NORTH CAROLINA DEPARTMENTOF ENVIRONMENT AND
NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH
ON-SITE WASTEWATER SECTION

EXPERIMENTAL WASTEWATER SYSTEM APPROVAL

EXPERIMENTAL WASTEWATER SYSTEM NO: EWWS-06-2

ISSUED TO:

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FOR:
Tire Chip Substitution for Rock Aggregate
in Standard Bed/Fill and “Brunswick” Bed/Fill Systems.

APPROVAL DATE: May 2, 2006

In accordance with 15A NCAC 18A.1969, an application by Barbara Hartley Grimes (DEH) and Aziz Amoozegar (NCSU) for approval of experimental systems monitoring and testing program for the evaluation of tire chips being utilized in Standard (15A NCAC 18A.1955(d), 1957(b)) and “Brunswick” (IWWS-95-1) Bed/Fill Systems has been found to warrant approval for the systems installed in accordance with this experimental system protocol.

I. Facility Served and System Description:

Six residential sites will be identified in various counties, primarily in eastern North Carolina. The local health department shall confer with the principle investigators for each of the six systems before issuing

any permits. Each of the six installations shall be assigned an individual tracking number. Three of these installations will be for Standard Bed/Fill configuration (Fig 1) and three in the “Brunswick” Bed/Fill configuration (Fig 1). These will be residential facilities with domestic wastewater flow. No sites will be used that have been permitted before repair areas were required.

