INTELLIGENT
HOUSING

Land
Surface Analysis Report

An Analysis of Elevation, Slope, Aspect, and Land Surface Morphology of Haka Game Park for Development Suitability

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Executive Summary

This report analyzes the terrain of Haka Game Park (2,500 ha, Masasa). Slope analysis shows slopes range from 0 to 11.5 degrees, with gentler areas suitable for development and steeper zones requiring engineering. Aspect analysis reveals north-facing slopes are present for optimal lodge placement. Elevation ranges from 1,518 to 1,570 meters, with total relief of 52 meters. Contour mapping confirms moderately varied terrain. Based on these findings, the property is moderately suitable for mixed-use development including lodges, game drive routes, and conservation zones.

3D MAP

Slope Stability

The terrain is exceptionally favorable for development. While the legend shows a maximum value of 11.5°, the vast majority of the land falls within the 0° to 3.5° range (green to yellow). In the context of an urban game park, this translates to low construction costs and high flexibility for infrastructure.

Construction Suitability Analysis

1. Core Infrastructure & Lodges (Green to Light Green: 0° – 2.3°)

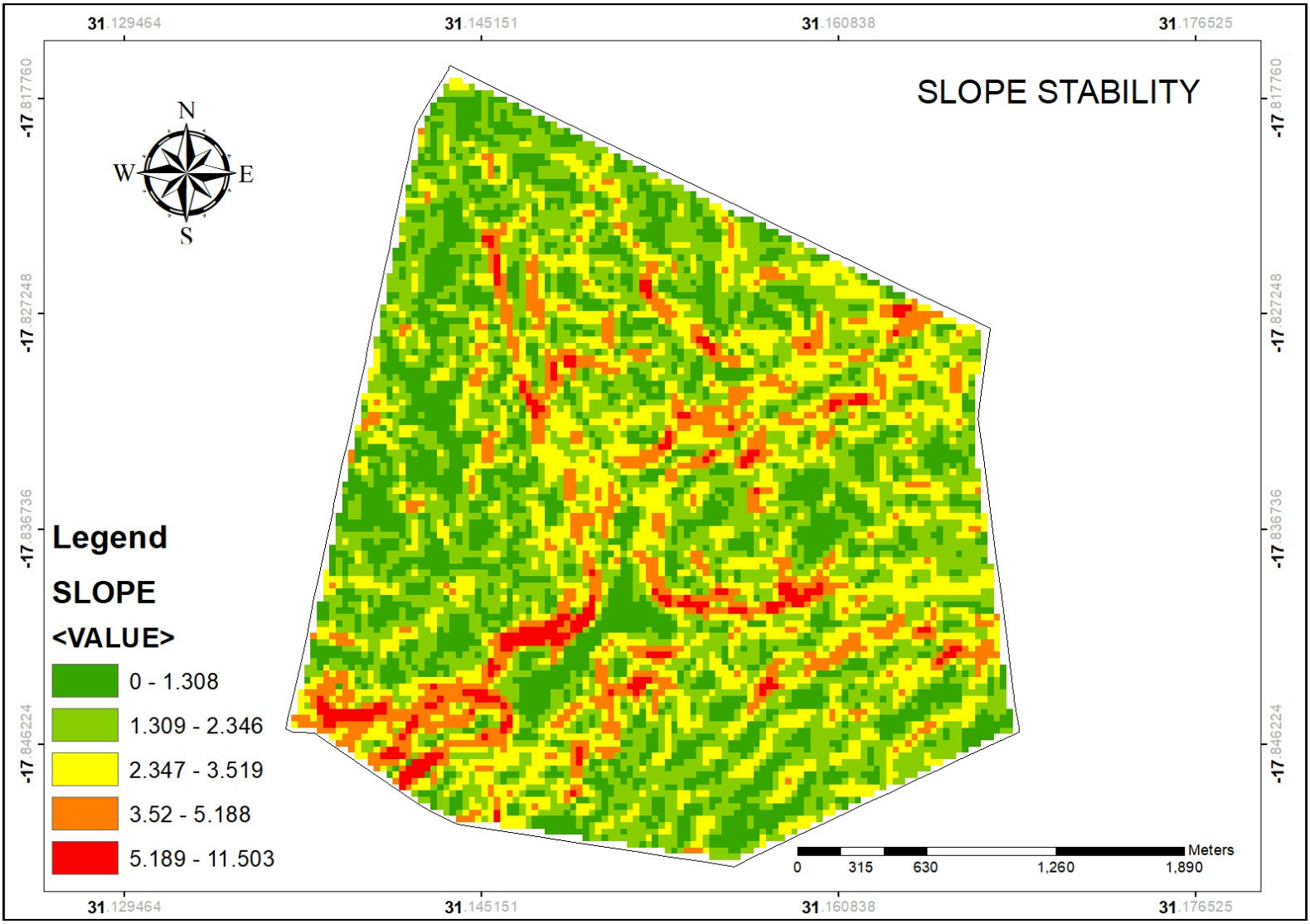
These areas represent the most stable ground for large scale construction. They are ideal for central hubs, staff housing, and heavy footprint structures like reception centers or storage sheds. Because the gradient is so slight, these zones require minimal cut and fill earthworks, significantly reducing foundation costs. For luxury lodges, these areas offer stable, flat building envelopes that can accommodate expansive decks and pools without the need for complex structural piling.

