TABULAR TEXT--SURFICIAL GEOLOGY OF THE JUNEAU URBAN AREA AND VICINITY, ALASKA

By
Robert D. Miller

Geologic Unit	General Lithologic Description and age	Distribution and Topographic Form	Thickness	General Physical Properties	Workability	Drainage	Erodibility	Foundation Stability	Probable Ground Response to a Severe Earthquake	Probable Susceptibility to Earthquake-induced Water Waves	Stability of natural and cut slopes	Susceptibility to encroachment by rockfalls	Use
Bedrock (b)	Rock types are layered greenstone, graywacke, slate, greenschist, and metavolcanic flow breccia of Mesozoic age.	Slate, graywacke, and flow breccia underlie eastern Douglas Island and Tee Harbor area; greenstone, greenschist, and slate crop out on mainland. Bedrock forms steep mountain slopes and vertical bluffs along shores.		Structural features of the bedrock include numerous fractures along strike of bedding or foliation, which approximately parallels the trend of steep slopes along Gastineau Channel, and joint sets nearly perpendicular to the strike of the bedding or foliation; intersecting cracks provide a cross-hatched fracture system.	Generally requires blasting to excavate; drilling is slow and moderately difficult.	Infiltration is slow, surface runoff is rapid.	Bedrock is generally very resistant to erosion, but is slowly broken down by mechanical weathering processes, especially along bedding, foliation, and joint fractures.	Generally excellent; bedrock beneath flat or gently sloping surfaces provides the most stable foundation in the Juneau area; bedrock along steep slopes is less suitable.	Probably excellent, less shaking expected in bedrock than in surficial deposit.	Variable; wave-cut benches in bedrock near sea level are highly susceptible; bedrock elsewhere not susceptible.	Good to excellent on ridge tops, hilltops and broad benches; marginal to poor on steep mountain slopes.	High to very low.	Locally suitable for quarry sites for borrow, riprap, select, embankment, base-course aggregate, and aggregate for asphaltic concrete.
Mine dumps (md)	Waste from mining operations; chiefly angular rock fragments as long as 10 in. in diameter, but mostly smaller.	Mostly found along Gold Creek or near the Alaska-Juneau mine at Juneau, and southeast of the Treadwell mine on Douglas Island; dumps form elongate ridges or multiple mounds and ridges of low relief.	Variable; over 100 ft thick at channel edge of Alaska-Juneau tailings dump, less elsewhere.	Generally blocky angular rock fragments 4-6 in. in diameter in a matrix of fine sand and silt in A-J mine dump; elsewhere range from fragments 2 or 3 in. in diameter in sand and silt; moderately compact.	Easily excavated by heavy power equipment; drilling probably difficult, especially in coarser deposits.	Variable; excellent to poor; internal openings in coarse deposits allow free flow of water, finer grained material resists infiltration.	Variable; finer deposits easily eroded; coarser deposits resist erosion.	Variable; bearing capacity generally good in coarse material, fair in fine material.	Vibration, shaking, some settlement, and possibly slope failure.	Only along Gastineau Channel.	Good to fair.	Variable; dumps along Gold Creek more susceptible to rockfalls than other dumps.	Source of fill; recreational use.
Undifferentiated fill (mf)	Composition highly variable; includes rock obtained locally and from A-J dump, as well as silty sand, gravel, soil, sawdust, and trees.	Mostly in Juneau along waterfront and on the Gold Creek fan delta, and at Juneau airport. Occurs as ridgelike or nearly level mantle over other deposits.	Variable; ranges from a few feet to more than 25 ft.	Variable; loose to dense	Variable; excavation and drilling ranges from easy to difficult depending on composition of deposit.	Generally good; locally poor where saturated or where fine-grained materials prevail. Runoff slow on large level areas.	Variable; coarse material resistant, finer material susceptible to sheet wash and stream scour where not protected.	Bearing capacity generally good for light loads if properly compacted. Bearing capacity low if poorly compacted. May consolidate rapidly under dynamic or heavy loads.	Highly variable depending on density of fill and on response characteristics of underlying materials; locally may be subject to violent shaking and, where poorly compacted, to fracturing and differential settlement; slumping of edges of deposit may occur where unconfined.	High where along the shoreline of Gastineau Channel and near the mouth of the Mendenhall River.	Generally good owing to low relief; locally poor.	Generally not affected by rockfalls.	General construction purposes.
