Maps showing landslides and slopes most susceptible to sliding in parts of the Mars and Valencia 7 1/2-minute quadrangles, Butler County, Pennsylvania

J. S. Pomeroy

This suite of maps is one of a series of selected 1:24,000 scale quadrangles in the Greater Pittsburgh region which identifies areas with potential slope stability problems significant to development. The maps are part of a smaller scale (1:50,000) map showing only landslides in Butler County (Pomeroy, 1977). Significantly, the area in Butler County with the greatest susceptibility to landsliding lies in Cranberry and Middlesex Townships which are experiencing moderate to relatively rapid growth.

Intensive interpretation of 1975 aerial photographs (1:24,000) was supplemented by field reconnaissance in late 1975. The resulting maps do not purport to show all recent landslides as most slides are too small to be discerned on the aerial photographs. Furthermore, many slopes not designated as containing older landslides undoubtedly include some but the geomorphic evidence for them has been obliterated by erosion or modified by man.

This map suite is essentially a guide to areas where detailed studies of slope stability would be most vital to the general public. In these areas, site evaluations are necessary in order to determine the degree of difficulty that slope instability map pose to a contemplated land use. The maps are not intended to replace detailed geological and engineering studies of specific sites by competent technical personnel.

Bedrock in this portion of southern Butler County consists almost entirely of rocks of the Conemaugh Group. A higher concentration of landslide problems occurs on the Conemaugh terrain in adjacent Allegheny County (Briggs et al, 1975, Pomeroy and Davies, 1975). Soils and weathered rock derived from the red mudstones of the Conemaugh Group are particularly prone to sliding. These soils are plastic with a moderate to high shrink-swell potential (U.S. Dept. Agriculture, 1972) and are mainly in colluvial and residual clayey to clayey silt soil.

Features shown on the map

Recent landslides.--Fresh scars characterize the youngest landslides in the area. Most slides have evidently been man-generated as they usually occur in the proximity of roads, construction sites etc. Landslides smaller than 10 m (33 ft.) in maximum dimension have not been plotted on the map and are best designated as soil slips. A few examples of recent landslides are cited as follows.

Locality 1 - A relatively fresh, arcuate-shaped landform which spans approximately 140 m (460 ft.) at its maximum width is clearly discernible on the aerial photographs. A rock-cut bench between the highway and the cirque-like feature suggested a massive slope failure during or shortly after construction of I-79. Field inspection indicates a complete renovation of the slope area with substantial removal of red soil in the landslide area. Neal Hawks (Penn DOT, Indiana, Pa., oral commun., 1977) informed the author that failure of the slope occurred during the construction stage in the summer of 1968. The massive slide involved an estimated 1,000,000 cu. yds, of rock and colluvium.

Locality 2 - A landslide on the southeast side of Mars roughly 30 m(100 ft.) long by 15 m (50 ft.) wide also lies above red mudstone. Although its cause is unknown, the recent landslide is part of a larger older landslide.

Locality 3 - Extensive slope movements have been occurring in the vicinity of a newly developed mobile home community east of Rte. 8, 2.3 km (1.4 mi.) north of Glade Mills. Soil slips occur at the east end of the development. Larger slides occur above the church parking lot south of the east-west trending road and along the same road east of the church.

Older landslides.-- Most of the older landslide areas do not represent single events but are accumulations of landslide deposits that probably occurred during and immediately after glaciation when rainfall intensity was considerably greater than it is now. Generally, older landslides occur in areas which are not only concave across slope but downslope as well. Instability is increased in such areas that have higher concentrations of ground water than adjacent slopes. Colluvial material along concave slopes is often thicker than 10 m (33 ft.) especially at the foot end (see figure).

Definite older landslides are characterized by conspicuous to slightly subdued hummocky and/or bulging surfaces along the lower slope. A head scarp (though modified by erosion) is commonly discernible.

Indefinite older landslides commonly lack some of the diagnostic criteria which indicate a definite older landslide.

Older landslides may be presently stable but are often sensitive to modification by man and can be reactivated by excavation, loading, and changes in ground-water and surface-water conditions.

Slopes most susceptible to sliding

Steep slopes underlain by red mudstones are more susceptible to landsliding than are other slopes. Generally, few slopes less than 15 percent are included within this zone. Slopes most susceptible to landsliding often include non-red mudstone, shale, and minor siltstone interlayered with the red mudstone. Soils derived from the non-redbeds are occasionally unstable.

Red mudstone weathers very rapidly on exposure to air and water and gives rise to slope failures involving driveways, sidewalks, patios, and other secondary structures founded on soil derived from the red mudstones. However, houses with foundations set in red mudstone (bedrock) apparently stand as well as houses set in other rock types.

As development in southern Butler County continues, the knob or hill areas which afford scenic vistas will more than likely be utilized. In the townships of Cranberry, Adams, and Middlesex red mudstone makes up much of the bedrock underlying these hills. Proper engineering and judicious control of land use in these sensitive areas can be used to control the threat of slope movement.

References cited

Briggs, R. P., Pomeroy, J. S., and Davies, W. E., 1975, Landsliding in Allegheny County, Pennsylvania: U.S. Geol. Survey Circ. 728, 18 p.

Eckel, E. B., ed., 1958, Landslides and engineering practise. Natl. Research Council Highway Research Board Spec. Rept. 29, 232 p. (also available as Natl. Research Council Pub. 544, 1958).

Pomeroy, J. S., and Davies, W. E., 1975, Map of susceptibility to landsliding, Allegheny County, Pennsylvania: U.S. Geol. Survey Misc. Field Studies Map MF-685 B, 2 sheets w/ text.

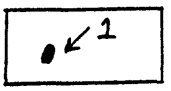
Pomeroy, J. S., 1977, Preliminary reconnaissance map showing landslides in Butler County, Pennsylvania: U.S. Geol. Survey open-file Rept., no. 77-246, 3 p., 2 pls.

U.S. Department of Agriculture, Soil Conservation Service, 1972, Soil survey maps and interpretations for developing areas in Butler County, Pennsylvania: Pa. Dept. Environmental Resources, State Conservation Commission, 116 p.

EXPLANATION

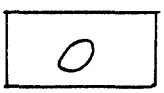
(see text for additional information)

RECENT LANDSLIDES

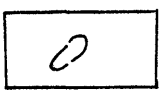


Well-defined, characterized by fresh scars, may still be active. Arrow points to darkened area indicative of a recent slide. Number refers to landslide mentioned in text.

OLDER LANDSLIDES



Definite, boundaries approximate.



Indefinite, fair to poor definition, boundaries inferred.

Slopes most susceptible to landsliding. Underlain largely by red mudstones of Conemaugh Group.

(p.2 Explanation)

NOTE

Variations in slope sensitivity may occur at any specific point within a unit. Boundaries largely are inferred and information given is intended as a general guide and should not be construed as applicable to all localities within the area shown. This map contains data usable in identification of areas involving slope stability but it cannot be used as a substitute for detailed engineering investigations of specific sites.

Nomenclature of parts of a landslide (simplified from Eckel, 1958).