2. Drainage & Sewage Systems (Yellow to Orange: 2.3° – 5.2°)

These moderate gradients are the sweet spot for utility planning. A slope of 2° to 5° is ideal for gravity fed drainage and sewage pipes, ensuring effluent moves efficiently without the need for expensive pumping stations. In a game park setting, these areas should be prioritized for lodge sites that require sophisticated plumbing, as the natural incline assists in waste management and prevents water from pooling around foundations.

3. Road Networks & Access (Red Zones: 5.2° – 11.5°)

While labeled red, these areas are still relatively gentle by engineering standards. However, within a game park, these represent the steepest sections where road design requires care. To prevent soil erosion and washouts during heavy rains, roads should follow the contours rather than cutting directly across them. These higher-gradient ridges are the best locations for scenic viewpoints or lookout style bush camps, as they provide the elevation needed for expansive views over the flatter green grazing plains.



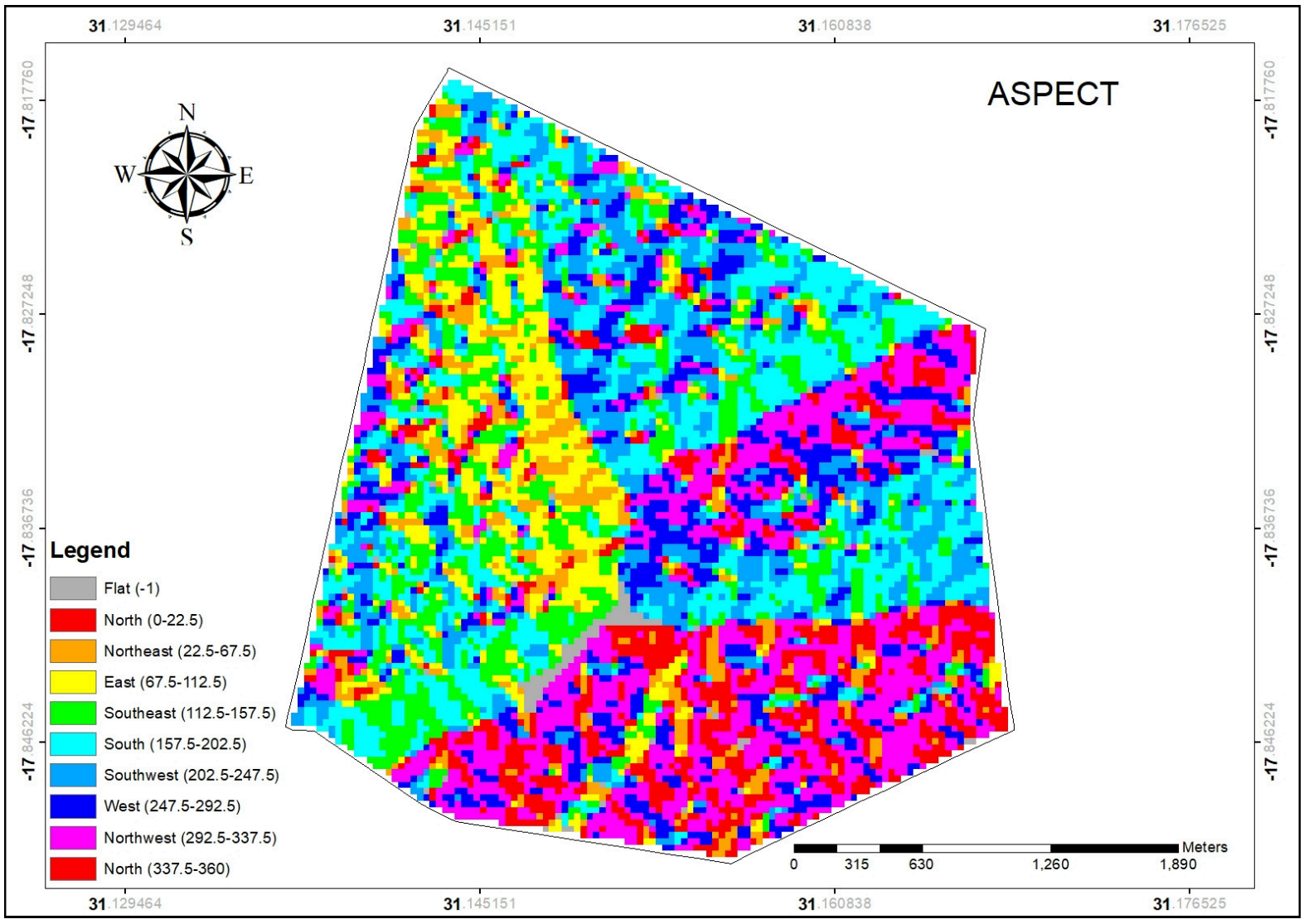
Aspect

The western half of the property is dominated by northern and eastern aspects (warm colors), while the eastern half features predominantly southern and western exposures (cool colors). This variety allows for a nuanced approach to infrastructure placement that prioritizes both human comfort and ecological sustainability.