Waste dump (mw)	Solid waste and rubbish, locally mixed with earth	Near mouth of Gold Creek, along waterfront, Channel, north of Juneau, and on Snowslide Creek delta.	Variable, as much as 25 ft.	Loose, generally unconsolidated, [illegible]	Variable; excavation and drilling easy to difficult.	Infiltration slow to rapid; runoff slow	Slight to high.	Poor.	Probably high; shaking and compaction likely.	Very high; waste dumps near sea level along Gastineau Channel could be inundated by a seiche or tsunami.	Very poor.	Low most places, very high at Snowslide Creek dump.	Light usage, such as recreational sites.
Peat (Qmk)	Decaying woody to fibrous matter, as well as moss; generally acid. Age is Holocene.	Found throughout area, mapped areas that provide gulley stories younger [illegible] and glaciomarine and glaciofluvial deposits, and bedrock on Douglas Island, Montana Creek, Fish Creek area, Sunny Point, and Mendenhall Valley. Generally flat to raised or slightly domed surfaces.	More than 10 ft thick in domed or raised areas, thinner in flat muskegs and in the mountain valleys.	Soft, saturated, spongy, still compact under heavy loads, water content causes expansion when frozen, and differential compaction when thawed.	Easily excavated with hand or power equipment; easily drilled.	Infiltration generally slow, but can be rapid if muskeg is dry; runoff slow to moderately slow.	Very low by sheet wash, rain, or by small streams that cut downward and laterally. Moderate to high where excavations have formed a steep slope in saturated muskeg; subject to slump or flowage at such places.	Poor.	Probably moderate to intense shaking, subsidence, and fracturing.		Fair to good; stands in nearly vertical fresh cuts; generally does not slide.	Very low.	Commercial moss peat.
Colluvium (Qc)	Variable lithology; derived from underlying and nearby upslope deposits. Age is Holocene.	Covers lower slopes of most hills	Variable; locally more than 15 ft thick.	Loose, lies near angle of repose on steeper slopes; density of material generally low; matrix generally weathered.	Variable; easy to difficult to excavate and drill.	Infiltration rate is high; runoff slow to rapid. Seeps common in roadcuts.	Easily cut by flowing water where vegetation removed.	Poor to marginal; especially poor on slopes covered by micaceous rocks.	May be subject to violent shaking, and where lying on steep slopes may fracture and move downslope as slides or slumps.	Not susceptible.	Poor to marginal; looseness of material results in poor internal cohesion; slumping common in cuts where unconfined	Generally very high.	Source for landfill of poor quality; the fine-grained mica-rich colluvium is the poorest quality.
Talus (Qta)	Variable; micaceous greenschist, greenstone, and metavolcanics. Age is late Holocene.	In many of the steep slopes on the mainland and Douglas Island; 50°-55° slopes common; deposits form thin ribbons to broad fans.	Variable; from a few feet to more than 10 ft.	Loose unconpacted angular fragments that lie at or near angle of repose.	Variable; easy in taluses composed of small fragments; taluses containing coarse fragments difficult to excavate or drill.	Variable; excellent in coarser taluses, poor in finer deposits.	Little chance for erosion in coarse taluses, moderate erosion in fine-grained taluses.	Poor; taluses are unsuitable locations for structures; they are a loose to tight jumbled mass of rock fragments which can be dislodged by weight of manmade structures, causing differential settlement.	Variable depending on steepness of slope, density of talus, and interlocking of fragments; violent shaking could cause sliding in upper parts of talus on steep slopes and differential compaction elsewhere.	Very low; taluses are above probably runup heights of seismic sea waves.	Very unstable; will ravel or slump where cuts are unconfined.	Extremely high; rock fragments high on slopes fall unexpectedly and roll down taluses.	Locally good source of coarse material for artificial fills; pieces are hard and angular. Also suitable for riprap.
Debris-flow deposits (Qfl)	Clayey silty sand, or sand and sandy gravel; angular and rounded fragments in dense sandy silt matrix.	Principally along slopes of Mount Roberts, also in Evergreen Bowl and along Salmon Creek; bands of rubble, bulbous to fan shaped.	Variable; generally 5-10 ft but may be more than 15 ft locally.	Generally dense and firm in deposits with clayey silty sand matrix, loose in sand deposit.	Variable; deposits along Mount Roberts probably difficult, contain large pieces of wooden buildings, pipe, and concrete. Other flow debris probably can be excavated by heavy power equipment; the sand flow at Salmon Creek can be excavated by hand or power tools.	Fair to good; infiltration generally is slower than in the undisturbed parent material. Runoff generally is good except in areas of closed depressions. Infiltration in sand flow is high.	Easily eroded by running water.	Poor; differential compaction and settlement is likely.	Variable; if wet, material probably would move downslope; if dry, it probably would shift and settle differentially.	The debris-flow deposits are high on slopes and would not be influenced.	Generally unstable.	High.	None.
