

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
SINKHOLE AND SINKHOLE AREA TREATMENT

(No.)

CODE 527

DEFINITION

The treatment of sinkholes and/or sinkhole areas to reduce contamination of groundwater resources, and/or improve farm safety.

PURPOSE

This practice may be applied as part of a conservation management system to support one or more of the following purposes.

- To improve Water Quality.
- To improve farm safety.

CONDITIONS WHERE PRACTICE APPLIES

On any land surface or existing practice where the soils and geologic conditions have led to the development of sinkholes.

CRITERIA

General Criteria Applicable to all Purposes

The installation and operation of sinkhole treatment(s) will comply with all federal, state, and local laws, rules, and regulations.

A geologic investigation of the potential impact of the treatment on ground water, surface water, and the karst features will be conducted by a qualified geologist.

Trash and other material will be removed from the sinkhole and disposed of in an environmentally sound manner.

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Excess surface water caused by construction activities will be diverted from the sinkhole area in accordance with the Conservation Practice Standard Diversion (Code 362).

Nutrient and pest management plans will be developed for the drainage area of the sinkhole controlled by the landowner.

Vegetative Treatment

All sinkholes treated will have a vegetated buffer a minimum of 25 feet wide measured from the rim of the sinkhole. The buffer area may be extended to control concentrated flow channels entering the sinkhole. Guidance for vegetative buffers for the treatment of sinkhole areas is addressed in Riparian Forest Buffer (Code 391), Riparian Herbaceous Cover (Code 390), and Filter Strip (Code 393). The width of the vegetated buffer will be established and maintained in accordance with the type of buffer chosen. The sinkhole and surrounding buffer will be fenced in accordance with Conservation Practice Standard Fence (Code 382).

Livestock will be excluded from the vegetative buffer except where applicable for maintenance purposes.

Nutrients, herbicides, pesticides, and animal waste will not be applied within an established buffer. Only mechanical treatments shall be used for weed control.

Appropriate erosion and sediment control measures will be used to reduce the amount of sediment entering sinkhole openings during the establishment of the vegetative buffer.

Surface Water Control

Changes to the volume of surface water that enters a sinkhole may disturb the underground

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Conservation practice standards are reviewed periodically, and updated as needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service [WV State Office](#) or visit the [electronic Field Office Technical Guide \(e-FOTG\)](#) located on our web site.
Note: Bold italics is information added or changes made to the National Conservation Standard by WV.

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hydrology. To the extent possible, the surface water flow should be maintained at historic (or predevelopment) volumes.

Pre-existing concentrated flow channels will be stabilized but should not otherwise be altered. If a plug or inverted filter is used, the area to be protected will be characterized by a qualified geologist. Concentrated flow caused by the construction activities will be dispersed with a suitable spreading structure.

Sinkhole Treatment/Closing

Adequate protection of most sinkhole and sinkhole areas can be achieved by the use of vegetative buffers and livestock exclusion. However, if an open sinkhole is a safety hazard, it may be treated with a rock filter, gabions, or other methods approved by the State Conservation Engineer.

Sinkholes that open into caves shall not be filled under any circumstances. Gated openings may be used for safety reasons.

CONSIDERATIONS

The practice should work in conjunction with conservation cropping systems, pest and nutrient management, and practices that control sheet, rill and gully erosion.

Current and planned land use should be considered. In particular, structures, septic fields, wells, feedlots, ponds, and animal waste storage systems should not be located over a sinkhole site or within the impact area.

For a sinkhole receiving contaminated overland flow, every effort should be made to first treat the source of the contamination. Although it is important to maintain the hydrology of the karst system, it may be more beneficial to the ground water quality to divert the contaminated water away from the sinkhole. In some cases, it may be necessary to completely plug a sinkhole with sealing materials rather than treat it with a filter. Acceptable sealing materials are provided in ASTM D 5299, part 6.4. An example of this would be a sinkhole in a feedlot or a site that is difficult to protect by any other method.

The sinkhole treatment should not result in excessive surface water ponding or high soil

moisture conditions over an extended period of time.

Treatment of one sinkhole may have an effect on other sinkholes or solution features in the vicinity.

The use of a Conservation Easement for the buffer and sinkhole should be considered.

PLANS AND SPECIFICATIONS

Plans and specifications for Sinkhole and Sinkhole Area Treatment will be in keeping with this standard and will describe the requirements for applying the practice to achieve its intended purpose.

1. Plan view showing sinkhole and sinkhole area. Include topographic information and photographs.
2. The geologic investigation will include a study of potential impacts on the Karst resource. **Document state geologist's report in conservation plan.**
3. **Provide statement about condition, age and stability of sink.**
4. Planned treatment measures.
5. Delineate the drainage area of sinkhole on a topographic map **and note ephemeral ditches, gullies, creeks, streams, etc. discharging to the sink.**
6. **Provide a soils map, soil properties, delineate Karst features, underground rivers, etc.**
7. Availability of safe outlet for surface water, if applicable
8. Operation and Maintenance requirements.
9. Special safety requirements **and potential safety hazards.**
10. Environmental Assessment.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan will provide specific instructions for maintaining the

sinkhole and sinkhole area treatment, including reference to periodic inspections and the prompt repair and/or replacement of damaged components.

REFERENCES

1. *Estimating Runoff and Peak Discharges*, USDA-NRCS, Engineering Field Handbook, Chapter 2, August 1987.
2. *Urban Hydrology for Small Watersheds*, USDA-NRCS, Technical Release 55, June 1986.
3. *Graded Riprap Stone, Quarried Stone for Erosion and Sediment Control*, National Crushed Stone Association, June 1978.
4. Koerner, R. M., *Designing with Geosynthetics*, Prentice-Hall, Englewood Cliffs, NJ, 1985.
5. *Geology*, USDA-NRCS, National Engineering Handbook, Part 531, Section 8, Chapter 1, 1978.
6. NRCS, Field Office Technical Guide, Section IV.
7. *Geology*, USDA-NRCS, National Engineering Manual, Part 531.21, September 1999.
8. White, W.B., *Geomorphology and Hydrology of Karst Terrains*, Oxford University Press, Inc., New York, New York, 1988.
9. ***NRCS Soil Data Mart Information, Engineering Properties, Water Features, Flood Duration, Hydrologic Soil Group, Risk of Corrosion –concrete, Water Table Depth, Physical Soil Properties etc.:***
<http://soildatamart.nrcs.usda.gov/>
10. ***WV Speleological Survey (WVSS)***
<http://www.wvass.org/>
11. ***Hydrology of Limestone Karst in Greenbrier County, WV by William K. Jones, WV Geological and Economic Survey 1973***