

15A NCAC 18E .0504 SOIL WETNESS CONDITION

(a) SWC, such as those caused by a seasonal high-water table, a perched water table, tidal water, seasonally saturated soil, or by lateral water movement, shall be determined by field observations of soil wetness indicators as follows:

- (1) the presence of colors with a value 4 or more and a chroma 2 or less using the Munsell Soil Color Book at greater than or equal to two percent of soil volume as redox depletions or as the matrix of a horizon. Colors of chroma 2 or less that are lithochromic features shall not be considered indicative of a SWC; or
- (2) the observation or indication of saturated soils, a perched water table, or lateral water movement flowing into a bore hole, monitoring well, or open excavation above a less permeable horizon, that may occur without the presence of colors with a value 4 or more or chroma 2 or less at greater than or equal to two percent of soil volume as redox depletions or as the matrix of a horizon.
- (3) The shallowest depth to SWC determined in this Paragraph shall be used.

(b) Initial site suitability as to SWC shall be determined by field observations of soil wetness indicators in accordance with Paragraph (a) of this Rule. Sites where the SWC is less than 12 inches below the naturally occurring soil surface, or less than 18 inches if more than six inches of Group I soils are present, shall be considered unsuitable with respect to SWC.

(c) Monitoring or modeling procedures as set forth in this Rule may be used to reclassify the site as suitable with respect to SWC.

(d) Monitoring or modeling procedures as set forth in this Rule shall be required when the owner proposes to use a wastewater system requiring a greater depth to a SWC than the depth observed by soil wetness indicators in accordance with Paragraph (a) of this Rule.

(e) Modeling procedures as set forth in this Rule shall be required when the owner proposes to use sites with Group III or IV soils within 36 inches of the naturally occurring soil surface with artificial drainage, or on sites when fill is proposed to be used in conjunction with an artificial drainage system.

(f) Monitoring or modeling procedures may include the following:

- (1) direct monitoring procedure as set forth in Paragraph (g) of this Rule;
- (2) modeling procedure as set forth in Paragraph (h) of this Rule;
- (3) monitoring and modeling procedure as set forth in Paragraph (i) of this Rule; or
- (4) other modeling procedures as set forth in Paragraph (j) of this Rule.

(g) The direct monitoring procedure involves determining the SWC by observation of water surface elevations in wells during periods of high-water in accordance with the following:

- (1) no later than 30 days prior to the start of the monitoring period, the owner shall notify the LHD of the intent to monitor water surface elevations by submitting a proposal prepared by a licensed professional, if required in G.S. 89C, 89E, or 89F, that includes a site plan, well and soil profile at each monitoring site, and a monitoring plan as follows:
 - (A) the site plan shall include the proposed sites for wastewater systems, the longitude and latitude of the site, the location of monitoring wells, and all drainage features that may influence the SWC. The site plan shall also specify any proposed fill and drainage modifications;
 - (B) the monitoring plan shall include the proposed number, installation depth, screening depth, soil and well profile, materials, and installation procedures for each monitoring well. A minimum of three water level monitoring wells shall be installed for water surface observation at each site. Sites handling systems with a DDF greater than 600 gpd shall have one additional well per 600 gpd increment. Well locations shall include portions of the initial and repair dispersal field areas containing the most limiting soil and site conditions. The monitoring plan shall also provide for monitoring of the water surface elevations in the wells and all precipitation at the site; and
 - (C) notification of whether the owner or a licensed professional will perform the monitoring, including the name of the licensed professional, if applicable.
- (2) prior to installation of the monitoring wells, the authorized agent shall approve the plan. Plan approval shall be based upon a site visit and compliance with this Rule. If the plan is denied, a signed, written report shall be provided to the owner that describes the reasons for denial, the changes necessary for approval of the plan, and notice of the right to appeal under G.S. 130A-24 and 150B;

