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October 19, 1989

State of North Carolina
Department of Environment, Health and Natural Resources
Division of Solid Waste Management
P.O. Box 27687
Raleigh, North Carolina 27611-7687

Attention: Mr. Bobby Lutfy
Hydrogeological Technician

Subject: Groundwater Monitoring Well Installation
Alamance County Landfill
Alamance County North Carolina

Dear Mr. Lutfy:

In reference to your letter of September 12, 1989 to Mr. Ernest Perry, Director Alamance County Health Department, my telephone conversations with you on October 2, 1989 and October 11, 1989, and a conversation I had with Mr. Perry on October 18, 1989, we would make the following comments:

1. Groundwater monitoring well construction techniques in a fractured bedrock aquifer system are significantly different than those employed for well construction in porous media.

2. A monitoring well constructed in a bedrock system according to the schematic diagram contained in your letter to Mr. Perry is insufficient in protecting the deep fractured rock aquifer from cross-contamination during installation. Contaminants that may be present in the shallow regolith aquifer system and especially in the transition zone between the regolith and the fractured rock may enter the bedrock aquifer. This is a significant risk since your method employs drilling of the borehole through the regolith and the bedrock in a single step. In a fractured rock system, such as we have in the Piedmont and the Blue Ridge Geomorphic Provinces, well construction to prevent cross-contamination must include the following steps:

A. A minimum eight inch diameter borehole is drilled through the shallow regolith aquifer system using a hollow stem auger. The boring is drilled to auger refusal in the bedrock.

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B. A tri-cone roller bit is then used to extend the borehole to a depth of 1-3 feet into the competent rock.

C. A six inch diameter pit casing is then set into the top of the bedrock and the annular space grouted from the bedrock to the ground surface.

D. The grout is allowed to set at least 24 hours.

E. The borehole is then advanced through the bedrock by using either a diamond core rotary bit or an air rotary hammer. Diamond coring is preferable to eliminate blowing rock cuttings into the rock fractures. The boring is extended to the desired depth using this method.

F. A Surface protective casing is then set and grouted in place with a concrete pad at the top of the ground.

G. Appropriate locks, well tags, signs and other designations are then attached at the well head.

3. Placement of a well screen in a bedrock well is neither necessary or desirable. The purpose of a well screen is outlined on page 395 of Driscoll's 1986 edition of Groundwater and Wells. This book is the definitive text on well construction. Per Driscoll, "A well screen is a filtering device that serves as the intake portion of wells constructed in UNCONSOLIDATED aquifers" (emphasis added). Bedrock aquifers in the Piedmont are certainly consolidated, otherwise we could drill in them with earth augers.

4. The well schematic that you have sent to Mr. Perry is the type of well utilized in the regolith portion of the Piedmont Aquifer System and in the Coastal Plain where unconsolidated materials require the presence of a well screen to keep the borehole open. A filter (sand pack) is placed around the screen in the annular space to act as a filter to prevent the entrance of formation materials into the well through the screen. I refer you to Campbell and Lehr, 1973, Water Well Technology, Chapter 11, pg 239 for well construction in consolidated formations.

5. I have reviewed the well construction methods employed on this project, have consulted with the drill crew and reviewed your letter. Based on the field logs, a bentonite seal was placed above the filter pack in shallow well MW-3. I have included an amended well record for this well.

6. The items you refer to as potential problems in an openhole well (paragraph 3 of page 2) cannot be substantiated and the possibility of their occurrence certainly would not be lowered or eliminated by the presence of a well screen. Remember that by using the two step well construction method, we have completely eliminated the hydraulic connection between the shallow regolith aquifer and the bedrock system.

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7. If you still are having problems with bedrock wells constructed in this manner, I suggest that you contact the regional hydrologists with the Division of Environmental Management's Groundwater Section located in the Piedmont and Mountain areas of our state (Don Link of the Asheville Office is available at 704-251-6208). Not only are they familiar with this type of construction, they endorse its use.

8. Based on discussions with Mr. Ernest Perry, we are standing by our well design and installation and request that you reconsider your instructions for abandonment of these wells.

9. Your suggestion to the County that we have constructed wells that may serve as conduits of contamination is inaccurate and we believe may be based on a lack of experience with bedrock well construction techniques in the Piedmont. We trust that after further review and consideration, you will reconsider your instructions for abandonment of these wells.

Should you have any questions or desire additional information, please contact us.

Very truly yours,
ENGINEERING TECTONICS, P.A.

Handwritten signature of A. Terry Nelson

A. Terry Nelson, P.G.
Chief Hydrologist

cc: Gordon Layton
Bill Meyer
Jim Coffey
Terry Waddell
Don Link
Ernest Perry