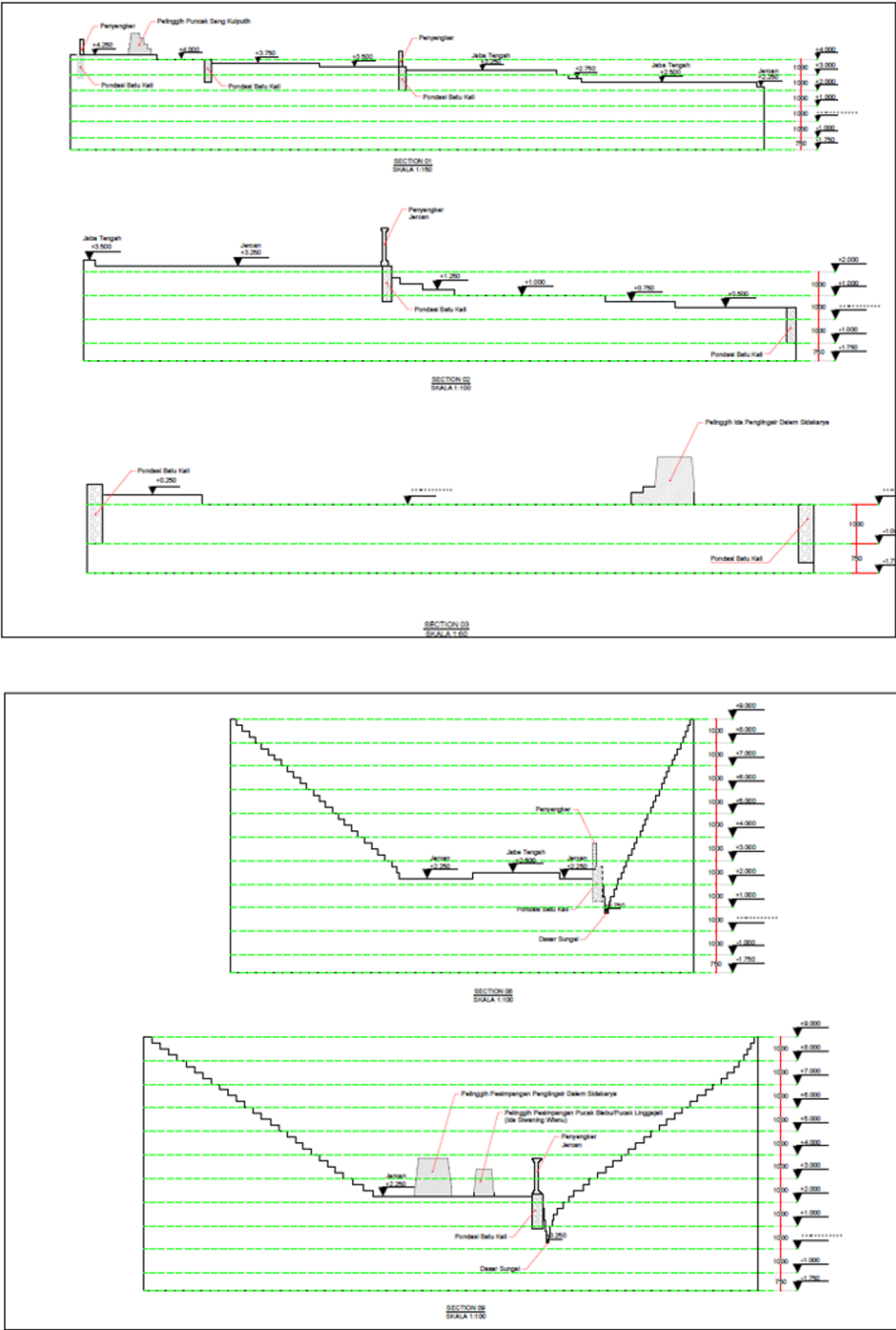


Figure 5. Longitudinal and Cross-Sectional Views of the Topography of Pura Luhur Puncak Les

4 Conclusion

High-precision topographic mapping using Total Station and GNSS alongside geotechnical soil investigations at Pura Luhur Puncak Les revealed that the western slopes and Dekah River banks are in a critical state due to steep gradients and the absence of permanent retaining structures. Uncontrolled surface runoff during high-intensity rainfall was identified as the primary driver of slope instability and bank erosion, directly threatening the sacred heritage complex. Practically, the measured elevation and contour data provide crucial engineering parameters for designing optimized retaining walls resistant to sliding and overturning failures. Furthermore, these technical findings serve as a fundamental baseline for sizing integrated surface drainage, normalizing the river channel, and establishing sustainable safety zoning to support long-term disaster risk mitigation for the heritage site.

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