- (3) wells shall extend a minimum of five feet below the naturally occurring soil surface, or existing ground surface for existing fill determined in accordance with Rule .0909(d) of this Subchapter, except that wells that extend down only 40 inches from the ground surface may be used if a continuous record of the water table is provided for a minimum of half of the monitoring period. One or more shallower wells may be required on sites where shallow lateral water movement or a perched SWC is anticipated based on the site investigation;
- (4) the water elevation in the monitoring wells shall be recorded daily from January 1 to April 30, taken at the same time during the day, plus or minus three hours. Rain gauges shall be located within two miles of the site. Daily rainfall measurements shall also be recorded from December 1 through April 30; and
- (5) the most recent information available from the SCO shall be used to determine the recurrence frequency of the total amount of rainfall at the site for the 120-day period ending April 15 based upon the site's historic rainfall record. This shall be done when the 120-day cumulative rainfall for the monitoring period ending on April 15 equals or exceeds the site's historic rainfall for the same period with a 30 percent frequency. The recurrence frequency shall be determined with one of the following methods:
 - (A) the licensed professional shall determine the 120-day SPI for April 15 by using the Integrated Water Portal located on the SCO's website at: <http://climate.ncsu.edu/water/map>. The licensed professional shall click on the map pixel that corresponds closest to the site's location. The Department will assist in obtaining this information upon request; or
 - (B) the recurrence frequency of the site's cumulative precipitation for the 120-day monitoring period ending on April 15 shall be determined for the site on a case-by-case basis from the most recent master grid provided to the Department by the SCO. The master grid contains probability distribution parameters that shall be used by the Department based upon guidance from the SCO. Based on the master grid, the Department shall derive the recurrence frequency values for the grid point that corresponds closest to the site's latitude and longitude.
- (6) The SWC shall be determined by the shallowest level that is continuously saturated for the number of consecutive days during the January through April well monitoring period shown in Table VIII as follows:

TABLE VIII. Rainfall SPI and exceedance probability during monitoring season related to number of consecutive days of continuous saturation

April 15 SPI 120-day range	Recurrence frequency range 120-day cumulative April 15 rainfall	Number of consecutive days of continuous saturation for SWC
SPI -0.543 to 0	30% to 49.9% duration	3 days or 72 hours
SPI 0 to 0.545	50% to 69.9% duration	6 days or 144 hours
SPI 0.546 to 0.864	70% to 79.9% duration	9 days or 216 hours
SPI $\geq$ 0.865	80% to 100% duration	14 days or 336 hours

- (7) If monitoring well data is collected during monitoring periods that span multiple years, the year that yields the shallowest SWC shall apply.
- (h) The modeling procedure may be used to determine SWC by using DRAINMOD, a groundwater simulation model, to predict daily water levels over a minimum 30-year period using site-specific input parameters as outlined in the DRAINMOD User's Guide. The SWC shall be determined as the shallowest level predicted by DRAINMOD to be saturated for a 14-day continuous period between January 1 and April 30 with a recurrence frequency of 30 percent, an average of a minimum of nine years in 30, and in accordance with the following:
 - (1) weather input files shall consist of hourly rainfall and daily temperature data collected over the entire period of record but for a minimum of a 30-year period from a measuring station site, such as the National Weather Service or SCO. The measuring station used shall be the station located closest to the owner's site;
 - (2) soil and site inputs for DRAINMOD shall include the following:
 - (A) soil input file with the soil moisture characteristic curve and data for the soil profile that is closest to the described soil profile that is present on the site;
 - (B) soil horizon depths determined on site;

- (C) site measured or proposed drain depth and spacing, and drain outlet elevation;
- (D) in-situ Ksat measurements for a minimum of three representative locations on the site and at each location for the three most representative soil horizons within five feet of the surface. In-situ Ksat measurements shall be for one representative soil horizon at or above redoximorphic depletion features and two representative soil horizons at and below redoximorphic concentration features at each location on the site;
- (E) all other model parameters based upon the DRAINMOD User's Guide; and
- (F) a sensitivity analysis shall be conducted for the following model parameters: soil input files for a minimum of two other most closely related soil profiles; in-situ Ksat of each horizon; drain depth and spacing; and surface storage and depth of surface flow inputs.

