TABLE 1.

GUIDELINE RELATIONSHIPS FOR DIFFERENTIATING AREAS OF RESPONSIBILITY WITHIN THE REALMS OF ENGINEERING GEOLOGY AND CIVIL ENGINEERING

(As applied to hillside residential development) Compiled by F. Beach Leighton

MOST COMMON PROBLEMS	GEOLOGIC ASPECTS	CIVIL ENGINEERING ASPECTS (Chiefly Soils Engineering)	COMMON GROUND (With Special Areas Shown that Require Consultation)
CUT SLOPE STABILITY	1. Types of earth material, their configuration, and mineral and chemical composition (lithology and geologic structure). 2. Cut-slope angle and benches in bedrock cuts on basis of above constitution and presence of ground-water problems; determination of geologic parameters and preparation of cross sections for calculation of buttresses by civil engineer. 3. Excavation difficulty (analysis from subsurface exploration, seismic studies, ground-water information, etc.) 4. Necessity of setbacks for structures above and below cuts, compacted soil blankets for cut-lot pads, slough barriers and/or special planting programs; construction of haul roads for grading purposes; construction of sewer trenches; safety of temporary cuts for construction purposes. 5. Recommendations for elimination, reorientation, or repositioning of cuts, and/or reduction of cut height; areas to be left natural ground. 6. Necessity of subdrains to relieve ground-water problems.	1. Soils engineering properties of earth materials. 2. Applied engineering procedures (e.g., the design of restraining structures -- buttresses, retaining walls, etc; final determination of slope angle in unconsolidated essentially homogeneous earth materials, (e.g., top soil, slope wash, old fill); terracing and drainage in these materials; stability analyses of bedrock slopes, based upon both geologic and soils parameters. 3. Excavation problems (difficulty of ripping from borehole information, etc.) 4. Design specifications and construction; supervision of effective soil blankets slough barriers and retaining walls. 5. On basis of stability analyses, recommendations for redesign of cut slope; economics of retaining walls vs. buttress vs. redesigned cut slope, etc. 6. Design specifications and supervision of installation of subdrains.	1. Subsurface program of exploration and testing: choice of equipment, access of rigs, location of probes, depths of probes, sampling, and measurement of ground-water levels. 2. Stability equivalents; cuts that expose unconsolidated earth materials; inspections to determine whether grading follows combined recommendations; unforeseen problems that occur during grading; construction of temporary reservoir sites; bedrock drainage; inspection of excavated keyways, benches, and footings during excavation for restraining structures. 3. Consultation. 4. Problems arising because of relationships to adjoining properties, particularly removal of support from adjacent slopes. 5. Consultation. 6. Location and length of subdrains.
FILL SLOPE STABILITY	1. Geologic description of materials available for fill. 2. Volumetric estimates of surficial materials subject to removal prior to placement of fill. 3. Natural problems in areas to be loaded with fill (e.g., ground-water, slides, faults, dip-slopes, potentially compressible materials, etc.) 4. Necessity of subdrains to relieve ground-water problems. 5. Configuration of old fills, well sites, seepage pits and sumps, mine workings, dump areas, etc., from surface mapping.	1. Soil engineering properties of materials available for fill; feasibility, design, placement and compaction control. 2. Final determination of materials subject to removal prior to placement of fills where problem is bearing capacity. 3. Design, feasibility, preparation of ground to be loaded with fill; provision for setbacks of structures; over-filling and excavation of natural ground and perched soil zones; reduction in slope angles and height; buttressing, special planting programs. 4. Design specifications and supervision of installation of subdrains; recommendations for subdrains on basis of protecting fills. 5. Stability evaluation and field handling of old uncompacted fills and other unsuitable man-made fills; conversion of sliver fills to stability fills, fill problems related to adjoining properties.	1. Consultation. 2. Inspection of canyon cleanout during grading and during benching needed to remove unsuitable materials. 3. Elimination, reduction of height and repositioning on basis of underlying geologic problems; construction of reservoir sites and haul roads for grading purposes. 4. Location and length of subdrains. 5. Subsurface exploration of old fills and other man-made features that need delineation; preparation of cross sections to evaluate lateral stability of fills; problems related to surcharged cut slopes and adjoining properties.
