

**NORTH CAROLINA DEPARTMENT
OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH
ON-SITE WATER PROTECTION SECTION**

**CONTROLLED DEMONSTRATION
WASTEWATER SYSTEM APPROVAL**

CONTROLLED DEMONSTRATION NO: CDWS 2010-03

Issued To: Alan F. Hassett, P.E.
The Oak Hill Company, Ltd.
5 Great Valley Parkway – Suite 239
Malvern, PA 19355
1-888-4-NOMOUND
<http://www.nomound.com/>

For: NoMound® Onsite System

Approval Date: August 5, 2010

In accordance with 15A NCAC 18A .1969, an application by The Oak Hill Company, Ltd., Malvern, PA for the NoMound® Onsite System has been reviewed and the system has been found to meet the standards of a controlled demonstration system when all of the following conditions are met:

I. General

- A. This sanitary system of sewage treatment and disposal is a groundwater lowering technology used in conjunction with a subsurface disposal system to be used for sites classified as UNSUITABLE as to soil wetness conditions.
- B. The purpose of this Controlled Demonstration is to demonstrate the capability of this system to create and maintain a zone of unsaturated soil beneath the drainfield area at all times in order to comply with the requirements for the site-specific separation distance for the treatment of effluent from a wastewater system.
- C. Design flow for systems to be approved under this Controlled Demonstration shall not exceed 1,000 gallons per day. Influent wastewater strength shall not exceed the strength of residential wastewater, and shall not exceed the influent quality standards set forth in Rule .1970. All other aspects of a sanitary system of sewage treatment and disposal shall be governed by the applicable on-site wastewater system laws and rules.

II. Siting and Design Criteria

- A. Site-specific plans and specifications shall be prepared by a North Carolina licensed professional engineer and a North Carolina licensed soil scientist and, when appropriate, other responsible professional(s). All plans and specifications shall be approved by an authorized NoMound® representative.
- B. The geomembrane shall be 30 mil PVC or equivalent approved material.

- C. The geomembrane must extend vertically to a sufficient depth to achieve site-specific separation requirements taking groundwater recharge mounding into account, as shall be determined by the system designer.
- D. Minimum geomembrane depth shall be 18 inches below the proposed trench/bed bottom. Supporting documentation for the proposed depth shall be provided in the application package.
- E. Lateral flow analysis shall be provided for sites with slopes in excess of 5%.
- F. The geomembrane must extend a minimum of five (5) feet horizontally from the edges of the nitrification trenches or bed.
- G. Fresh air supply shall be provided that is adequate to satisfy BOD and NOD plus a safety factor. The safety factor shall be a minimum of 3 times the projected oxygen demand. Computations for oxygen demand and their basis shall be provided by the designer in the application package. For single-family residential applications, the fresh air pump shall be Gast model DDL 15-101 or manufacturer and designer approved equivalent.
- H. Air bleed shall be designed to cease during power outage thereby allowing separation distance to be maintained.
- I. Ballasting for the geomembrane shall be provided that is adequate to resist site-specific design maximum upward pressure during operation. Ballast design shall be determined by the design engineer.
- J. Continuous monitoring shall be provided for all systems to assure conformance with the site-specific vertical separation distance and ongoing fresh air pump functionality. Notification of high water conditions or fresh air pump malfunction shall be forwarded from the on-site alarm panel to an off-site central monitoring station and thereafter to the Operator in Responsible Charge (ORC). The well containing the alarm float shall be centrally-located within the drainfield area footprint for sites with a slope of 2% or less. For sites with slopes greater than 2%, the alarm well shall be located as close as feasibly possible (based on constructability constraints) to the high point of the estimated groundwater recharge mounding as determined by the responsible professional.
- K. The alarm circuit or circuits shall be supplied ahead of any fresh air pump electrical control circuit overload and short circuit protection device.
- L. Horizontal setbacks shall be measured from the edge of the nitrification trench or bed to surface water, wells and water lines, and to any adjacent drainage system features (exclusive of the NoMound® system components).
- M. Horizontal setbacks shall be measured from the edge of the nitrification trench or bed plus five (5) feet to property lines, building foundations, basements, swimming pools, other nitrification fields (except repair area) and any other site-specific features which could interfere with system installation.
- N. Prominent, weather-proof, permanent labeling shall be provided on the field pump/dosing tank lid or riser and/or panels with wording "NoMound® nitrification field: -- **DO NOT PROBE**". A

copy of the as-built dimensioned drawings of the tank and field locations shall be stored in a NEMA 4X panel (or superior) on-site.

