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EROSION BY HIGH INTENSITY RAINFALLS IN THE LOWER WAIKATO

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Abstract

A high intensity rainstorm with rainfalls exceeding 10 inches in 24 hours on the Hunua Range is described, and some of its geomorphological and economic consequences discussed.

In an earlier paper (Selby, 1967) it was suggested that intense rainfalls are responsible for most of the slope erosion in the greywacke ranges of the lower and middle Waikato Basins. This note describes one such storm and some of its consequences.

On February 27th, 1966 an anticyclone lay to the east of New Zealand and an extensive depression was moving across the Tasman Sea towards the country. A warm moist northeasterly airstream brought rain to Auckland by midday on the 28th and to the Lower Waikato and the Hauraki Plains by mid-afternoon, so that most places within the area received 1 to 2 inches of rain during the afternoon and evening. By midnight of the 28th February the warm front, associated with the depression, was lying across the area bringing heavy rain and thunder which affected the Lower Waikato and Hauraki areas (Fig. 1).

The general rainfall distribution is shown in Figure 2. It is clear that orographic lifting and increased instability produced very heavy rainfalls over all of the high country, and in particular over the Hunua and Hapuakohe Ranges. The widespread thunderstorm activity over the hill country probably gave rise to considerable local variations in the rain received, but as the network of rain gauges is sparse the extent of these differences has not been recorded, and it is possible that some areas in the Hunua and Hapuakohe Ranges actually received more than the 8 and 10 inch falls shown in Figure 2. The two rainfall stations nearest to the Hapuakohe Range, Maramarua and Tainui, recorded 6.03

