Annette M. Lucas, PE
Environmental Engineer
NCDENR | DEMLR | Stormwater Program
1612 Mail Service Center, Raleigh, NC 27699-1612

RE: Proposed revisions to the 02H Stormwater rules

Dear Ms. Lucas:

I am writing in regards to the proposed revisions to the NC 02H Stormwater System rules. I appreciate your interest in having feedback from this board. In this letter I hope to provide feedback as to what constitutes the legal practice of soil science, for your guidance in determining what stormwater related site investigations would require a Licensed Soil Scientist (LSS) stamped report. I also hope to address your request for input as to which Stormwater Control Measures (SCM's) would benefit from LSS input in the design process. First I would like to address generally the legal bounds of the practice of soil science in North Carolina based on statute.

Based on careful consideration of NCGS chapter 89F, the North Carolina Soil Scientist Licensing Act ("Licensing Act"), which established the practice of soil science as a profession in NC, and of the regular practice of soil science, engineering (especially geotechnical investigations) and geology as reflected in prepared reports, it is the finding of the North Carolina Board for Licensing of Soil Scientists (NCBLSS) that any investigation involving detailed description and delineation of soil horizons and their properties, especially pedogenic characteristics such as structure, presence or absence of argillic, plinthic, sodic etc characteristics, the presence of limiting horizons such as fragipans, and the determination of seasonal high water table, is the sole province of soil scientists. No other profession has expertise in identifying these detailed features, which are crucial to the function and design of stormwater systems so that they will perform as intended.

Furthermore, any investigation relating to pedogenic characteristics such as soil horizons, is the sole province of soil scientists. For example, identification of potentially restrictive soil horizons and of existing compaction conditions in in situ soil, and measurement of saturated hydraulic conductivity ("Ksats") in specific horizons, such as a Bt or BC horizon, would fall solely within the practice of soil science.

In 89F-3, Definitions, the Licensing Act defines soil as "consisting of soil material, saprolite, weathered materials, and soil rock interface" and defines soil science as including "soil characterization, classification, and mapping, and the physical, chemical, hydrologic, mineralogical, biological, and microbiological analysis of soil per se, and to

its assessment, analysis, modeling, testing, evaluation, and use for the benefit of mankind when specifically required to complete the investigation and evaluation of interactions between water, soil, nutrients, plants, and other living organisms described in subdivision (5) of this section." Based on these definitions related to the proposed stormwater regulations, two points are worth emphasizing. First, the practice of soil science includes the investigation and evaluation of interactions between soil, nutrients and plants, and therefore activities like the development of media for plant growth as for example for green roofs, and soil investigations of pH, nutrient and other parameters relating to plant growth fall within the practice of soil science. It is not clear to me that this type of investigation or activity falls within the practice of either engineering or geology. Second, based on this definition the practice of soil science extends through the unconsolidated parent material to bedrock. It includes both the vadose zone and unconfined aquifer. Both soil scientists and geologists study and model the movement of water in this zone and would be qualified to provide determinations regarding lateral flow and groundwater mounding within this material. It should be noted that engineering geotechnical investigations dealing with the bearing capacity and compactability of soil and other parameters that relate to soil materials as building materials DO NOT fall within the practice of soil science.

Based on the above discussion, investigations of the following characteristics would fall within the practice of soil science. The SCM's that appear to require information that falls within each investigation type are listed at the end of each paragraph.

Natural soil permeability: In all SCM's whose function relies strongly on the natural permeability of the soil, an investigation of the in situ soil horizons and analysis of their characteristics by a licensed soil scientist is likely needed. This information is critical, among other things, in assessing draw down time for structures in natural and modified soils. Identification of pedogenic features like structure or presence of fragipans, plinthic horizons and other restrictive horizons is crucial to accurately assessing in situ permeability accurately. As discussed above, no other profession has expertise in this type of investigation. The following structures/practices appear to rely strongly on natural permeability for their function and drawdown times: Infiltration systems (.1051), (Bioretention cells .1052 NO??) , Wet ponds (.1053), Stormwater wetlands (.1054), Permeable pavement (.1055), Vegetated receiving areas for disconnected impervious surfaces (.1060(3)), Treatment swales?? (1061), Dry ponds (.1062)

