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APPENDICES

APPENDIX A

Table 1. Primary topographic attributes calculated from DEM data (from Wilson and Gallant 2000)

Attribute	Definition	Significance
Altitude	Elevation	Climate,vegetation,potential energy
Upslope height	Mean height of upslope area	Potential energy
Aspect	Slope azimuth	Solar insolation, evapotranspiration, flora and fauna distribution and abundance
Slope	Gradient	Overland and subsurface flow velocity and runoff rate, precipitation, vegetation, geomorphology, soil water content, land capability class
Upslope slope	Mean slope of upslope area	Runoff velocity
Dispersal slope	Mean slope of dispersal area	Rate of soil drainage
Catchment slope	Average slope over the catchment	Time of concentration
Upslope area	Catchment area above a short length of contour	Runoff volume, steady-state runoff rate
Dispersal area	Area downslope from a short length of catchment	Soil drainage rate
Catchment area	Area draining to catchment outlet	Runoff volume
Specific catchment area	Upslope area per unit width of contour	Runoff volume, steady-state runoff rate, soil characteristics, soil water area content, geomorphology
Flowpath length	Maximum distance of water flow to a point in the catchment	Erosion rates, sediment yield, time of concentration
Upslope length	Mean length of flow paths to a point in the catchment	Flow acceleration, erosion rates
Dispersal length	Distance from a point in the catchment to the	Impedance of soil drainage

	outlet	
Catchment length	Distance from highest point to outlet	Overland flow attenuation
Profile curvature	Slope profile curvature	Flow acceleration, erosion/deposition rate,
Plan curvature	Contour curvature	Converging/diverging flow, soil water content, soil characteristics
Tangential curvature	Plan curvature multiplied by slope	Provides alternative measure of local flow convergence and divergence
Local topographic position	Proportion of cells in a user- defined circle lower than the center cell	Relative landscape position, flora and fauna distribution and abundance

APPENDIX B

Properties and data definitions for the add-on lithology and aggregate quality attributes file as applied to the digital data sets for this area.

GENERAL ATTRIBUTES

TYPE - The label used on the original individual geologic maps as supplied by the digitizing contractor. Contains some errors when check to original map. Retained for thoroughness.

CODE – Corrected map unit label of the original geologic quadrangle map.

TOTAL – Generalized unifying geologic map symbol for each of the geologic units.

AGE- That part of the SYMBOL (above) that indicates geologic age. Symbol can be a combination of youngest (first character) and oldest (second character) for units that span more than one age period.

Geologic Map Unit Classification

1. **Unconsolidated deposit** A sediment that is loosely arranged or unstratified, or whose particles are not cemented together, found either at the surface or at depth.

1.1. **Alluvium** A general term for clay, silt, sand, gravel or similar unconsolidated detrital material, deposited during comparatively recent geologic time by a stream or other body of running water, as a sorted or semi-sorted sediment.

1.1.1. **Flood plain** Unconsolidated sediment deposited adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

1.1.2. **Levee** A long broad low ridge or embankment of sand and coarse silt, built by a stream on its flood plain and along both banks of its channel, esp. in time of flood when water overflowing the normal banks is forced to deposit the coarsest part of its load.

1.1.3. **Delta** The low, nearly flat, alluvial tract of land at or near the mouth of a river, commonly forming a triangular or fanshaped plain of considerable area.

1.1.4. **Alluvial fan** A low, outspread, relatively flat to gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream (esp. in a semiarid region) at the place where it issues from a narrow mountain valley upon a plain or broad valley.

1.1.5. **Alluvial terrace** A stream terrace composed of unconsolidated alluvium (including gravel), produced by renewed downcutting of the flood plain or valley floor.

1.2. **Lake or marine deposit (non-glacial)** A sedimentary deposit laid down conformably on the floor of, or along the shore of, a lake, sea, or ocean, usually consisting of coarse material near the shore and sometimes passing into clay and limestone in deeper water.

1.2.1. **Mud flat** A relatively level area of fine silt along a shore (as in a sheltered estuary) or around an island, alternately covered and uncovered by the tide, or covered by shallow water.

1.2.2. **Beach sand** A loose aggregate of unlithified mineral or rock particles of sand size forming a beach (the relatively thick and temporary accumulation of loose water-borne material that is in active transit along, or deposited on, the shore zone between the limits of low water and high water).