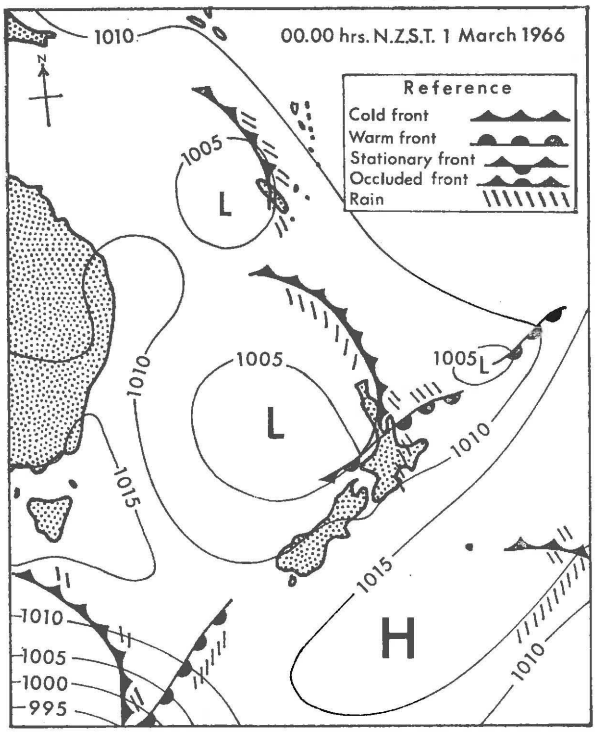

Figure 1

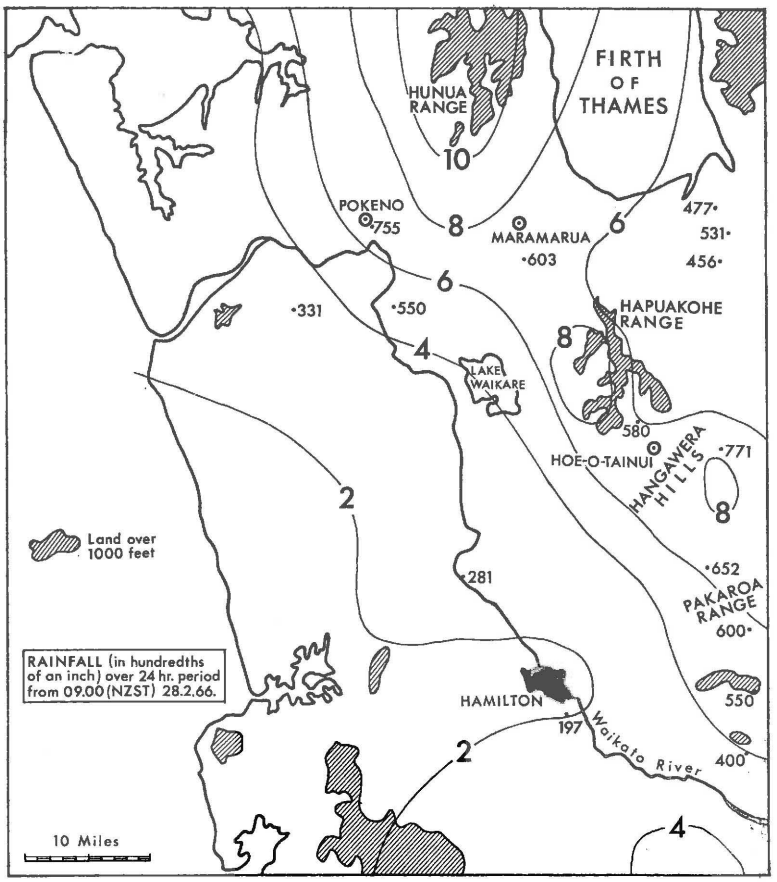

Figure 2

inches and 5.80 inches respectively — totals which are well in excess of the previous highest daily rainfall figures of 4.07 inches and 4.87 inches. Average rainfall intensities of about 1 inch/hour were maintained for periods of 1 to 2 hours in many areas, and in areas affected by thunderstorms much higher intensities were experienced for short durations, as is shown by the record from Pokeno where out of a total 24 hour rainfall of 7.55 inches, two separate hourly falls of 2.5 inches and 1.5 inches contributed half. The maximum intensities recorded at Pokeno were approximately:

4.2	in/hr	for	a	duration	of	10	minutes
3.3	,,	,,	,,	,,	,,	20	,,
3.0	,,	,,	,,	,,	,,	30	,,
2.5	,,	,,	,,	,,	,,	60	,,

It is reasonable to assume that similar or even greater intensities were experienced in the Ranges where no automatic recorders were available.

Erosion

The excessive runoff from this storm caused widespread mass movement on the Ranges. In the Hapuakohe Range debris slides occurred with such proximity to each other that in some order three catchments up to 40% of the ground surface was affected by movements or deposition

of debris. Figure 3 shows the location of debris slids in one catchment. They occurred in two positions: either at the base of slopes which were being undercut by streams, or within the scars of older mass movement features. It is noticable that no movements occurred in the forested areas. Extensive field observations indicate that movements did occur in some forested areas, but always less frequently than on adjacent pastures. In the case of the area shown in Figure 3 it is not certain that the differences in the extent of mass movement, between the pasture and forest areas, are the result of vegetation and land use alone, for the precipitation in thunderstorms is so variable over short distances as to produce quite different intensities in adjacent catchments.

In the valley floors the discharge was such that in the headwaters of the Waerenga Stream in the Hapuakohe Range, where the normal estimated discharge is about 5 cusecs, the peak discharge during the storm was estimated at between 3,000 and 5,000 cusecs from a catchment of 2.8 square miles. This discharge is of the same order as that calculated for