Rockslide-avalanche deposits (Qra)	Rubbly debris including blocks as large as 30 ft; local rock types. Age is probably Holocene but prehistoric.	Along slopes above Gold Creek, Salmon Creek, on the lower part of the mountainside near the airport, and on the lower slope of Mount Anderson on Douglas Island; form is jumbled and lobate.	Probably more than 20 ft in Gold Creek valley, less elsewhere; in most places deposit consists only of discrete overlapping blocks.	Large unbroken dense fragments	Excavation and drilling difficult because of the large size of frugments.	Generally good; locally poor.	Not easily eroded because of coarseness.	Generally poor. Deposits containing many large rock fragments with openings between could have differential movement if overloaded by manmade structures; many deposits lie on steep slopes and could slump or slide if overloaded.	Probably intense; shaking, displacement, and possible differential compaction.	Generally not susceptible; deposits lie above probable encroachment by water waves; one exception is the small avalanche deposit near airport.	Generally poor; excavations may change equilibrium of deposit.	High; source areas of deposits are unstable; fragments will be loosened and fall. Rainfall or strong winds could trigger rockfalls.	Good source for fill and riprap.
Undifferentiated landslides (Qsl)	Variable composition; consist of mixture of rock, soil, and surficial materials. Age is Holocene.	Mostly on north sides of valleys on mainland, but locally along Gastineau Channel; broad bands of debris, some of which narrow to ribbonlike deposits upslope.	From a few feet to more than 20 ft.	Loose and porous.	Easy in deposits containing mostly fine material; difficult in deposits containing large masses of rock. Size of material not differentiated on geologic map.	Infiltration good.	Highly variable; finer and coarser deposits susceptible to gullying by streams on steep bare slopes; finer deposits slightly susceptible on gentle slopes.	Generally poor.	Moderate to intense reaction expectable; possible compaction, settlement, and rockfalls. Slides now dormant may be reactivated.	Very low; all except Snowslide Creek deposit are above heights that could be reached by seiche or seismic sea waves.	Generally poor; locally fair, such as on the Lemon Creek slide.	High.	Possible source of embankment fill of fair quality.
Colluvial(?) diamicton (Qud)	Cohesive, massive, heterogeneous mixtures of silt, clay, sand, pebbles, and cobbles. Age is late Pleistocene or Holocene, or both.	In valleys on Douglas Island; forms elongate ridges.	Uncertain, estimated to be 25-50 ft.	Non plastic; porous, dry bulk density 150 pcf.	Probably easily excavated and drilled.	Infiltration is probably slow; runoff probably rapid.	Easily eroded by streams.	Probably poor to fair; may compact or frost heave.	Probably would react to prolonged shaking by fracturing.	None.	Good; stands naturally on slopes of 30°-35°.	Low.	
Pitted outwash deposits (Qop)	Medium sand to medium gravel; most fragments are granite, gneiss, and greenstone. Sand grains are chiefly of quartz and assorted dark mica and hornblende. Age is late Holocene.	South of Mendenhall Lake near the U.S. Forest Service Visitor's Center; flat surface pitted by depressions 4-10 ft deep.	More than 12 ft.	Loose to moderately compact.	Easily excavated and drilled.	Excellent infiltration; poor surface runoff.	Resists sheet erosion, but can be eroded by concentrated running water.	Marginal for buildings; suitable for roads.	Probably would react strongly to a severe earthquake; shaking would cause compaction and settlement; possibly some fracturing caused by lateral movement of outwash toward Mendenhall Lake.	Only slightly susceptible to waves from Mendenhall Lake; surface of the pitted outwash is 15-20 ft above lake level.	Generally fair to good; natural slopes are less than angle of repose of 20°-30.	Nil.	Limited source of good-quality coarse sand and fine- to medium-grained gravel.