1.2.3. **Terrace** A narrow shelf, partly cut and partly built, produced along a lake shore and later exposed when the water level falls, or a wave-cut platform that has been exposed by uplift along a seacoast or by the lowering of sea level, and from 3 m to more than 40 m above mean sea level; an elevated marinecut

bench.
1.3. **Eolian** Sediments such as loess or sand deposited by the action of the wind.
1.3.1. **Dune sand** A type of blown sand that has been piled up by the wind into a sand dune, usually consisting of rounded mineral grains, commonly quartz, having diameters ranging from 0.1 to 1 mm.
1.4. **Volcanic Ash** A fine pyroclastic material (under 2.0 mm in diameter). The term usually refers to the unconsolidated material.
1.5.1. **Colluvium** A general term applied to any loose, heterogeneous, and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash, or slow, continuous downslope creep, usually collecting at the base of gentle slopes or hillsides.
1.5.2. **Mudflow** Deposits formed by a process characterized by a flowing mass of predominantly fine-grained earth material possessing a high degree of fluidity during movement.
1.6. **Clay, mud** A loose, earthy, extremely fine-grained, natural sediment composed primarily of clay-size or colloidal particles and characterized by high plasticity and by a considerable content of clay minerals.
1.7. **Silt** A loose aggregate of unlithified mineral or rock particles of silt size (1/256 to 1/16 mm); an unconsolidated deposit consisting essentially of fine-grained clastic particles.
1.8. **Sand** A loose aggregate of unlithified mineral or rock particles of sand size (1/16 to 2 mm); an unconsolidated deposit consisting essentially of medium-grained clastic particles.
1.9. **Gravel** A loose accumulation of rock fragments composed predominantly of more or less rounded pebbles and small stones.
2. **Sedimentary rock** A rock resulting from the consolidation of loose sediment that has accumulated in layers.
2.1. **Clastic** A composed principally of broken fragments that are derived from preexisting rocks or minerals and that have been transported some distance from their place of origin.
2.1.1. **Mudstone** A general term that includes claystone, siltstone, shale, and argillite, and that should be used only when the amounts of clay-sized and silt-sized particles are not known or specified, or cannot be precisely identified.
2.1.1.1. **Claystone** An indurated rock having more than 67% clay-sized minerals.
2.1.1.2. **Shale** A laminated, indurated rock having more than 67% claysized minerals.
2.1.1.3. **Siltstone** An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt-sized particles predominate over clay-sized particles.
2.1.2. **Fine-grained mixed clastic** A mixture of clastic sedimentary rocks varying from mudstone to sandstone, dominated by rocks containing claysized or silt-sized particles.
2.1.3. **Sandstone** A medium-grained clastic sedimentary rock composed of Abundant sand-sized fragments, which may have a finergrained matrix (silt or clay), and which is more or less indurated by a cementing material.
2.1.3.1. **Graywacke** A dark gray, firmly indurated, coarse-grained sandstone that consists of poorly sorted angular to subangular grains of quartz and feldspar, with a variety of dark rock and mineral fragments embedded in a compact clayey matrix having the general composition of slate and containing an abundance of very fine-grained illite, sericite, and chloritic minerals.

2.1.4. **Medium-grained mixed clastic** A mixture of clastic sedimentary rocks varying from siltstone to conglomerate, dominated by rocks containing sand-sized particles.
2.1.5. **Conglomerate** A coarse-grained clastic sedimentary rock, composed of rounded to subangular fragments larger than 2 mm in diameter typically containing fine-grained particles in the interstices, and commonly cemented by calcium carbonate, iron oxide, silica, or hardened clay.
2.1.6. **Coarse-grained mixed clastic** A mixture of clastic sedimentary rocks varying from siltstone to conglomerate, dominated by rocks containing coarse sand-sized or gravel-sized particles.
2.2. **Carbonate** A sedimentary rock composed of more than 50% by weight carbonate minerals.
2.2.1. **Limestone** A sedimentary rock consisting chiefly (more than 50% by weight or by areal percentages under the microscope) of calcium carbonate, primarily in the form of the mineral calcite.
2.2.2. **Dolostone (dolomite)** A carbonate sedimentary rock of which more than 50% by weight or by areal percentages under the microscope consists of the mineral dolomite.
2.3. **Mixed clastic/carbonate** An undivided mixture of clastic and carbonate sedimentary rocks.
2.4. **Mixed clastic/volcanic** An undivided mixture of clastic sedimentary rock and volcanic rock.
2.5.1. **Evaporite** A nonclastic sedimentary rock composed primarily of minerals produced from a saline solution as a result of extensive or total evaporation of the solvent.
2.5.2. **Chert** A hard, extremely dense or compact, dull to semivitreous, microcrystalline or cryptocrystalline sedimentary rock, consisting dominantly of interlocking crystals of quartz less than 30 μm in diameter.
3. **Volcanic rock (aphanitic)** A generally finely crystalline or glassy igneous rock resulting from volcanic action at or near the Earth's surface, either ejected explosively or extruded as a lava. The term includes near-surface intrusions that form a part of the volcanic structure.
3.1. **Tuff** Consolidated or cemented volcanic ash.
3.2. **Rhyolite** A volcanic rock defined in the QAPF diagram as having $Q/(Q+A+P)$ between 20 and 60% and $P/(P+A)$ between 10 and 35%.
3.3. **Andesite** A volcanic rock defined modally by $Q/(Q+A+P) < 20\%$ or $F/(F+A+P) < 10\%$, $P/(A+P) > 90\%$, and $M < 35$.
3.4. **Mafic** A solidified body of volcanic rock having abundant darkcolored minerals in its mode.
3.5. **Basalt** A volcanic rock defined modally by $Q/(Q+A+P) < 20\%$ or $F/(F+A+P) < 10\%$, $P/(A+P) > 90\%$, and $M > 35$.
3.6. **Alkalic** A volcanic rock that contains more sodium and/or potassium than is required to form feldspar with the available silica.
3.7. **Ultramafitite (komatiite)** A volcanic rock with color index (M) greater than or equal to 90.
3.8. **Volcanic carbonatite** A rock of apparent volcanic origin composed of at least 50% carbonate minerals.
4.1. **Granitoid** A general term for all phaneritic igneous rocks dominated by quartz and feldspars.
4.2. **Granite** A plutonic rock defined in the QAPF diagram as having Q between 20 and 60% and $P/(A+P)$ between 10 and 65%.

