

LAND USE AND DEVELOPMENT

102 Attachment 11

Table 1: Design Element, Risks, Testing Requirements, Performance Standards, Preferred Design Elements and Remedial Plan Elements for Development on Karst Terrain¹
[Added 4-18-1996 by Ord. No. 255-6-96]

High-load and broad-load structures (high-rise buildings, parking decks, warehouses, water towers, etc.)	<ul style="list-style-type: none"> * Settlement * Structural damage/loss * Personal injury/death 	<ul style="list-style-type: none"> * Evaluate available data * Reconnaissance----- * Test pits----- * Borings----- * Geophysics----- * Conceptual failure model---- * Bridging analysis----- * Inspection of footings----- 	<p>prior to design to confirm shallow bedrock where suspected 1 per 5,000 square feet area of building footprint, depth based on column/slab load proposed at foundation elements discretionary discretionary intermittent during construction</p>	<ul style="list-style-type: none"> * Optimal layout * Redundancy of support elements * Predrill foundation sites; depths determined by proposed loads * High-tensile-strength slabs, with load transfer capability * Use pile tips * Drill caisson sites; depths determined by proposed loads * Preconstruction grouting 	<ul style="list-style-type: none"> * Inspection * Evaluation plan * Remedial grouting plan * Remedial designs
Low-load structures (single-family homes; small offices, stores, etc.)	<ul style="list-style-type: none"> * Settlement * Collapse * Property damage * Personal injury 	<ul style="list-style-type: none"> * Evaluation of available data * Inspection of footings----- 	<p>during installation of trench for footing</p>	<ul style="list-style-type: none"> * Foundation areas show no evidence of creep or settlement * Drainage directed away from foundation * Piles, caissons to competent bedrock * Redundancy * Footing with bridging of anticipated failure * Preconstruction grouting 	<ul style="list-style-type: none"> * Foundation reinforcement * Occasional inspection by owner
Bridges	<ul style="list-style-type: none"> * Settlement * Collapse * Embankment failure 	<ul style="list-style-type: none"> * Test pits----- * Borings----- 	<p>to competent bedrock 5 to 10 feet into competent bedrock</p>	<ul style="list-style-type: none"> * Alternate route * Abutment reinforcement modifications * Evacuation plan * Escrow to cover repair 	
Underground tanks	<ul style="list-style-type: none"> * Settlement/failure * Undermining/failure * Undetected leaks 	<ul style="list-style-type: none"> * Test pits----- * Borings----- 	<p>in excavation in or near excavation, 10 feet into competent bedrock</p>	<ul style="list-style-type: none"> * Soil and rock void-free * Voids grouted * Aboveground tanks 	
Roads and parking areas	<ul style="list-style-type: none"> * Settlement * Undermining * Collapse * Contaminated runoff 	<ul style="list-style-type: none"> * Analysis of existing data * Reconnaissance of route * Test pits or borings----- * Geophysics----- 	<p>installed in depressions, or other likely karst features where warranted, and to link</p>	<ul style="list-style-type: none"> * Layout to avoid karst features * Minimize paved areas * Control drainage under pavement * Controls on blasting * Use of ripping * Compaction of roadbase * Reinforced roadbed 	<ul style="list-style-type: none"> * Alternative route * Evacuation route * Repair procedures * Subsidence monitoring * Bridging over sinkholes
Drainage features: conduits swales catch basins detention basins ponds injection pits	<ul style="list-style-type: none"> * Settlement * Leaks * Collapse * Undermining of adjacent areas * Injection of pollutants to groundwater 	<ul style="list-style-type: none"> * Analysis of existing data * Reconnaissance of route----- * Test pits, probes at select catch-basin sites * Inspection schedule----- * Evaluate available data * Reconnaissance of route * Borings into bedrock----- * Permeability testing----- 	<p>prior to design continuous during construction</p> <p>locations and depth based on geology and practical considerations, +/- 2 per acre for injection sites</p>	<ul style="list-style-type: none"> * Route consistent with site evaluation results * Swales/lined swales * Watertight joints * Impermeable backfill * Layout to avoid karst features * Liners/compacted substrate * Velocity reducers * Ponds at water table elevation * On-stream ponds * Facilities remote from structures 	<ul style="list-style-type: none"> * Inspection schedule * Repair proposal/escrow * Reserve area * Grouting specifications * Repair escrow * Abandonment plan
Utility conduits	<ul style="list-style-type: none"> * Leaks * Conduit failure * Pollution/explosion/fire * Property damage 	<ul style="list-style-type: none"> * Reconnaissance of route----- * Inspection schedule----- * Test pits, borings, probes at key locations 	<p>prior to design continuous during construction</p> <p>identification of possible areas of undermining</p>	<ul style="list-style-type: none"> * Route consistent with site evaluation results * Backfill with native soil * Geotextiles * Piers, where appropriate * Strong, flexible conduit * Proper backfill procedures 	<ul style="list-style-type: none"> * Evacuation plan * Shutoffs and key locations * Alternate routes
Subsurface sewage disposal systems	<ul style="list-style-type: none"> * Groundwater contamination * Structural failure 	<ul style="list-style-type: none"> * Test pits----- 	<p>one per 1,000 square feet; 2 at a minimum</p>	<ul style="list-style-type: none"> * Pressure-closed disposal beds * Beds not located next to rock pinnacles, nor in natural depressions 	<ul style="list-style-type: none"> * Alternate sites * Closed systems (holding tanks)
Wells	<ul style="list-style-type: none"> * Washed-out subsidence during drilling * Subsidence due to dewatering * Excessive grout take * Turbidity in well/aquifer * Natural water quality hardness, metals, radium, rad 	<ul style="list-style-type: none"> * Careful oversight * Intermittent reconnaissance, monitoring * Sampling of parameters of concern 		<ul style="list-style-type: none"> * Well screen and gravel pack * Minimize well loss * Reconnaissance/monitoring of subsidence 	<ul style="list-style-type: none"> * Alternate site * Grout modification * Pumpage modification * Casing-off of mud zones * Well screen and gravel pack

¹ See § 102-39.2