*SURCHARGES	1. Geologic description of underlying earth materials, natural problems in areas to be loaded with fill (e.g., ground-water, faults, dip-slopes, potentially compressible materials, etc.) 2. Necessity of subdrains to relieve ground-water problems.	1. Feasibility; quantitative analysis of load effects on basis of geologic data; design of slopes, including fill setbacks. 2. Design specifications and supervision of installation of subdrains; recommendations for subdrains on basis of protecting fills.	1. Subsurface exploration, elimination, reorientation, buttressing of surcharged slope; surface drainage; stripping at daylight lines. 2. Location and length of subdrains.
SURFACE DRAINAGE	1. Natural occurrence; correlation of geology-hydrology-drainage history-topography. 2. Width and spacing of surface drainage devices on cut-slopes.	1. Runoff computations. 2. Design of protective drainage devices and specifications of drains for fills.	1. Drainage at daylight lines; drainage problems from adjoining properties. 2. Consultation.
NATURAL SLOPE INSTABILITY	1. SLIDES: Chiefly bedrock types: areas of emphasis include: description (including three-dimensional geometry and physiochemical characteristics), classification, origin, history, rates of movement and/or probability of future movement, need for subdrains. 2. ACTIVE FAULTING AND TECTONIC CREEP: seismicity, geomorphic evidence, delineation of fault zones and branches; prehistoric and historic occurrences; probability of recurrence within lifetime of structure, natural materials, geologic structures and drainage involved. 3. SUBSIDENCE AND AREAL SETTLEMENT OF NATURAL MATERIALS: origin, past rates, geometry and nature of problematic materials. 4. SLOPES TO BE LEFT NATURAL: geologic description including three-dimensional geometry; restricted use areas, recommendations for future development; special removal and proper drainage above natural slopes; necessary setbacks of structures above natural slopes; special planting programs; need for subdrains.	1. SLIDES: Analyses of potential arcuate soil and fill failures; analyses of potential planar slides: areas of emphasis include: soil mechanics, rock mechanics, design of remedial structures including subdrains; permeability and pore pressure tests. 2. ACTIVE FAULTING AND TECTONIC CREEP: Foundation recommendations and structural design; vibrational effects in fills and relatively homogeneous materials. 3. SUBSIDENCE AND AREAL SETTLEMENT: Soils engineering properties of materials; settlement calculations and recommendations for structural design; proper abandonment of wells, etc. 4. SLOPES TO BE LEFT NATURAL: Foundation investigations for stilt-type construction; stability analyses; buttress design; need for subdrainage at contact of natural slope and fill below; design and supervision of installation of subdrains; design for land use potential.	1. Subsurface explorations; determination of ground-water levels; control and corrections; inspections for proper removal and benching; inspections for hazards during removal and their correction. 2. Actual and potential earthquake damage. 3. Subsurface investigations; precise surveys of area; drainage problems. 4. Haul roads for grading purposes that create instability and divert runoff; inspection of daylight areas during adjacent grading; setbacks of structures; restricted use areas.
ROCK BLASTING	Volumetric estimates, geologic and seismic properties of material to be blasted, recommendations for redesign to avoid blasting.	Disposal of rock material or placement in controlled engineered fills.	Diagnosis of relative resistance to ripping; utilization of shot materials.
PERCOLATION SYSTEMS	Spatial distribution of test locations with respect to types of geologic materials and geologic features.	Spatial distribution (including depth of systems) with respect to topography and future design; measurements to determine rates of percolation.	Feasibility of septic tank systems and other systems involving percolation problems.
AGGREGATE SOURCES	Three-dimensional geometry of deposits; petrographic analysis of mineral and chemical composition; chemical reactions and expansive potential.	Soils engineering properties of materials; value as concrete and asphalt aggregate; testing for unfavorable chemical reactions and expansive potential.	Suitability of materials for intended use; subsurface investigation of materials.
WAVE EROSION	Type, rates, (prehistoric and historic); natural materials being eroded and deposited; recent changes in sea level; coastal geology including analysis of fault activity.	Physical and mechanical analysis of beach materials; design of control and corrective measures; analysis of relevant nearby water front structures.	Protection and control of shoreline facilities.
EXPANSIVE SOILS	Geologic description of geometry, clay types, slaking qualities, creep aspects, evidence of historical damage.	Testing and evaluation of degree of expansiveness; design requirements; consideration of changing expansive properties of expansive materials and removing expansive potential.	Inspections for removal of unsuitable materials during grading.

*Surcharges refer to overloading a slope (by human or natural agencies) usually by means of artificial fills.