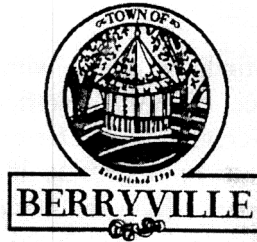




Jefferson County West Virginia

Public Information



Town of Berryville Subdivision Ordinance

Article IV – SUBDIVISION DESIGN STANDARDS

L. SINKHOLES AND KARST FEATURES

The purpose of this section is to establish review procedures, use limitations, design standards and performance standards applicable to land development activities that encompass or affect sinkholes or other karst features. The intent of this section is to protect the public health, safety and welfare by requiring the development and use of karst areas to proceed in a manner that promotes safe and appropriate construction and stormwater management.

1. Definitions

- a. **Geotechnical Engineer** – a Virginia-Registered Professional Engineer (PE) engaged in the practice of Geotechnical Engineering, or a Virginia-Registered Professional Geologist (PG) who is engaged in the practice of Engineering Geology.
- b. **Karst feature** – karst topography is a landscape created by groundwater dissolving sedimentary rock such as limestone. Features are sinkholes, fissures enlarged by dissolution and caves.
- c. **spring** – any spring that is depicted on the most recent version of the Virginia Department of Mineral Resources Publication 102, Plate 2. Hydrogeologic Components of Clarke County, Virginia.
- d. **stream, intermittent or perennial** – any stream that is depicted as intermittent or perennial on the most recent U.S. Geological Survey 7 1/2 minute topographic quadrangle (scale 1:24,000).

2. Site Review

a. Investigation by a Geotechnical Engineer

Whenever an application for development is filed, the applicant will hire a Geotechnical Engineer to undertake an inspection of the subject area. The PE or PG shall review available geologic and engineering data and air-photographs relevant to the site and shall make on-site observations, photographs, and measurements as appropriate. The PE or PG shall provide a written summary of his or

Richard G. Sponseller
Mayor

Allan W. McWilliams
Recorder

Council Members

Lawrence Russell, III
Ward 1

H. Allen Kitzelman, III
Ward 2

F. Barry Nicholson
Ward 3

Wilson L. Kirby
Ward 4

Keith R. Dalton
Town Manager

her initial findings along with a recommendation to perform a fracture trace analysis, electrical resistivity, cone sounding, core samples, microgravity, and/or other geophysical or intrusive studies as appropriate to determine if the action requested may have a negative impact. The examination for karst features by the engineer shall take place prior to any public hearing process applicable to the parcel in question. The PE or PG will report to the planning staff any findings as to whether there may be significant karst features that apply to the site.

- i. No evidence of karst features. If the PE or PG finds that the site has no evidence of karst features, they shall so indicate in a written report provided to the reviewing body.
- ii. Evidence of karst features. In cases where the PE or PG finds evidence that karst features do exist and which would be impacted by development, electrical resistivity testing, core drilling, microgravity tests or tests as recommended by a PE or PG shall be required within a 100-foot radius of all locations on the property where karst features were identified. and along any linear trend of three or more features. For sinkholes, the 100-foot radius shall be measured from the discernable edge. At the completion of the tests, the applicant shall submit a Karst Plan to the Town's Zoning Administrator and follow specific development procedures.
- iii. The presence of karst features on the site which are not impacted. At the discretion of the planning staff, the karst plan may be simplified if the environmental constraint found to be present on the site is not impacted by the proposed site development.

b. Karst Plan

A karst plan shall be developed for property identified as having evidence of karst features (i.e., sites upon which sinkholes are fully or partially located and/or which drain to sinkholes). The burden of proof for establishing that there will be no significant impacts shall rest with the applicant. A karst plan shall include the following:

- i. An engineering audit that identifies and maps karst features and the limitations which such features impose on site development. The audit shall include:
 - a) the physical location and limits of the area of sinkhole depressions as determined by field survey, the "Soil Survey of Clarke County" (1982), or the "Map of Selected Hydrogeologic Components of Clarke County, Virginia" (1990), or other reliable sources as may be approved by Town's Zoning Administrator;
 - b) locations of other karst features (fissures enlarged by dissolution and caves);

- c) topographic contours at maximum intervals of two feet, and spot elevations sufficient to determine low points and discernable edges; and
 - d) identification of a one-hundred (100) foot zone from the discernable edge of each sinkhole.
 - ii. A plan prepared by a PE to ensure structural stability for principle structures proposed within one-hundred (100) feet of the discernable edge of sinkholes or other karst features. Such plan shall identify tests that will be completed to determine sub-surface conditions.
 - iii. The Karst Plan developed for the property shall be reviewed and approved by the Town's Engineer and the Town's Zoning Administrator prior to approval to the development plan or subdivision.
- c. Requirements and Restrictions
 - i. All sinkholes or other karst features identified prior to construction shall be either mitigated or separated from construction in accordance with Section 317 of the Berryville Zoning Ordinance.
 - ii. Sinkholes or karst features identified during construction shall be mitigated as described in the Virginia Department of Transportation's Location and Design Division Instructional and Informational Memorandum 228 (IIM-LD-228), or other applicable standard as recommended by a PG or PE and approved by the Town's Engineer and the Town's Zoning Administrator.
 - iii. Stormwater discharge into a karst feature shall not be increased over its predevelopment rate.
 - iv. Stormwater runoff from paved areas or structures shall not directly enter a mitigated sinkhole or other karst features. Stormwater facilities shall be designed to route runoff through approved vegetative filters or other filtration measures before it enters a mitigated sinkhole or other karst features.
 - v. After necessary testing to determine if sinkholes are present on the location of a proposed stormwater basin, stormwater basins in karst areas shall be lined with either impermeable soil or a synthetic membrane to prevent sudden loss of the contents of the basin into the groundwater due to induced collapse. Where native materials are deemed adequate for the purpose, the Geotechnical Engineer shall verify conditions, establish the required parameters, and monitor placement.

- vi. Construction plans shall contain a narrative describing stormwater drainage design, retention, erosion control, and where appropriate, stormwater quality mitigation measures, as these provisions relate to karst features.
- vii. Underground utilities located within 100 feet of sinkholes and karst features shall be laid out so that they do not intersect those features. Along all such underground utilities, a dike of clay or other suitable material shall be constructed across the trench of the transmission lines and pipelines at intervals of 20 feet or less, or as directed by a PE or PG.
- viii. For any tests requiring boreholes, such as air track drilling, the boreholes must be grouted upon completion. Grouting should be done with a mixture of 50% bentonite and 50% portland cement.
- ix. If air track drilling is used to determine the depth of overburden and continuity of bedrock, then these operations must be monitored full time by a geotechnical engineer to confirm the findings of the driller.
- x. Storage tanks shall have impervious secondary containment. Underground fuel storage tanks shall have interstitial monitoring of tanks and piping systems.
- xi. Where applicable, the following Consumer Disclosure Statement that provides information on what review occurred and what was discovered shall be included in the Deed of Dedication and record plat:
This property is located in an area identified as having karst features. Karst features are created by groundwater dissolving sedimentary rock such as limestone. Features include sinkholes, fissures enlarged by dissolution, and caves. Geologic tests were conducted and one or more of these features were identified on this property. Karst features are unstable and collapse may occur. Measures have been taken to ensure structural stability in this area; however, karst areas are dynamic and geologic changes may cause future structural instability. Fertilizers, herbicides, and pesticides should not be applied within 100 feet of any karst feature, whether it has been mitigated or not.
- xii. Measures to permanently protect karst features that have not been mitigated shall be identified on the site plan. These measures may include fencing and/or signage.