- O. The borders (at least the four corners) of the geomembrane shall be identified in the field with permanent markers or monuments that are located at or above finished grade. Non-conventional drainfield designs (e.g., L-shaped, etc.) shall have each corner identified. The permanent markers or monuments must remain readily visible to the user and operator at all times. In lawns or other landscaped areas they may be at-grade if readily visible, and shall be above grade with clear identifying labels elsewhere.
- P. This approval is issued for use in the following soil/site conditions:
 - 1. Sites which are classified as suitable or provisionally suitable, except for soil wetness conditions, for systems approved by the North Carolina Laws and Rules for Sewage Treatment and Disposal Systems, 15A NCAC 18A .1900, et seq;
 - 2. Sites which are classified as unsuitable which may be reclassified as provisionally suitable through the use of the NoMound® system;
 - 3. Sites which are classified as unsuitable, which can be reclassified provisionally suitable if a special investigation indicates that a modified or alternative system can be installed in accordance with Rules .1956 or .1957(a), and all of the conditions of this approval shall be met; and
 - 4. Approval for use in additional soil/site conditions may be issued upon review of site-specific conditions and associated system design on a case-by-case basis by NCDENR On-Site Water Protection Section.
- Q. The proposed site shall also include a separate area or site for a non NoMound® repair/replacement system that can be approved pursuant to Rule .1955, .1956, 1957, or .1969 (an Innovative or Accepted System only). If the replacement system/site requires a drainage system (e.g., pump drainage groundwater lowering system), necessary plans, supporting documentation and legal agreements for the drainage system design shall be included with the NoMound® system application.
- R. This approval is issued for use with the following prescriptive on-site wastewater system designs.
 - 1. PTI Multi-Pipe System 11-pipe Model, IWWS-2002-05-R3 (MPS-11) trenches or beds, utilizing pressure distribution or pressure dispersal.
 - 2. Designs for trench layouts will locate the air supply piping in each trench adjacent to the MPS-11 distribution pipe. Designs for bed layouts will array the air supply piping in an “H” pattern on top of the MPS-11 bed.
 - 3. Pressure dispersal is preferred. Pressure dispersal shall be by LPP distribution and not drip. Pressure dispersal (LPP) lateral piping shall be installed within the unbundled 4-inch MPS-11 distribution pipe.
 - 4. Pressure distribution (pressure manifold) may be used on a case-by-case basis when reviewed and approved by NCDENR On-Site Water Protection Section
 - 5. A 4-inch observation port (Sch. 40 PVC, or superior, within a valve box with a latching lid flush with the ground surface) shall be installed in the middle portion (lengthwise) of each nitrification trench or bed (as close to the center as feasibly possible based on constructability constraints). The bottom of each observation port pipe shall not exceed the nitrification trench or bed bottom depth.
- S. Approval for use of designs other than those described in Section II.R.1 through R.5 may be issued upon review and approval of the site-specific design on a case-by-case basis by NCDENR On-Site Water Protection Section.

III. Installation Criteria

- A. Installation shall be in accordance with approved site-specific plans and specifications.
- B. Installation shall be by a NCOWCICB certified Level IV Contractor who has been trained and is authorized in writing by NoMound prior to installing the NoMound® system.
- C. An installation checklist shall be provided by NoMound, as a guide to the designer, installer and inspector.
- D. Prior to Operation Permit issuance, as-built plans shall be provided to the owner and local health department and the installation certified by the design engineer to have been installed in accordance with approved plans and specifications, or approved modifications.

IV. Operation and Maintenance Requirements

- A. Operation and Maintenance requirements shall be in accordance with site-specific instructions prepared by the design engineer and also approved by an authorized NoMound® representative.
- B. The fresh air pump shall be inspected for proper operation during each Operator inspection, and replaced when needed, as specified by NoMound®. For single-family residential applications, the standard fresh air pump (Gast model DDL 15-101 linear air pump) has an estimated service life of 35,000 hours or more when operating continuously. NoMound® recommends the fresh air pump be replaced during the next scheduled ORC visit after the 4th year of continuous operation in order to limit the possibility of a non-scheduled service call.
- C. ORC individual(s) and firm(s) must be trained in all aspects of system design (relevant to the system functioning properly), performance, inspection, operation, maintenance and troubleshooting, and authorized in writing by NoMound® prior to the issuance of the Operation Permit by the local health department (LHD). A list of approved operators shall be provided to the NCDENR On-Site Water Protection Section, and kept up to date (revise at least quarterly).
- D. An inspection, operation and maintenance checklist shall be provided by NoMound® as a guide to the ORC.
- E. The provisions of Table V(a) and Table V(b) of Rule .1961(b) shall apply as applicable. As a minimum, the NoMound® system shall be classified a Type V system in accordance with Rule .1961, except that the required ORC inspection frequency shall be at least quarterly for this Controlled Demonstration system. A greater frequency may be required at the 15 sites to be specially monitored for this Controlled Demonstration Project, as described in Section F of this Approval. At least one inspection shall be during a projected period of high water table. At sites in coastal areas, at least one inspection shall be during the projected seasonal high use period.
- F. The presence and depth of ponding shall be determined in the observation ports (Section II.R.5) that are located in each nitrification trench/bed during one of the four ORC inspections (once annually), and results recorded in the Operator's inspection log and reported to the Health Department. Drainfield dosing will be disabled while observation ports are open and then enabled only after required separation distance is confirmed (by high-level alarm device). Ponding in excess of 5 inches will be reported by the ORC and an overall system evaluation conducted to determine cause(s) and appropriate correction(s).