Seasonal High Water Table (SHWT): In general it is the opinion of the NCBLSS that determination of SHWT based on soil characteristics such as soil color patterns and other criteria should be done only by licensed soil scientists and is the most reliable method of identifying SHWT. It has been our experience that when this is done by other professionals and by other methods such as direct observation of the water table at a specific moment of time, the resulting data has not provided good results in stormwater system design. Structures/practices whose design needs this information include: Outlets (.1050(2)), Infiltration systems (.1051), Bioretention Cells (.1052), Permeable pavement (.1055), Sand filters (.1056), Treatment swales (.1061), Dry Ponds (.1062)

Hydrogeologic Investigations: practice of soil science extends through unconsolidated parent material to bedrock, and soil scientists have considerable expertise in conducting hydrogeologic investigations in these layers to assess water table movement. Practices which appear to require hydrogeologic investigations in some cases include: Infiltration systems (.1051) , Bioretention Cells (.1052)

Assessement of sand for presence of fine sands: It sounds like the make up of sands has been a factor in causing some bioretention cells (.1052) and sand filters (.1056) to fail prematurely. Soil scientists have training in identifying different sand grain sizes in the field based on the USDA texture system. Whether you prefer to use the USDA sand classification system or the Engineering system depends on the crucial breaks for sand grain size in these practices. In addition, depending on the level of accuracy required, a field assessment by a soil scientist may be adequate. A summary of the two systems is as follows:

USDA		Engineering
Very coarse sand:	2.0-1.0 mm	Sieve 10 to sieve 40: 2.0 mm-0.425
Coarse sand:	1.0-0.5 mm	
Medium sand:	0.5-0.25 mm	Sieve 40 to sieve 100: 0.425-0.150 mm
Fine sand:	0.25-0.1 mm	
Very fine sand:	0.1-0.05 mm	Sieve 100 to sieve 200: 0.15-0.075 mm

The NCBLSS will be glad to work with your department further in determining the appropriate approach for this concern if needed.

Hydrologic group: This is typically determined based on USDA soil survey. Please be aware that the soil survey is not done with the intention of being applied to practices on areas less than 5 acres in size, and was certainly not intended as a regulatory tool. Typical soil map units can have inclusions of contrasting soils of 1-3 acres in size due to limitations of the map scale. In areas of highly variable soils, such as the mountains, map units may be designed as complexes, consisting of more than one soil type. Depending on how crucial this determination is to system function, it may well be important to have an LSS do a high intensity soil survey of the specific vegetated receiving area. Where the system designer wants to challenge the NRCS Soil Survey determination, it would be necessary to have an LSS do the investigation.

Plant-soil relationships: Activities such as measuring pH and nutrients for plant growth, designing plant growth media, determining phosphorus index, assessment of in situ soil characteristics such as plow pans and soil texture for promotion of plant establishment and growth is an area of LSS expertise. Soil science grew out of the agricultural field and plant nutrition and soil fertility is a core area of study. Agronomists also have expertise in this area. Any practice where establishment of plants or creation of plant growing media is needed will need input from an LSS. Practices where this type of investigation is needed appear to include: Bioretention cells (.1052), Wet ponds vegetated shelf (.1053(5)), Stormwater wetlands (.1054), Green roofs (.1058), Level spreaders-filter

strips (.1059), Vegetated receiving areas for disconnected impervious surfaces (.1060(3)), Treatment swales (.1061).

It may be that you will need to identify in your rules which professions are qualified to conduct which investigations and design work. One possible option is the format used in the 02T Non-discharge rules. For example, "In a letter dated xx/xx/xxxx the North Carolina Board for Licensing Soil Scientists indicated that the determination of SHWT as described in this section falls within the practice of soil science".

Thank you for the opportunity to provide input on these rules. If you have questions or require additional information, we will be happy to work with you.

Sincerely,

Connie Adams, LSS
Board member