The northern facing slopes (0°–22.5° and 337.5°–360°), highlighted in light green and red, represent the highest-value real estate for energy-efficient lodge construction. Because these areas receive the most direct sunlight throughout the year, they are the primary candidates for off-grid solar arrays and passive solar building designs. Structures situated on these slopes will benefit from natural heating during winter months, significantly reducing long-term energy costs. Additionally, the northeast and east-facing slopes (orange and yellow) are ideal for guest accommodations; they capture the early morning sun while providing natural afternoon shade, creating a comfortable environment for guests returning from morning game drives.

Conversely, the southern and southwest-facing regions (cyan and purple) offer a cooler, more shaded environment. In the context of a game park, these aspects are often the preferred corridors for wildlife during the heat of the day, as they retain moisture better and support denser vegetation. While these cooler slopes may require more insulation for buildings, they are excellent locations for viewing hides or bush camps that remain temperate during peak summer heat. These areas are also less susceptible to the drying effects of the sun, making them critical zones for maintaining soil health and supporting the park's biodiversity.

The western facing slopes (blue and dark blue) are exposed to the intense afternoon sun and often the prevailing weather systems. For infrastructure development, these areas should be designed with robust shading and wind protection. However, from a tourism perspective, western aspects are unparalleled for sundowner decks and communal lounge areas, as they provide direct views of the sunset over the landscape.