V. Repair of Systems

The provisions of Rule .1961(c) shall govern the use of the NoMound® Onsite System for repairs to existing malfunctioning wastewater systems.

VI. Controlled Demonstration Criteria

- A. The Controlled Demonstration study shall consist of a minimum of fifteen (15) and a maximum of two hundred (200) permits to be issued under this Controlled Demonstration approval. The fifteen sites will be selected and monitored as described below. Sites which are not monitored to the degree described below will be monitored continuously by the central monitoring station as described in Section II.J.
- B. This study shall be organized and segmented and evaluated individually by soil texture Groups and Sub-Groups. Controlled demonstration sites shall be sites classified with an unsuitable soil wetness conditions. All other soil and site conditions shall be consistent with the applicable wastewater system type proposed in conjunction with the NoMound® system as described in Sections II.P and II.R of this approval.
- C. This approval shall be subject to evaluation and review by the NCDENR On-Site Water Protection Section after the first fifty (50) controlled demonstration operation permits have been issued. The review process will not affect the issuance of subsequent permits, nor preclude action by the State on the system's approval status, pursuant to applicable Laws and Rules.
- D. The following premises define the criteria of interest and applicable tests for satisfactory performance:
 1. The depth for determining the most limiting soil texture within the saturated zone to determine the effective hydraulic performance will be a minimum of 12 inches below the termination elevation of the PVC geomembrane for Soil Groups I and II, and a minimum of 24 inches below the termination elevation of the PVC geomembrane for Soil Groups III or IV.
 2. For sites where the soil horizon texture is inconsistent within the saturated zone in the proposed NoMound® system area, it shall be the responsibility of the licensed responsible professional to substantiate effective hydraulic performance on a case-by-case basis. Substantiating data, which shall be provided in the application package, shall be based on site-specific testing and analysis.
 3. NoMound® systems installed in Group III or IV textures within the unsaturated ("treatment") zone above the level of the bottom of the geomembrane must incorporate an approved TS-I or more stringent pretreatment component.
 4. The use of a bed systems is acceptable in Soil Groups I, II, and III (limited to 600 gpd system treating domestic septic-tank quality effluent). A bed system may also be used for a design unit with a sewage flow greater than 600 gpd, not to exceed 1,000 gpd, and shall incorporate an approved TS-I or more stringent advanced pretreatment component prior to the treatment and dispersal field. A design unit sewage flow is limited to 1,000 gallons per day.
 5. Each soil textural Group and Sub-Grouping shall be field tested and approved independently.
 - a. Soil Group I - Three (3) demonstration sites shall be designated for Soil Group I
 - b. Soil Group II - Three (3) demonstration sites shall be designated for Soil Group II
 - c. Soil Group III

