UTAH GEOLOGICAL SURVEY
a division of
Utah Department of Natural Resources

Plate 14
Utah Geological Survey Special Study 127
Geologic Hazards and Adverse Construction Conditions,
St. George–Hurricane Metropolitan Area, Washington County, Utah

PLATE 14

SHALLOW-GROUND-WATER-SUSCEPTIBILITY MAP FOR THE ST. GEORGE–HURRICANE METROPOLITAN AREA

by

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2008

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Approximate mean declination, 2007

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

SGW$_1$ Naturally wet soils mapped by the Natural Resources Conservation Service (NRCS) (depth to groundwater ≤60 inches), and soils mapped by the NRCS as poorly drained or frequently irrigated where water-well or geotechnical information indicates a significant area of permanent shallow ground water (≤10 ft). Construction in these areas will likely encounter shallow ground water at depths ≤10 feet, and basements and other water-sensitive underground facilities are not recommended without adequate drainage or other protection. Following development, lawn watering and other sources of urban runoff may cause ground-water levels to rise even higher in these areas.

SGW$_2$ Poorly drained, generally fine-grained soils mapped by the NRCS that may develop shallow ground water locally when rates of water application exceed the soil's drainage capacity. Subsurface drains are frequently required to prevent these soils from becoming saturated. Because these soils naturally drain slowly, they may remain wet for most of the year, even though water is applied only during the growing season. Permanent shallow ground water is possible following urbanization.

SGW$_3$ Moderately to freely draining soils mapped by the NRCS that are commonly irrigated for agricultural purposes. Where high rates of water application occur, these soils may develop seasonally shallow ground water, but typically drain quickly once water application stops or is reduced below the soil's drainage capacity. Seasonal or transient shallow ground water is possible following urbanization.

DISCUSSION

Ground water is water in saturated zones beneath the land surface in soil and rock at various depths. Ground water may exist under either unconfined (water table) or confined (artesian/pressurized) conditions, in regional aquifers or as local perched zones. Shallow-ground-water levels are typically dynamic and fluctuate in response to a variety of conditions; ground-water levels may rise or fall in response to seasonal variations in precipitation, long-term climatic change, irrigation, pumping, and the effects of urban development. Most construction-related ground-water problems occur when ground water is within 10 feet of the ground surface. Shallow ground water can flood basements and other underground facilities, damage buried utility lines, and destabilize excavations. Inundation of landfills, waste dumps, and septic-tank systems can impair the performance of those facilities and lead to ground-water contamination. Because of its ability to change the physical and chemical nature of rocks and soil, ground water can also induce volumetric change in expansive and collapsible soils, and is a major factor in slope instability. During earthquakes, ground water within 50 feet of the ground surface may cause some soils to liquefy. Because shallow ground water rarely if ever causes rapid, catastrophic property damage or is a threat to life safety, for purposes of this study, shallow ground water is considered an adverse construction condition and not a geologic hazard.

For additional information about shallow ground water in the St. George – Hurricane metropolitan area, refer to the Shallow-Ground-Water text document in this report.

USING THIS MAP

The Shallow-Ground-Water-Susceptibility Map shows the location of known and possible areas of shallow ground water in the St. George – Hurricane metropolitan area. The map is intended for general planning purposes to indicate where shallow ground water may be present and where special studies may be required. The UGS recommends a site-specific geotechnical foundation/geologic-hazards study for all development at all locations in the St. George – Hurricane metropolitan area. Site-specific studies can resolve uncertainties inherent in generalized hazard mapping and help ensure safety by identifying the need for special foundation designs or mitigation techniques. This is particularly true in the case of shallow ground water because our geotechnical database indicates that localized areas of shallow, perched ground water too small to show on the Shallow-Ground-Water-Susceptibility Map may be present anywhere within the study area. A site-specific investigation can establish the presence or absence of shallow ground water at a site, and if shallow ground water is present or is expected to be seasonally present, estimate the shallowest ground-water level expected. Doing so may require monitoring observation wells through more than one season and/or examining sediments exposed in test pits for evidence of seasonal ground-water fluctuations. If shallow ground water is present, or if the potential for seasonal shallow ground water exists, the consultant should provide appropriate design recommendations.

MAP LIMITATIONS

The Shallow-Ground-Water-Susceptibility Map is based on limited geologic, geotechnical, and hydrological 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. Therefore, the map-unit boundaries are approximate and subject to change with additional information. Shallow ground-water conditions at any particular location may be different than shown because of geological or hydrological variations within a map unit, gradational and approximate map-unit boundaries, and the generalized map scale. Localized areas of shallow, perched ground water may exist anywhere within the map area, but their identification is precluded because of data limitations and map scale. Seasonal and long-term fluctuations in weather patterns and changes in land use also may affect the depth to ground water at a site. 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, problems associated with shallow ground water rarely are life threatening. As with most adverse construction conditions, avoidance is the most effective way to mitigate possible problems. However, avoidance is not always a viable or cost-effective option. International Building Code section 1807 (International Code Council, 2006a) and International Residential Code section R406 (International Code Council, 2006b) contain dampproofing and waterproofing requirements for structures built in wet areas. Slab-on-grade construction is common in shallow-ground-water areas as is placing fill on a site to raise building elevations where seasonal fluctuations in ground water may bring water very near or to the ground surface. Other possible ground-water mitigation techniques include installing well point systems, sump pumps, horizontal drains, vertical sand drains, or creating a ground-water barrier using sheet piling, cutoff walls, or grouting (Water and Power Resource Service, 1981, formerly and since the U.S. Bureau of Reclamation). However, pumping can be expensive, and pumps are subject to mechanical failure and electrical power outages. Where possible, a system of subsurface gravity drains to collect and carry ground water away is the preferred mitigation technique; however, drains require periodic cleaning and other long-term maintenance.