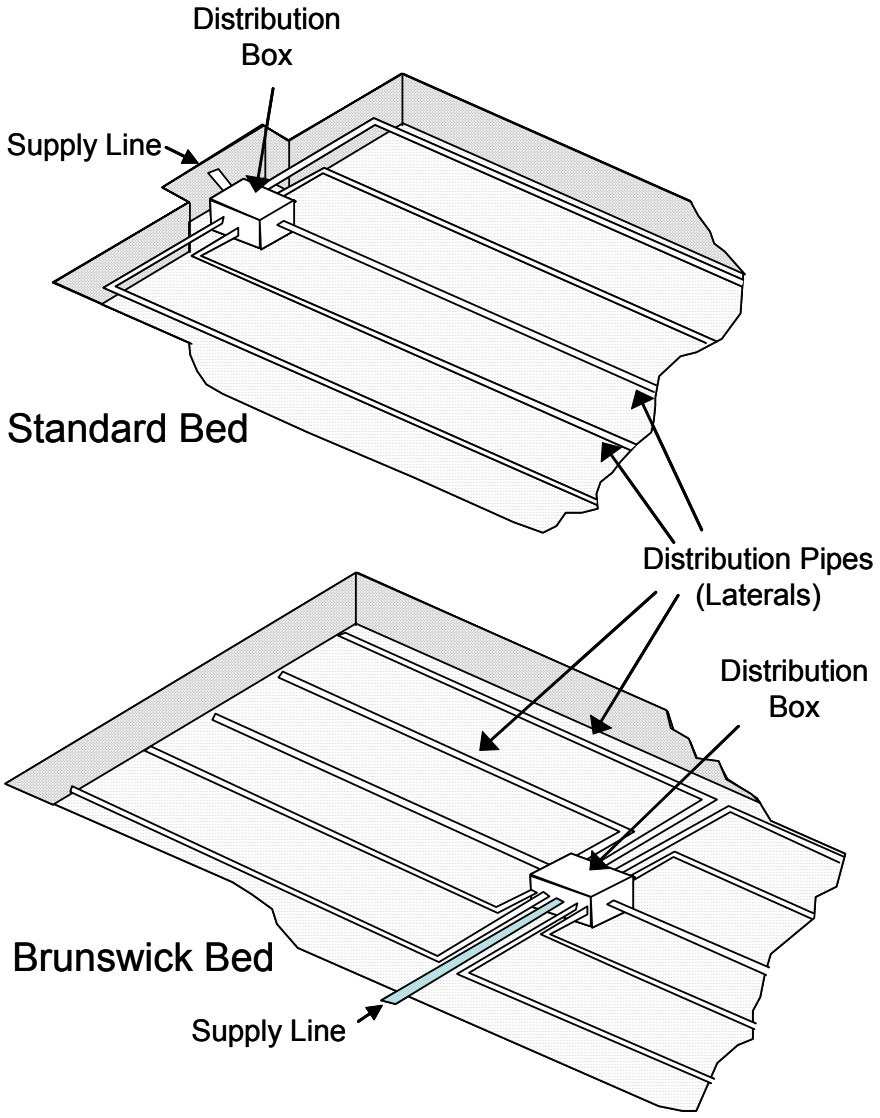

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Figure 1. Schematic diagram of examples of the construction of standard and Brunswick bed/fill systems used in gravel systems in North Carolina.

II. Permitting and Installations :

Two types of bed/fill systems, standard bed and Brunswick bed (Fig. 1), using gravel aggregate are currently permitted in North Carolina. With cooperation from the officials from the Brunswick (or another) County Health Department and the Regional Soil Scientist of the On-Site Wastewater Section (OSWS), we will install six bed systems with tire chip aggregate at individual single family residences in soils commonly permitted for bed systems (and two gravel systems as controls). Tire chips produced specifically for use in septic systems according to the current North Carolina specifications will be obtained from a waste tire processor approved by the OSWS of the NCDENR. For all systems, tire chips in the beds will be covered with geotextile fabric currently approved by OSWS for tire chip installations. Except for tire chips, all other components of the experimental system will be similar to the currently permitted system in the respective county. The experimental systems will be constructed by an experienced and knowledgeable private wastewater system installer/contractor that is currently registered in the respective county. Depending on the type and location of the experimental bed system at each site, the project will pay for partial cost of the system associated with the installation of drainfield (treatment and dispersal field), and the homeowner may pay for the cost of the septic tank and its installation. Each experimental system will be installed at a home site with adequate repair area for the installation of a comparable bed system with gravel. Each system will receive domestic strength wastewater.

A. The local health department, may issue an Improvement permit, Authorization to Construct, and an Experimental System Operation Permit (ESOP) for the 6 experimental systems installed with this approval and the applicable provisions of Rule.1969(4)(c). Please note that before a system is permitted, a system ID number must be obtained from the PIs in this approval.

B. At this time, specific approval only applies to the six sites, with 3 being standard bed configurations and 3 being "Brunswick" bed configurations
   1. System owners shall install an alternate approved backup system if the system fails.

2. System owners shall be responsible for the proper operation of their system and shall allow access to the system.
3. System owners shall retain the designated repair area as approved by the local health department and shown on the approved plans for a non-experimental system in an undisturbed state.

C. The installation shall be under the direct field supervision of Dr. Aziz Amoozegar (NCSU) and Dr. Barbara Hartley Grimes, as well as other monitoring and testing individuals (e.g. other faculty at NCSU) and the local health department. The installation shall include the systems as described above and shall also be in accordance with requirements for tire chips and geotextile cover as listed in the Innovative Approval for Tire Chip Trenches in Innovative Approval IWWS-2002-3-R.

D. All other applicable requirements of Rule.1969 shall be met.

III. Operation and Monitoring:

The six experimental systems (and two gravel beds for controls) will be operated according to the rules set by the state and respective county using either gravity or pressure distribution manifold (except low pressure pipe). The systems will be monitored by researchers at North Carolina State University in cooperation with staff at OSWS and the county health department (see full proposal below). A summary of the protocols:

A. Any changes in the elevation of the top of the bed of each system at the respective site will be determined to assess potential settling of the tire chips.

B. A series of redox probes and tensiometers will be installed at various depths in and around the bed of each of the 8 systems for monitoring the soil oxygen status and soil water potential, respectively.

C. Two five-segmented time domain reflectometry (TDR) rods will be installed in the soil at two opposite sides of the bed of each system to measure the water content of the soil.

D. Observation/sampling wells (perforated pipes) will also be installed at various locations within each bed.

E. Each system will be visited monthly. During each visit, the soil water content, soil water potential, and soil redox status will be measured using the TDR rods, tensiometers, and the redox probes, respectively.