The sensitivity analysis shall be used to evaluate the range of soil and site characteristics for choosing input parameters related to the soil profiles, Ksat input values based upon the range of in-situ Ksat values measured on the site, and inputs for surface and subsurface drainage features based upon the range of possible elevations and distances that occur or may occur after installation of improvements. The sensitivity analysis shall establish which parameters are most critical for determination of the depth to SWC. Conservative values for the most critical parameters shall be used in applying the model to the site;

- (3) for sites designed to receive over 600 gpd, the SWC determination using DRAINMOD shall take into consideration the impact of wastewater application on the projected water table surface; and
 - (4) the groundwater simulation analysis shall be prepared and submitted to the LHD by licensed professionals, if required in G.S. 89C, 89E, or 89F, qualified to use DRAINMOD by training and experience. The LHD shall submit the groundwater simulation analysis to the Department for technical review prior to approval of the SWC determination.
- (i) The monitoring and modeling procedure is a combination of the direct monitoring procedure and the modeling procedure. The SWC shall be determined as the shallowest level predicted by DRAINMOD to be saturated for a 14-day continuous period between January 1 and April 30 with a recurrence frequency of 30 percent, an average of a minimum of nine years in 30, and in accordance with the following:
- (1) the procedures set forth in Paragraph (g) shall be used to monitor water surface elevation and precipitation. The rain gauges and monitoring wells required by Subparagraph (g)(4) shall use a recording device and a data file that is DRAINMOD compatible. The recording devices shall record rainfall hourly or daily and well water levels daily. The data file shall be submitted with the report to the LHD;
 - (2) DRAINMOD shall be used to predict daily water levels. The DRAINMOD modeling shall be in accordance with the following:
 - (A) weather input files shall be developed from daily temperature and hourly or daily rainfall data collected over a minimum 30-year period from a measuring station, such as the National Weather Service or SCO. The measuring station used shall be the station located closest to the site. Daily maximum and minimum temperature data for the December 1 through April 30 monitoring period shall be obtained from the closest available weather station;
 - (B) soil and site inputs for DRAINMOD, including a soils data file closest to the soil series identified, depths of soil horizons, in-situ Ksat of each horizon, depth and spacing of drainage features, and depression storage shall be selected in accordance with procedures outlined in the DRAINMOD User's Guide;
 - (C) inputs shall be based upon site-specific soil profile descriptions. Soil and site input factors shall be adjusted during the model calibration process to achieve the best possible fit as indicated by the least squares analysis of the daily observations over the whole monitoring period and to achieve the best possible match between the shallowest water table depth during the monitoring period that is saturated for 14 consecutive days, measured vs. predicted. The mean absolute deviation between measured and predicted values shall be no greater than six inches during the monitoring period;
 - (D) for sites intended to receive greater than 1,500 gpd, the SWC determination using DRAINMOD shall take into consideration the impact of wastewater application on the projected water table surface; and
 - (E) the DRAINMOD analysis shall be prepared and submitted to the LHD by licensed professionals, if required in G.S. 89C, 89E, or 89F, qualified to use DRAINMOD by

training and experience. The LHD or owner may request a technical review by the Department prior to approval of the SWC determination.

The monitoring and modeling procedure may also be used to re-evaluate a SWC that was previously evaluated by the direct monitoring procedure.

(j) Modeling procedures other than those set forth in this Rule may be used to determine SWC upon approval by the Department. Other modeling procedures shall be approved if the following requirements are met:

- (1) the modeling procedures use daily water levels or weather records over a 30-year period to predict future daily water levels;
- (2) the proposed model and prediction are shown to be as accurate as the prediction from DRAINMOD, calculated in accordance with Paragraph (h) of this Rule; and
- (3) documentation is provided in accordance with Rule .0509(c) of this Section.

(k) A report of the investigations made for the direct monitoring procedure, modeling procedure, or monitoring and modeling procedure in accordance with Paragraphs (g), (h), or (i) of this Rule shall be prepared prior to approval of the SWC determination. A request for technical review of the report by the Department shall include digital copies of monitoring data, model inputs, output data, and graphic results, as applicable.

History Note: Authority G.S. 130A-335(e);
Eff. January 1, 2024.