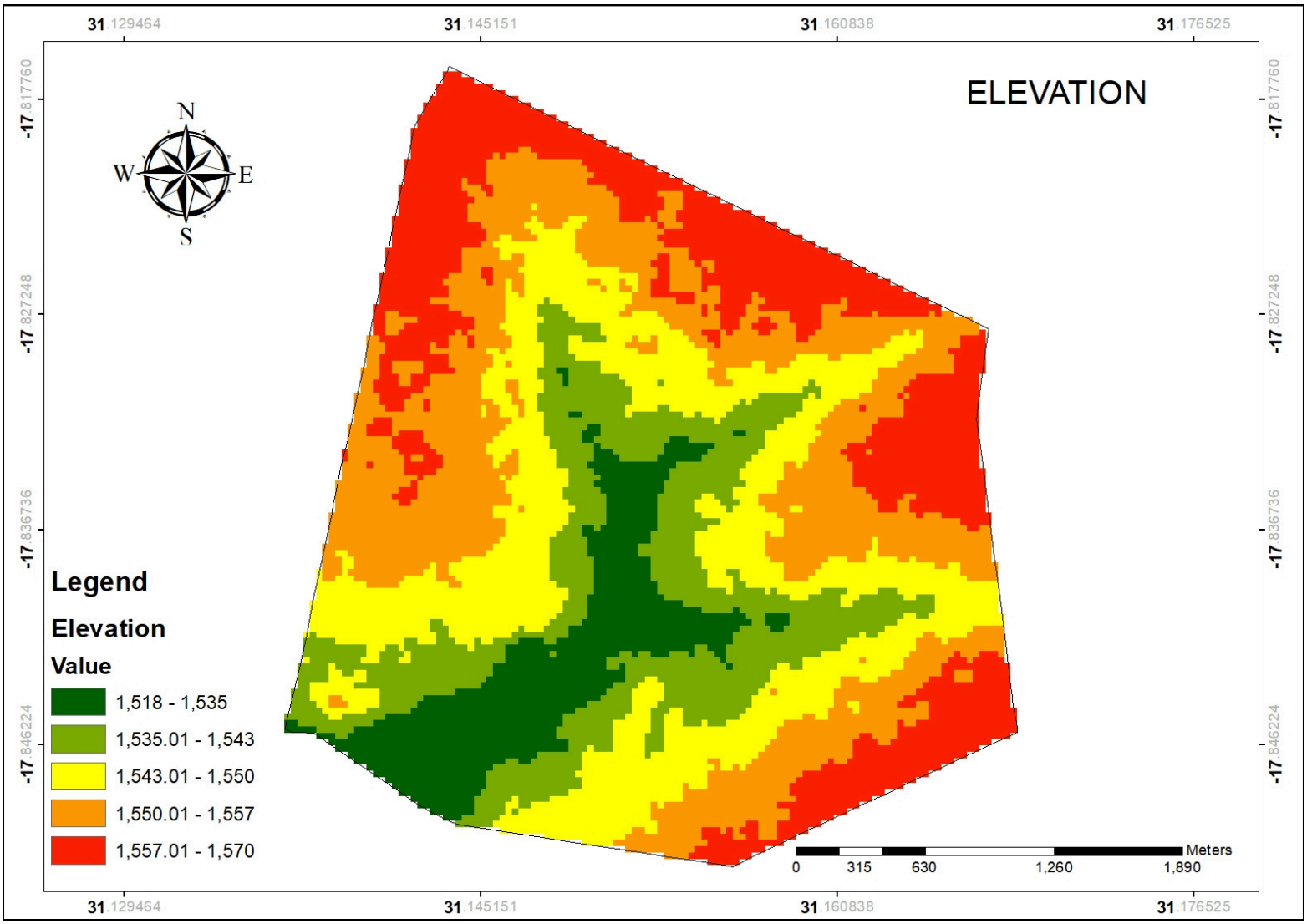
Elevation

The elevation analysis reveals a significant topographical basin structure, with a total relief of approximately 52 meters across the property. The site transitions from high altitude peripheral ridges at 1,570 meters down to a central valley floor at 1,518 meters. This drainage centric topography is a defining feature for the game park, as it dictates the natural movement of water, the distribution of vegetation, and the strategic placement of all permanent infrastructure to avoid flood prone zones.

The high altitude ridges (red and orange: 1,550m – 1,570m) form a natural horseshoe around the northern, eastern, and western boundaries. These elevated zones are the most secure locations for primary lodge developments and staff housing. Building on these heights ensures excellent natural drainage away from structures and provides the panoramic views essential for high end tourism. Because these areas represent the recharge zones for the property's water table, they are less likely to experience seasonal waterlogging, making them the most stable year-round sites for heavy infrastructure and road access.

The mid elevation transitions (yellow and light green: 1,535m – 1,550m) act as the primary connective tissue of the park and are the optimal corridors for gravity fed utilities. By following these elevation gradients, drainage and sewage systems can operate efficiently without mechanical assistance. These zones often support the most diverse flora, as they benefit from the runoff of the higher ground while remaining safely above the potential flood line of the central basin.

The central lowlands (dark green: 1,518m – 1,535m) function as the park’s primary catchment area and ecological heart. In a game park context, these are the most likely locations for natural waterholes, seasonal pans, or lush grazing meadows that will attract high concentrations of wildlife. However, from a construction standpoint, these zones carry the highest risk of saturation and flood vulnerability during peak rainfall. Consequently, infrastructure in the dark green zones should be limited to light-touch developments such as viewing hides, raised timber boardwalks, or temporary seasonal camps. Most importantly, these low points represent the highest potential for borehole suitability, as the water table is likely closest to the surface here, making it the logical target for sustainable water extraction.