F. The level of ponding in each observation/sampling well will be measured.

G. At least four times during the year an effluent sample from the bottom of the bed of each system will be collected for analysis.

1. Arrangements will be made with a local certified laboratory for fecal coliform analysis. Samples for fecal coliform will be collected and handled according to the procedure provided to us by the respective laboratory in South Carolina or North Carolina.
2. Samples collected for chemical analysis (wastewater contaminants and other chemicals) may be acidified and placed on ice before transportation to the laboratory (see attached proposal).

H. Interim/summary reports are to be provided at least quarterly. Written reports are to be provided to the respective county health department and the Division of Environmental Health, including a final report summarizing the results of this monitoring/testing program and making recommendations on the future use, specifications requirements, and future use of tire chips in Bed and Fill Systems including standard Bed/ Fill and “Brunswick’ Bed/Fill Systems.

IV. Repair of System*:*

The provisions of 15A NCAC 18A .1961(l) shall govern the repairs to malfunctioning wastewater systems.

Approved by:_____ Date: 6/21/06
Terry Pierce Division Director DEH

APPLICATION FOR INSTALLATION OF SIX EXPERIMENTAL BED SYSTEMS USING TIRE CHIPS

Executive Summary

The On-Site Wastewater Section (OSWS), NCDENR, has approved the use of tire chips as a substitute for gravel aggregate in septic systems with nitrification trenches, but does not allow tire chips to be used in bed systems. The primary goal of this study is to assess the structural and biological performance of tire chips in the bed system drainfield configuration.

Six bed systems using tire chips and 2 bed systems using gravel will be installed in Brunswick or another county in North Carolina. Any changes in the elevation of the top of the bed of each system at the respective site will be determined for assessing settling of the tire chips and gravel aggregate. Soil water content and potential under and around beds will be assessed using time domain reflectometry (TDR) and tensiometry, respectively. Redox probes will be installed under each bed system for assessing the oxygen status of the soil, and sampling wells will be installed at two to four locations within each bed system. Soil water content, soil water potential, redox potential, and the level of ponding in the bed at each site will be measured at least once a month. Effluent samples from the bottom of each bed will be collected and analyzed at least four times per year. For comparison, a minimum of two bed systems constructed with gravel will also be studied.

General Specifications for the Experimental Systems

The On-Site Wastewater Section (OSWS) of the North Carolina Department of Environmental Health and Natural Resources (NCDENR) has approved the use of tire chips as a substitute for gravel aggregate in the septic systems constructed using trenches (see http://www.deh.enr.state.nc.us/oww/Filterri/TireChipInnovAppr102402.pdf). The approval, however, does not cover bed systems.

SYSTEM DESCRIPTION -- Two types of bed systems, standard bed and Brunswick bed (Fig. 1), using gravel aggregate are currently

permitted in North Carolina. With cooperation from the officials from the Brunswick (or another) County and the Regional Soil Scientist of the On-Site Wastewater Section (OSWS), we will install six bed systems with tire chips and two systems with gravel aggregate at individual single family residences in soils commonly permitted for bed systems. Tire chips produced specifically for use in septic systems according to the current North Carolina specifications will be obtained from a waste tire processor approved by the OSWS of DEH NCDENR. For all systems, tire chips and gravel aggregate in the beds will be covered with geotextile fabric currently approved by OSWS. Except for tire chips, all other components of the experimental system will be similar to the currently permitted system in the respective county. The experimental systems will be constructed by an experienced installer. Depending on the type and location of the experimental bed system at each site, the project will pay for partial cost of the system associated with the installation of drainfield, and the homeowner may pay for the cost of the septic tank and its installation. Each experimental system will be installed at a home site with adequate area for the installation of a comparable bed system with gravel. Each system will receive domestic wastewater from the respective septic system serving the dwelling.