Moraine (Qm)	Silt-rich gravelly sand to sandy coarse gravel containing cobbles and boulders; dioritic and granitic rocks, gneiss, greenstone, schist, and quartz are principal constituents. Age is late Holocene.	Arcuate ridges across the Mendenhall valley merge with sloping straight ridges that form lateral moraines upon the sides of the valley. Surface of moraine is broken by small knobs, and depressions, some of which contain lakes.	Variable; more than 80 ft locally.	Loose, uncompacted; locally compact where matrix has a high silt content.	Generally easy to excavate with power equipment, but scattered boulders as large as 12 ft across make excavation and drilling locally difficult. The overprint on geologic map shows areas where boulders are especially abundant.	Infiltration varies from good in most places to poor where deposits are extremely high in silt; kettle lakes replenished in part by infiltrated water. Runoff generally good along steep slopes to poor elsewhere.	Sheet wash erosion low; vegetation protects most slopes from erosion.	Generally suitable for light structures and roads.	Differential compaction possible; raveled slopes; fractures, sand spouts, and sand boils likely where water table near surface.	Moderate to high susceptibility from local water waves caused by slides or ice falls.	Generally fair to good; steep bluffs along the shore of Mendenhall Lake, however, are unstable.	Generally not susceptible, except for cirque areas.	Deposits low in silt make good quality filler and crushed aggregate. Large boulders on morainal ridges are suitable for riprap.
Younger outwash deposits (Qoy)	Generally sand in front of outermost moraine, and coarse gravel in outwash channels within moraine; locally contain boulders; widespread carbonaceous or peaty layers 10-60 ft below surface. Age is late Holocene; ranges from about 900 years old to modern.	Along Mendenhall valley and Nugget Creek; have slightly dissected even surfaces.	Ranges from 10 to 60 ft, generally about 40 ft in Mendenhall valley.	Loose and uncompacted.	Generally easy to excavate and drill.	Infiltration is good in most places above a generally high water table; surface runoff generally restricted to stream channels.	Easily eroded by streams.	Generally good for light buildings and roads.	Probably would react strongly by compacting and fracturing, and by formation of sand boils and sand spouts.	The seaward margin of outwash in Mendenhall valley might be affected by tsunamis.	Generally fair to good.	The eastern edge of the valley is very susceptible to rockfalls.	Used for gravel; material is coarsest in upper part of Mendenhall valley, especially in meltwater channels. Suitable for embankment, highway base course, and very selectively for concrete and asphalt aggregate.
Late glacial-outwash deposits (Qol)	Silty sand to sandy pebble and cobble gravel, containing beds of silt and sand locally; greenstone, greenschist, slate, and granite are predominant rock types. Age is late Pleistocene to early Holocene.	On Douglas Island and the mainland along several streams; generally have several eroded surfaces. Extend at least 600 ft above sea level.	Variable, from less than 10 ft to probably more than 100 ft.	Generally loose; variable texture.	Easily excavated and drilled with light power equipment.	Rapid infiltration; slow runoff.	Easily eroded by streams.	Probably suitable for light structures.	Probably would locally compact, fracture, and slump along and adjacent to free faces.	Nil	Generally fair to good stability in excavations with slopes less than 35°.	High in areas adjacent to steep slopes. Deposits near Gold Creek have been affected by rockfalls and rock avalanches in prehistoric and modern times.	Possible source of good quality gravel; some of deposits have been placered for gold in past, especially in Last Chance Basin and Silver Bow Basin.
Older glacial(?) alluvium (Qpm)	Brownish-gray very fine sand interlayered with layers of pebble sand and iron-stained sand. Fluvially bedded. Probably more than 10,000 years old.	Exposed only along Montana Creek; but possibly underlies glaciomarine deposits in the valleys of Gold, Salmon, and Auke Creeks.	At least 30 or 35 ft.	Compact, hard when dry, somewhat softer but firm even when wet	Compact, moderately difficult to excavate; easy to drill.	Infiltration slow; runoff rapid.	Moderately resistant to sheet wash in steep natural exposures; moderately resistant to stream scour.		Probably slight to moderate; some small slumps or rolling rocks could be expected if deposit is wet.	Nil.	Fair to poor; some ravelling common, and slumps occur after prolonged heavy rain.	None.	Possible source for landfill of fair quality.
Older till (Qpt)	Clayey, silty, sandy and pebbly till; compact, cohesive. Age is probably Pleistocene.	Apparently underlies most of the mountain valleys; exposed in Fish and Kowee Creek valleys. Has no distinctive form; lies plastered against bedrock; found as high as 2,200 ft.		Appears to be weathered and to contain clay; generally moist to wet.	Can be excavated by hand or power equipment.	Infiltration slow; runoff rapid where muskeg cover removed.	Moderately resistant to sheet wash; less resistant to stream scour.			Nil.	Fair to good; some ravelling after prolonged rainfall.	Moderate to high; deposit occurs in cirques and along steep mountain slopes, both sources for falling or sliding rock.	