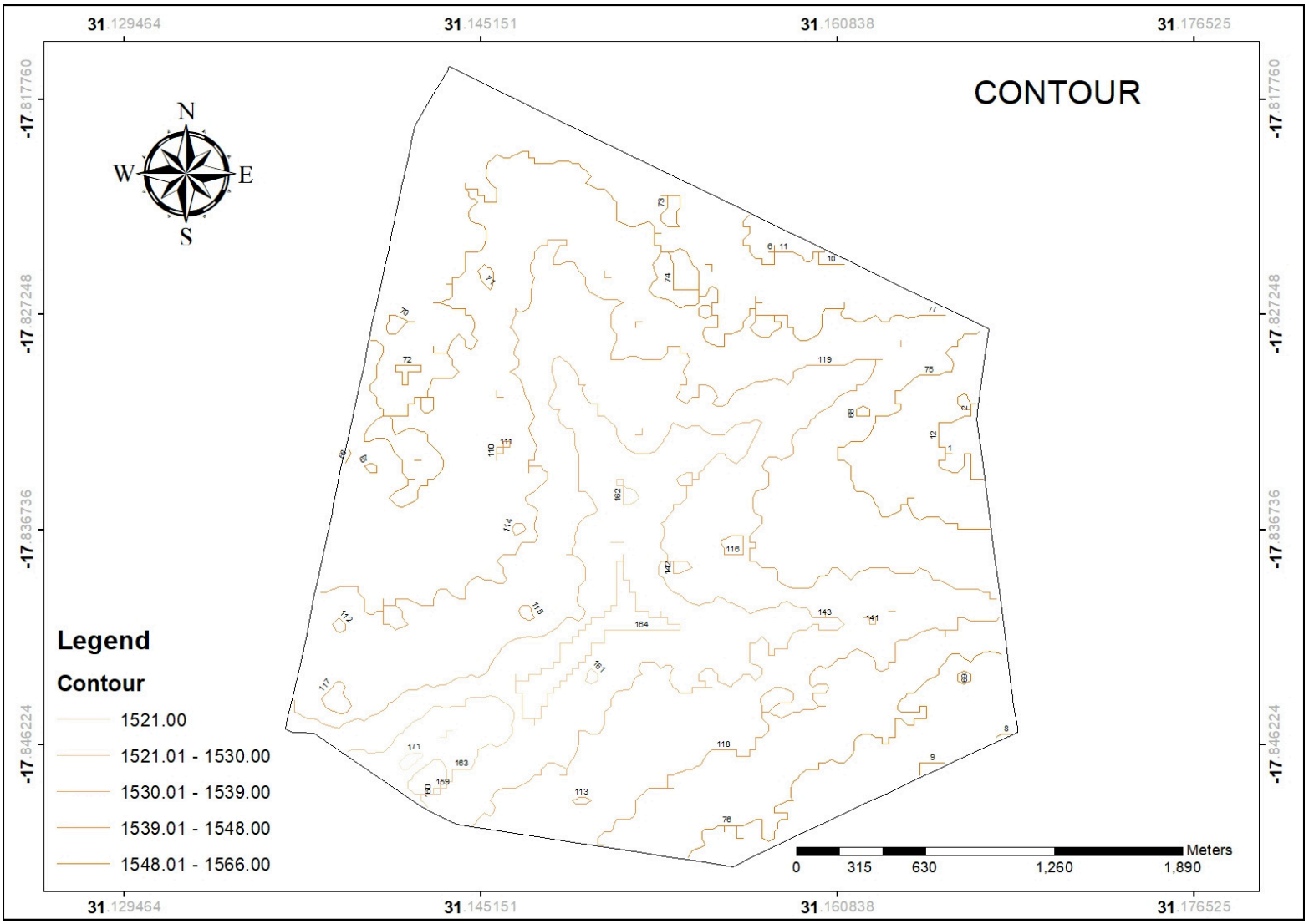


Contour

The widely spaced contour lines in the northern and central sections indicate broad, relatively flat plateaus. These are the most stable building envelopes on the property, offering expansive areas for lodge footprints and communal infrastructure without the need for significant terraforming. Conversely, where the contour lines cluster more tightly, particularly along the eastern and southwestern boundaries, the gradient increases. These steeper embankments act as natural boundaries and should be utilized for privacy between lodge sites or as elevated platforms for viewing decks, as they provide natural height without requiring artificial elevation.

These valleys are the natural conduits for surface water runoff and represent the areas of highest flood risk during extreme weather. To ensure infrastructure longevity, roads should avoid crossing these channels where possible, or be equipped with significant culvert systems. However, these same valley floors are the high-priority zones for groundwater exploration; the convergence of these lines suggests these are the locations where sub-surface water is most likely to accumulate, making them ideal for borehole drilling.

Finally, the ridges identified by contours pointing "downhill" offer the most resilient locations for the park's primary access roads. By aligning the road network along these high points, the developer can ensure natural drainage away from the road surface, significantly reducing maintenance costs and preventing washouts that often plague rural game parks. This contour map effectively serves as the skeleton of the property; by building on the ridges and respecting the valleys, the developer can create a sustainable footprint that works in harmony with the site's natural water cycles and topographical strengths.



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