

15A NCAC 13B .0538 GEOLOGIC AND HYDROGEOLOGIC INVESTIGATIONS FOR C&DLF FACILITIES

(a) Site Hydrogeologic Report. A permit applicant must conduct a hydrogeologic investigation and prepare a report. An investigation is required to assess the geologic and hydrogeologic characteristics of the proposed site to determine the suitability of the site for solid waste management activities, which areas of the site are most suitable for C&DLF units, and the general ground-water flow paths and rates for the uppermost aquifer. The report must provide an understanding of the relationship of the site ground-water flow regime to local and regional hydrogeologic features with special emphasis on the relationship of C&DLF units to ground-water receptors (especially drinking water wells) and to ground-water discharge features. Additionally, the scope of the investigation must include the general geologic information necessary to address compliance with the pertinent location restrictions described in Rule .0536 of this Section. The Site Hydrogeologic Report must provide, at a minimum, the following information:

- (1) A report on local and regional geology and hydrogeology based on research of available literature for the area. This information is to be used in planning the field investigation. For sites located in piedmont or mountain regions, this report must include an evaluation of structurally controlled features identified on a topographic map of the area.
- (2) A report on field observations of the site that includes information on the following:
 - (A) topographic setting, springs, streams, drainage features, existing or abandoned wells, rock outcrops, (including trends in strike and dip), and other features that may affect site suitability or the ability to effectively monitor the site; and
 - (B) ground-water discharge features. For a proposed site where the owner or operator does not control the property from any landfill unit boundary to the controlling, downgradient, ground-water discharge feature(s), additional borings, geophysics or other hydrogeological investigations may be required to characterize the nature and extent of groundwater flow; and
 - (C) the hydrogeological properties of the bedrock, if the uppermost ground-water flow is predominantly in the bedrock. Bedrock for the purpose of this rule is defined as material below auger refusal.
- (3) Borings for which the numbers, locations, and depths are sufficient to provide an adequate understanding of the subsurface conditions and ground-water flow regime of the uppermost aquifer at the site. The number and depths of borings required will depend on the hydrogeologic characteristics of the site. At a minimum, there must be an average of one boring for each 10 acres of the proposed landfill facility unless otherwise authorized by the Division. All borings intersecting the water table must be converted to piezometers or monitoring wells in accordance with 15A NCAC 02C .0108.
- (4) A testing program for the borings which describes the frequency, distribution, and type of samples taken and the methods of analysis (ASTM Standards or test methods approved by the Division) used to obtain, at a minimum, the following information:
 - (A) standard penetration - resistance (ASTM D 1586);
 - (B) particle size analysis (ASTM D 422);
 - (C) soil classification: Unified Soil Classification System (USCS) (ASTM D 2487);
 - (D) formation descriptions; and
 - (E) saturated hydraulic conductivity, porosity, effective porosity, and dispersive characteristics for each lithologic unit of the uppermost aquifer including the vadose zone.
- (5) In addition to borings, other techniques may be used to investigate the subsurface conditions at the site, including but not limited to: geophysical well logs, surface geophysical surveys, and tracer studies.
- (6) Stratigraphic cross-sections identifying hydrogeologic and lithologic units, and stabilized water table elevations.
- (7) Water table information, including:
 - (A) tabulations of water table elevations measured at the time of boring, 24 hours, and stabilized readings for all borings (measured within a period of time short enough to avoid temporal variations in ground-water flow which could preclude accurate determination of ground-water flow direction and rate);
 - (B) tabulations of stabilized water table elevations over time in order to develop an understanding of seasonal fluctuations in the water table;