Operation, Maintenance and Monitoring Procedures -- Each experimental system (and control gravel systems) will be operated according to the rules set by the respective county. The systems, however, will be monitored by researchers at North Carolina State University in cooperation with staff at OSWS and the county. A series of redox probes and tensiometers will be installed at various depths in and around the bed of each of the 8 systems for monitoring the oxygen status and soil water potential, respectively. In addition, two five-segmented time domain reflectometry (TDR) rods will be installed in the soil at two opposite sides of the bed of each system. Observation/sampling wells (perforated pipes) will also be installed at various locations within each bed. Each system will be visited monthly. During each visit, the soil water content, soil water potential, and soil redox status will be measured using the TDR rods, tensiometers, and the redox probes, respectively. The level of ponding in each observation/sampling well will also be measured. At least four times during the year an effluent sample from the bottom of

the bed of each system will be collected for analysis. Arrangements will be made with a local certified laboratory for fecal coliform analysis. Samples for fecal coliform will be collected and handled according to the procedure provided to us by the respective laboratory in South Carolina or North Carolina. Samples collected for chemical analysis (wastewater constituents and other chemicals) may be acidified and placed on ice before transportation to the laboratory.

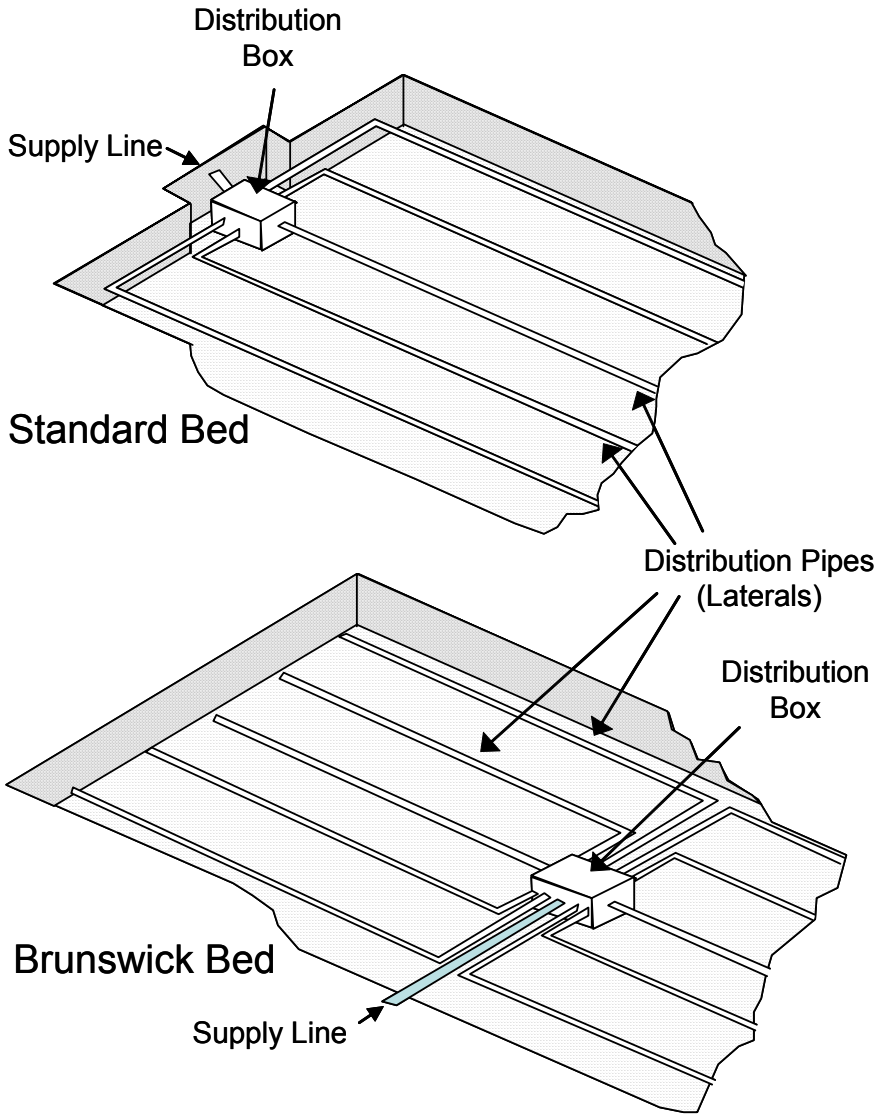

Figure 1. Schematic diagram of examples of the construction of standard and Brunswick bed systems used in North Carolina.