4. 3. **Granodiorite** A plutonic rock defined in the QAPF diagram as having Q between 20 and 60% and P/(A+P) between 65 and 90%.
4.4.1. **Quartz diorite** A plutonic rock defined in the QAPF diagram as having Q between 5 and 20%, P/(A+P) > 90%, and plagioclase more sodic than An50.
4.4.2. **Quartz gabbro** A plutonic rock defined in the QAPF diagram as having Q between 5 and 20%, P/(A+P) > 90%, and plagioclase more calcic than An50.
4.4.16. **Diorite** A plutonic rock defined in the QAPF diagram as having Q between 0 and 5% or F/(F+A+P) < 10%, P/(A+P) greater than 90% and plagioclase more sodic than An50.
4.5. **Alkalic intrusive rock** A plutonic rock that contains more sodium and/or potassium than is required to form feldspar with the available silica.
4.6. **Ultramafic intrusive rock** A general name for plutonic rock with color index (M) greater than or equal to 90.
4.6.1. **Peridotite** A plutonic rock with M equal to or greater than 90 and ol/(ol+opx+cpx) greater than 40%.
4.7. **Intrusive Carbonatite** A plutonic rock composed of at least 50% carbonate minerals.
5. **Metamorphic rock** A rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, essentially in the solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment, generally at depth in the earth's crust.
5.1. **Metasedimentary** A sedimentary rock that shows evidence of having been subjected to metamorphism.
5.2.1. **Slate** A compact, fine-grained metamorphic rock that possesses slaty cleavage and hence can be split into slabs and thin plates.
5.2.2. **Quartzite** A granoblastic metamorphic rock consisting mainly of quartz and formed by recrystallization of sandstone or chert by either regional or thermal metamorphism.
5.2.3. **Marble** A metamorphic rock consisting predominantly of fine- to coarse-grained recrystallized calcite and/or dolomite, usually with a granoblastic, saccharoidal texture.
5.3. **Metavolcanic** A volcanic rock that shows evidence of having been subjected to metamorphism.
5.4. **Mafic** A metavolcanic rock having abundant dark-colored minerals, typically feldspar, amphibole, and/or pyroxene.
5.5. **Phyllite** A metamorphosed rock, intermediate in grade between slate and mica schist. Minute crystals of graphite, sericite, or chlorite impart a silky sheen to the surfaces of cleavage (or schistosity).
5.6. **Schist** A strongly foliated crystalline rock, formed by dynamic metamorphism, that can be readily split into thin flakes or slabs due to the well developed parallelism of more than 50% of the minerals present, particularly those of the lamellar or elongate prismatic habit, e.g. mica and hornblende. such as subduction zones.
5.7. **Gneiss** A foliated rock formed by regional metamorphism, in which bands or lenticles of granular minerals alternate with bands or lenticles in which minerals having flaky or elongate prismatic habits predominate. Generally less than 50% of the minerals show preferred orientation.
5.8. **Granitic gneiss** A gneissic rock with a general granitoid composition.

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