

Rockwool RAN-5 Project: Supplemental Sinkhole Repair Procedure

Identified surface sinkholes that could potentially receive surface runoff on-site or dropouts occurring from exposed voids during excavation will be repaired. The repair is based on the depth to bedrock, location in regard to storm water management facilities/piping and proximity to infrastructure. The West Virginia Department of Environmental Protection Division of Water and Waste Management Groundwater Protection Program – Sinkhole Mitigation Guidance dated August 8, 2005 is specifically referenced for use on the location as amended by the repair procedures described in this document for site specific repairs.

WVDEP shall be notified of sinkhole or dropout features as described below:

- Rockwool or their designee will report identified potential sinkholes or drop outs within 24 hours to one of the following based upon time and day identified. Contact preference will be in the following order: 1) the WVDEP Environmental Enforcement Inspector 2) WVDEP Storm Water Section Permit Writer or 3) WVDEP Spill Hotline.
- Rockwool or their contractor will protect the identified feature from storm water runoff by providing a soil berm or similar approach around the perimeter of the identified potential feature within 72 hours of notification to WVDEP. Rockwool will also begin preparation of proposed approach for repair.
- WVDEP will be provided 48 hours notice (2 business days) prior to repairing sinkholes to provide the opportunity for WVDEP to be present during the repair.

Repair Descriptions:

- Type 1 repair is near a structure or within the reclaim pond or storm water pond and has a depth to bedrock of 15 feet or less, to permit excavation and exposing the throat of the sinkhole.
- Type 2 repair is near a structure and has a depth to bedrock beyond what can easily be excavated.
- Type 1 and 2 repairs are described below. Identified sinkholes or dropouts will be inspected at least once every seven (7) calendar days and within 24 hours after any storm event greater than 0.5 inches within a 24-hour period. Sinkholes and dropouts will also be evaluated by the Geotechnical Engineer, and repair methods tailored to fit the specific conditions. The descriptions below are provided to facilitate planning for anticipated repairs. The Geotechnical Engineer should be contacted before repairs are attempted.

Type 1 Repair:

- Excavate to expose the opening in the bedrock where erosion has occurred.
- Hand clean exposed throat with shovels or equipment as dictated by appropriate health and safety methods.
- Place course aggregate or rip rap consistent with average size and depth recommended by WVDEP guidance, in throat of sinkhole. Aggregate or rip rap materials shall be a standard WVDOH or AASHTO washed aggregate or riprap from an offsite source.
- This initial placement of rock will be followed by 12 to 18 inch lift of AASHTO # 57 or #4 stone aggregate, to form a graded rock filter at the throat of the sinkhole.

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- The surface of the rock filter will be covered with a minimum 4-ounce per square yard non-woven, geo-textile (in lieu of a sand layer), to reduce the potential for soil fines traveling into and plugging the stone layers and provide a smooth surface. The geotextile shall be covered with six (6) mil polyethylene (PE) sheet plastic. If more than one panel of PE sheet is needed to cover the graded rock plug, overlap adjacent panels by a minimum of 18 inches. Verify surface is sufficient to retain concrete and excess mix water and will prevent it from flowing into the sinkhole throat during placement.
- The geo-textile layer should be covered with a 6-inch to 2 foot lift of concrete or flowable fill as recommended by the Geotechnical Engineer. Concrete and flowable fill can continue to be placed to the depth deemed necessary for structural or infiltration prevention purposes once the initial lift of concrete or flowable fill has set up.
- Backfill the remainder of the excavation with well compacted engineer fill, consisting of clayey/silty soil (CL, ML, CH, or MH). Compacted engineer fill is to be compacted to at least 95 percent of maximum dry density based on the Standard Proctor test method. For fill material compacted with heavy compaction equipment, the fill should be placed in maximum 8-inch loose lift. Highly plastic soils should not be used as engineered fill within 4 ft. of the ground surface.
- For repairs located outside of stormwater management facilities, the finished surface shall be graded to direct stormwater away from the repaired sinkhole location.
- For repairs located inside of a stormwater management facility that are expected to have water impoundment above the repair, the finished surface shall be lined with a subgrade reinforcement plastic geogrid covered with a geosynthetic clay liner (GCL). The surface of the GCL will then be covered with a 60 mil high density polyethylene (HDPE) liner.

Type 2 Repair:

- Remove loose soils from the dropout to the extent practical.
- Verify by visual methods that no visible connection or void to subsurface is exposed. If present, excavate and install graded AASHTO or WVDOH washed limestone layers with geotextile filter as described in Type 1 over exposed void. **If void depth is too deep to safely accomplish this, protect feature from storm water runoff and consult with WVDEP on potentially allowable procedures.**
- Backfill the dropout to within 5 feet of the ground surface with flowable fill.
- Then backfill above the flowable fill with well compacted engineered fill consisting of clayey/silty soil (CL, ML, CH, or MH). Compacted engineer fill is to be compacted to at least 95 percent of maximum dry density as per the Geotechnical Engineer. Highly plastic soils should not be used as engineered fill within 4 ft. of the ground surface.
- Conduct cap grouting at and just above the bedrock if encountered. Cap grouting is similar to compaction grouting, but the grout is less stiff, typically with a slump of 6 to 8 inches. Grout with a lesser slump might be used to fill voids encountered by drilling (i.e., low-mobility grouting). Grout quantities, depths, and injection pressures should be reviewed by the Geotechnical Engineer. **Pressure/Compaction grouting procedure must be approved by WVDEP as a minor modification prior to implementation.**
- For repairs located outside of stormwater management facilities, the finished surface shall be graded to direct stormwater away from the repaired sinkhole location.

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- For repairs located inside of a stormwater management facility that are expected to have water impoundment above the repair, the finished surface shall be lined with a subgrade reinforcement plastic geogrid covered with a geosynthetic clay liner (GCL). The surface of the GCL will then be covered with a 60 mil high density polyethylene (HDPE) liner.