- (C) an estimation of the long-term seasonal high water table based on stabilized water table readings, hydrographs of wells in the area, precipitation and other meteorological data, and streamflow measurements from the site frequent enough to demonstrate infiltration and runoff characteristics, and any other information available; and
 - (D) a discussion of any natural or man-made activities that have the potential for causing water table fluctuations, including but not limited to, tidal variations, river stage changes, flood pool changes of reservoirs, high volume production wells, and injection wells.
- (8) The horizontal and vertical dimensions of ground-water flow including flow directions, rates, and gradients.
 - (9) Ground-water contour map(s) to show the occurrence and direction of ground-water flow in the uppermost aquifer and any other aquifers identified in the hydrogeologic investigation. The ground-water contours must be superimposed on a topographic map. The location of all borings and rock cores and the water table elevations or potentiometric data at each location used to generate the ground-water contours must be shown on the ground-water contour map(s).
 - (10) A topographic map of the site locating soil borings with accurate horizontal and vertical control, which are tied to a permanent onsite benchmark.
 - (11) Information for wells and water intakes within the site characterization study area, in accordance with Rule .0536(c) of this Section including:
 - (A) boring logs, construction records, field logs and notes, for all onsite borings, piezometers and wells;
 - (B) construction records, number and location served by wells, and production rates, for public water wells; and
 - (C) available information for all surface water intakes, including use and production rate.
 - (12) Identification of other geologic and hydrologic considerations including but not limited to: slopes, streams, springs, gullies, trenches, solution features, karst terranes, sinkholes, dikes, sills, faults, mines, ground-water discharge features, and ground-water recharge/discharge areas.
 - (13) A report summarizing the geological and hydrogeological evaluation of the site that includes the following:
 - (A) a description of the relationship between the uppermost aquifer of the site to local and regional geologic and hydrogeologic features,
 - (B) a discussion of the ground-water flow regime of the site focusing on the relationship of C&DLF unit(s) to ground-water receptors and to ground-water discharge features,
 - (C) a discussion of the overall suitability of the proposed site for solid waste management activities and which areas of the site are most suitable for C&DLF units, and
 - (D) a discussion of the ground-water flow regime of the uppermost aquifer at the site and the ability to effectively monitor the C&DLF units in order to ensure early detection of any release of constituents to the uppermost aquifer.

(b) Design Hydrogeologic Report

- (1) A geological and hydrogeological report must be submitted in the application for the Permit to Construct. This report must contain the information required by Subparagraph (2) of this Paragraph. The number and depths of borings required must be based on the geologic and hydrogeologic characteristics of the landfill facility. At a minimum, there must be an average of one boring for each acre of the investigative area. The area of investigation must, at a minimum, be the area within the unit footprint and unit compliance boundary, unless otherwise authorized by the Division. The scope and purpose of the investigation is as follows:
 - (A) The investigation must provide adequate information to demonstrate compliance with the vertical separation and foundation standards set forth in Items (2) and (5) of Rule .0540 of this Section.
 - (B) The report must include an investigation of the hydrogeologic characteristics of the uppermost aquifer for the proposed phase of C&DLF development and any leachate management unit(s). The purpose of this investigation is to provide more detailed and localized data on the hydrogeologic regime for this area in order to design an effective water quality monitoring system.
- (2) The Design Hydrogeologic Report must provide, at a minimum, the following information:
 - (A) the information required in Subparagraphs (a)(4) through (a)(12) of this Rule;

- (B) the technical information necessary to determine the design of the monitoring system as required by Paragraph (b) of Rule .0544 of this Section;
- (C) the technical information necessary to determine the relevant point of compliance as required by Part (b)(1)(B) of Rule .0544 of this Section;
- (D) rock cores (for sites located in the piedmont or mountain regions) for which the numbers, locations, and depths are adequate to provide an understanding of the fractured bedrock conditions and ground-water flow characteristics of at least the upper 10 feet of the bedrock. Testing for the corings must provide, at a minimum, rock types, recovery values, rock quality designation (RQD) values, saturated hydraulic conductivity and secondary porosity values, and rock descriptions, including fracturing and jointing patterns, etc.;
- (E) a ground-water contour map based on the estimated long-term seasonal high water table that is superimposed on a topographic map and includes the location of all borings and rock cores and the water table elevations or potentiometric data at each location used to generate the ground-water contours;
- (F) a bedrock contour map (for sites located in piedmont or mountain regions) illustrating the contours of the upper surface of the bedrock that is superimposed on a topographic map and includes the location of all borings and rock cores and the top of rock elevations used to generate the upper surface of bedrock contours;
- (G) a three dimensional ground-water flow net or several hydrogeologic cross-sections that characterize the vertical ground-water flow regime for this area;
- (H) a report on the ground-water flow regime for the area including ground-water flow paths for both horizontal and vertical components of ground-water flow, horizontal and vertical gradients, flow rates, ground-water recharge areas and discharge areas;
- (I) a report on the soils in the four feet immediately underlying the waste with relationship to properties of the soil. Soil testing cited in Subparagraph (a)(4) of this Rule must be used as a basis for this discussion; and
- (J) a certification by a Licensed Geologist that all borings which intersect the water table at the site have been constructed and maintained as permanent monitoring wells in accordance with 15A NCAC 02C .0108, or that the borings will be properly abandoned in accordance with the procedures for permanent abandonment of wells as delineated in 15A NCAC 02C .0113. All piezometers within the footprint area must be overdrilled to the full depth of the boring, prior to cement or bentonite grout placement, and the level of the grout within the boring must not exceed in height the elevation of the proposed basegrade.

*History Note: Authority G.S. 130A-294;
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