UTAH GEOLOGICAL SURVEY
a division of
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PLATE 13

PIPING- AND SOIL-EROSION-SUSCEPTIBILITY MAP FOR THE ST. GEORGE–HURRICANE METROPOLITAN AREA

by

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Approximate mean declination, 2007

Map Location

Basemap consists of National Agricultural Imagery Program natural color aerial photography.

Universal Transverse Mercator Projection, zone 12. North American Datum 1983.

Scale 1:24,000

1 0.5 0 1 2 Miles

1 0 1 2 Kilometers

SYMBOLS

- Municipality boundary
- Interstate Highway
- State Highway
- Major local surface street
- Other road

EXPLANATION

P&ES Soils susceptible to piping and erosion. Generally fine-grained, noncohesive, loose to poorly consolidated sand and silt deposits, landslide deposits, and some poorly consolidated siltstone and claystone. For piping to develop, a free face and percolating ground water are necessary requirements. The loose, noncohesive nature of erodible soils makes them highly susceptible to the effects of water and wind erosion, especially when disturbed from their natural conditions.

Geologic Deposits Susceptible to Piping and Erosion

Type of Deposit	Map Units[1]
Stream Alluvium	Qal,
Fan Alluvium	Qae, Qac, Qaq, Qaec, Qaes, Qaeg
Eolian Deposits	Qes, Qed, Qea, Qeas, Qec, Qe/Qmsy, Qes/Qal, Qes/Qafo
Landslide Deposits	Qms, Qmsy, Qmsm, Qmsh, Qmsc, Qmsb, Qmsv
Poorly Consolidated Bedrock	Petrified Forest Mbr., Chinle Fm.; Shnabkaib Mbr. and red mbrs., Moenkopi Fm.; lower mbr., Kayenta Fm.; Kayenta Fm. undivided; Whitmore Point and Dinosaur Canyon Mbrs., Moenave Fm.

[1]Refer to UGS 1:24,000-scale geologic maps (see SOURCES OF DATA and REFERENCES sections in accompanying text) for unit descriptions.

DISCUSSION

Fine-grained, noncohesive, loose sand and silt deposits present in many areas of the St. George – Hurricane metropolitan area are subject to piping and erosion. Piping is the subsurface erosion of permeable, fine-grained, unconsolidated or semi-consolidated deposits by percolating ground water. Piping creates narrow, subterranean conduits that grow both in diameter and length as increasingly more subsurface material is removed and as the cavities trap greater amounts of ground-water flow. Piping eventually leads to collapse of the overlying surficial materials, and is an important process in the headward extension of gullies in the study area. The characteristics that make soils susceptible to piping (fine-grained texture, little or no internal cohesion, and loose or poor consolidation) are also typical of highly erosive soils; consequently, piping often develops in otherwise highly erodible soils. In the study area, most erosion occurs during cloudburst storms and is caused by sheetwash and eventual channelization of runoff. If disturbed, highly erosive soils are even more susceptible to erosion, particularly when stabilizing vegetation is removed. Because piping and highly erosive soils rarely if ever causes rapid, catastrophic property damage or are a threat to life safety, for purposes of this study, piping and highly erosive soils are considered adverse construction conditions and not geologic hazards.

For additional information about piping and highly erosive soils in the St. George – Hurricane metropolitan area, refer to the Problem-Soil-and-Rock text document in this report.

USING THIS MAP

The Piping-and-Soil-Erosion-Susceptibility Map shows the location of unconsolidated geologic deposits in the St. George – Hurricane metropolitan area that are susceptible to piping and erosion. The map is intended for general planning purposes to indicate where susceptible soils exist and where special studies may be required. The UGS recommends performing a site-specific geotechnical foundation/geologic-hazards study for all development at all locations in the study area. Site-specific studies can resolve uncertainties inherent in generalized mapping and help ensure safety by identifying the need for special foundation designs or mitigation techniques. The presence of soils susceptible to piping and erosion along with other adverse construction conditions and geologic hazards should be addressed in these investigations. If a potential for piping and erosion is present at a site, appropriate design recommendations should be provided.

MAP LIMITATIONS

The Piping-and-Soil-Erosion-Susceptibility Map is based on limited geologic and geotechnical data; site-specific studies are required to produce more detailed geotechnical information. The map also depends on the quality of those data, which varies throughout the study area. The boundaries of the areas shown as susceptible to piping and erosion are approximate and subject to change with additional information. Localized areas of piping and soil-erosion susceptibility may exist throughout the study area, but their identification is precluded because of limitations of map scale. This map is not intended for use at scales other than the published scale, and is designed for use in general planning to indicate the need for site-specific studies.

MITIGATION

Although potentially costly when not recognized and properly accommodated in project design and construction, problems associated with piping and highly erosive soils rarely are life threatening. As with most adverse construction conditions, early recognition and avoidance is the most effective way to mitigate potential problems. However, soils susceptible to piping and erosion are widespread in the St. George – Hurricane metropolitan area, and avoidance may not be a viable or cost-effective mitigation option.

In Utah, soil-test requirements are specified in the soil and foundations provisions of IBC Chapter 18 (p. 343) and the foundations provisions of IRC Chapter 4 (p. 42), which are adopted statewide. IBC Section 1802.2.1 (p. 343) contains requirements for soil investigations in areas where questionable soil (soil classification, strength, or compressibility in doubt) are present. IRC Section R401.4 (p. 67) states that the building official shall determine whether to require a soil test to determine the soil's characteristics in areas likely to have expansive, compressible, shifting, or other unknown soil characteristics. Where the presence of soils susceptible to piping or rapid erosion is confirmed, possible mitigation techniques include minimizing disturbance of vegetated areas, controlling the flow of shallow ground water, and managing surface drainage onsite in a controlled manner.