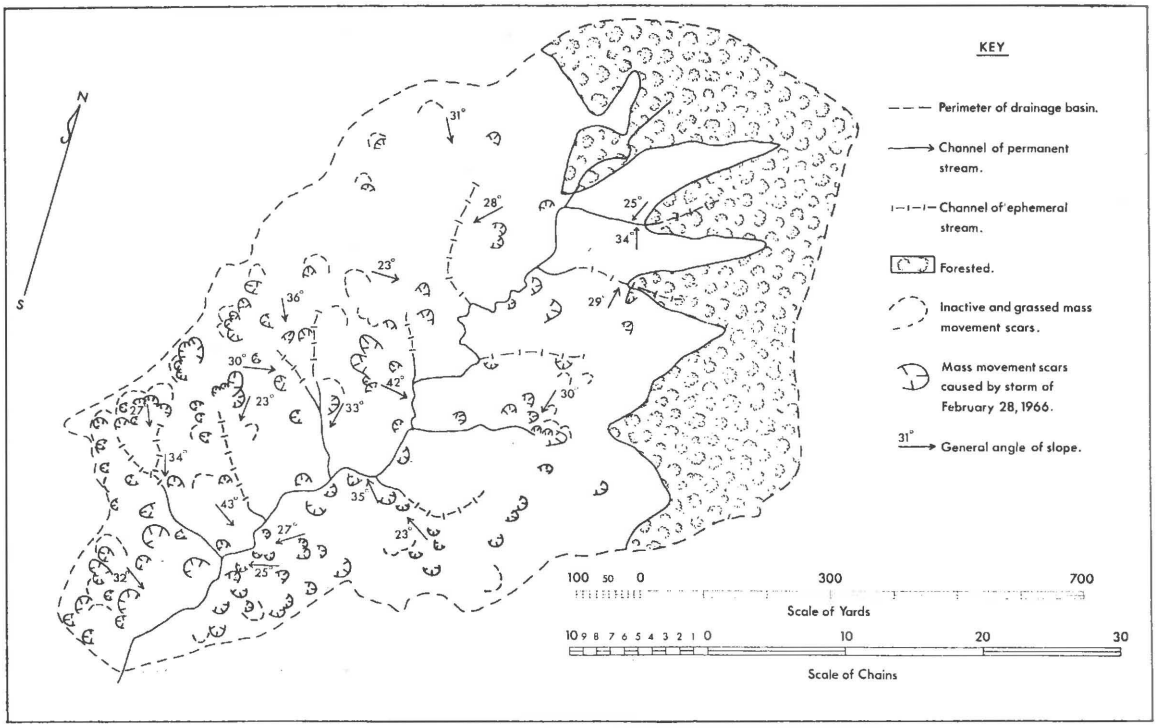

Figure 3

the forested headwaters of the Mangatangi Stream in the Hunua Ranges where, during the same storm, a catchment of 17 square miles yielded a peak discharge of 12,500 cusecs. The result of these floods was extensive stream erosion in the upper catchment areas and flooding and sediment deposition in the lower reaches where the streams debouch on to the flat land of the Waikato and Hauraki Plains.

Economic effects of the storm

Information compiled by the Waikato Valley Authority suggests that the storm damage in the Lower Waikato area included: 800 chains of fencing destroyed; 600 acres covered by floodwaters of which 200 acres

needed regrassing; and 3,500 acres affected by mass movements. Many farmers whose individual losses were small did not make claims for subsidies, to cover the cost of repairs, but the Waikato Valley Authority received requests for restoration work on 830 acres which had a total cost of $NZ3,440. The estimated cost of repairs to bridges, culverts and roads in the Waikato Country was $NZ20,000 and in Piako County $NZ5,000.

On the east-facing slopes of the Hapuakohe Range, in the area of the Hauraki Catchment Board, about 125 acres of land were so seriously affected by mass movements that farmers requested aid of $NZ1,194, although only $NZ202 was actually paid out. The greatest charge to the Hauraki Catchment Board for was cleaning drains and streams, which cost $NZ5,186. Again costs to individual farmers for loss of production on eroded land, damage to farm roads and fences, or in downstream areas of silting and flooding of pastures are not known.

Conclusion

The effectiveness of high intensity rainstorms as the major contemporary cause of erosion seems well established. Evidence already presented (Selby, 1967) indicates that such storms do less damage in areas of forest than in areas in pasture, and that once the equilibrium on slopes has been disturbed there will be a long period of readjustment. The storm of February 28th, 1966, had a return period probably in excess of 20 years (but in view of the shortness of the rainfall records available from automatic raingauges a reliable figure is not available). Its effects are sufficiently serious to make detailed economic and geomorphological investigation of land use in the Ranges most necessary.

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REFERENCE

Selby, M. J., 1967: Aspects of the Geomorphology of the Greywacke Ranges Bordering the Lower and Middle Waikato Basins. *Earth Sci. Jnl.* 1(1): pp. 37 – 58.