- i. Three (3) demonstration sites shall be designated for Soil Group III with a Silt, Silt Loam, or Sandy Clay Loam textural class
 - ii. Three (3) demonstration sites shall be designated for Soil Group III with a Clay Loam or Silty Clay Loam textural class
 - d. Soil Group IV - Three (3) demonstration sites shall be designated for Soil Group IV
6. The proposed NoMound® system claims a reduction in the water table, within the soil environment enclosed by a PVC geomembrane, in relation to the water table in the soil environment outside the PVC geomembrane. Water level recording devices shall document the effectiveness of the NoMound® system to maintain the required water level separation beneath the nitrification field at all times. Minimum required separation shall be 12 inches for a pressure dispersal system and 18 inches for a gravity distribution system.
 - a. For sites with slope of 2% or less, at least one recording device shall be installed to record the water level under the PVC geomembrane. At least one recording device shall be installed to record the water level outside of the PVC geomembrane.
 - b. For sites with slopes greater than 2%, at least two recording devices shall be installed to record the water level under the PVC geomembrane. Two recording devices shall be installed to record the water level outside of the PVC geomembrane. At least one device shall be installed upgradient and one device downgradient of the NoMound® drainfield.
 - c. The water level recording devices shall be automated and set to measure and record the water level at least once per hour. The location and number of the devices shall be determined by the responsible soil scientist or hydrogeologist as applicable, in accordance with this approval.
 - d. For sites to be permitted pursuant to this controlled demonstration approval in addition to the 3 sites to be specially monitored in each soil textural group, as described in Sections VI.5 and VI.6, the high water level alarm in the well centrally located within the PVC geomembrane will serve as the indicator of non-compliance of soil wetness beneath the system.
7. The controlled demonstration evaluation period for each of the 3 sites to be specially monitored in each of the soil textural groups, as described in Sections VI.D.5 and VI.D.6, shall be long enough to sufficiently demonstrate effective performance during wet weather periods and at sites in coastal areas with at least one inspection made during the projected seasonal high use period. This demonstration period shall include one or more of the following conditions:
 - a. Three (3) distinct time periods following rainfall events when the ambient water level rises to a height greater than the termination elevation of the PVC geomembrane, as determined by water level recording devices, and the water level high-point beneath the membrane is measured to be depressed by at least 6 inches below the ambient water level for at least a 24-hour period. The rain events may occur in any month provided the aforementioned criteria are met, and are separated by drier periods when the ambient water level is at or below the termination elevation of the membrane, and the water level beneath the membrane has dropped to be within 1 inch or below the termination elevation of the membrane; or
 - b. One or more distinct time periods when the ambient water level rises to a height greater than the termination elevation of the PVC geomembrane, as determined by water level recording devices, and the water level high-point beneath the membrane is measured to be depressed by at least 6 inches below the ambient water level for a cumulative period of at least 14 days. These time periods may occur in any month or months, provided the aforementioned criteria are met; or
 - c. Five (5) months of continuous water level data during the predicted wet season (December through April), including at least 3 of the 5 months with precipitation that

equals or exceeds the 30th percentile of normalcy based on the most recent published 30+ year historic record from the nearest weather station with available data (National Weather Service, or equivalent). During this monitoring season there shall be at least one 72 hour or longer period where the water table beneath the membrane has been measured to be continuously depressed by at least 6 inches below to the ambient water level.

Regardless of which of these conditions are complied with by the demonstration period, the site-specific minimum vertical separation requirement shall be met at all times.

8. Third party independent monitoring shall be conducted on sites as defined in Section VI.D.5 above. The third party shall be proposed by The Oak Hill Company and approved by the NCDENR On-Site Water Protection Section.
9. The third party shall review the site-specific sampling and flow-monitoring protocol, collect and analyze the ORC inspection reports, sampling and monitoring data, and prepare Semi-Annual Reports summarizing all data for all the sites. These reports are due by January 31 and July 31 of each year, and shall include all data gathered through December 31 and June 30 of the previous six-month period, respectively. These reports shall provide information to the Department based upon the monitoring data and observations made from the Controlled Demonstration systems installed pursuant to this Approval. This should include an assessment of system performance in relation to the established treatment performance standards; an assessment of physical and chemical properties of the materials used to construct the system, in terms of strength, durability, and chemical resistance to loads and conditions experienced; recommended areas of applicability for the system; and any conditions and limitations related to the use of the system. Copies of the reports shall be sent to the On-Site Water Protection Section and to all county health departments that the systems are installed in.
10. Upon completion of the monitoring period defined in Section VI.D.7.a, b, or c, above, a final written report summarizing the results of the controlled demonstration shall be developed by the third party, and submitted for review to the NCDENR On-Site Water Protection Section. Performance shall be judged by the ability of the system to continuously maintain the required minimum vertical separation distance between the trench/bed bottom and the water level high-point beneath the membrane when the naturally-occurring groundwater levels outside the NoMound® system are non-conforming. The Final Report shall be in electronic format and may be published on the On-Site Water Protection Section's website without confidentiality. The contents of the interim and final reports shall not be altered from the original document without approval from The Oak Hill Company, Ltd.
11. The data will be evaluated with a textural class designation. A final written report of findings shall be completed by the third party investigator and submitted to the On-Site Water Protection Section for review prior to action being taken on future applications. Applications for future approval of the NoMound® system as Innovative may proceed on a Group-by-Group or Sub-Group-by-Sub-Group basis (as defined under Section VI.D.5), as soon as the minimum number of sites in the above Sections have been installed, monitored and independently demonstrated to meet the monitoring requirements and performance criteria specified in this approval.
12. As a condition of this approval, a separate assessment of water quality impacts shall also be recommended by the manufacturer and approved by the On-Site Water Protection Section prior to this system being considered for Innovative Approval.

Approved by: _____ Date: _____