December 15, 1997

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MEMORANDUM

To: William D. Sessoms, DWM

From: James M. Gamble, P.G., DWM

Re: Design Hydrogeologic Study
City of Albemarle MSWLF
Stanly County, NC

The above referenced document is currently under review. Some additional evaluation must be provided before the review can be completed. Please have the following items addressed.

General Comments:

The maps provided do not accurately represent current site conditions. The maps included in the application show abandoned ponds as wetlands east of proposed Phase 1. However, the largest pond has been drained and is now only a small stream. New maps should be provided in the Design Study which accurately reflect current site conditions. The change will have implications for interpreting the potentiometric surface.

The description of the upper aquifer regime needs some clarification. First, are statements about groundwater flow in the transition zone, paragraph 1 Upper Aquifer Regime, to be applied the Piedmont Physiographic Province in general or specifically to the Stanly County site? Second, paragraph two, page 17, states that the depth to groundwater in the flood plain indicates groundwater discharge conditions. Please note that depth to the water table alone does not indicate vertical flow direction.

There is considerable discussion about "artesian" pressures in the bedrock portion of the upper aquifer. The consultant attributes the "artesian" conditions to flow along individual fractures within the bedrock. These "artesian" pressures are assumed to be the cause of increasing water levels in borings P-43, P-46, and P-47 in the days following their installation. However, it seems more likely that the rise in water levels following installation is from equilibration of the aquifer after disturbance by drilling. The consultant should reconsider their choice of the "artesian" concept to describe this site. True artesian pressures are associated with confined aquifers only. Additionally, the hydraulic head in a confined aquifer is only considered artesian if the potentiometric surface rises above the ground surface. To describe a hydraulic gradient in an unconfined aquifer as artesian

implies a distribution of hydraulic properties inconsistent with water table conditions. In order to have a confined aquifer, there has to be a zone of low permeability separating the confined aquifer from adjacent aquifers. There is no low permeability zone apparent from the data provided for the Stanly County site. RQD and core recovery percentages as well as the consultant's interpretations suggest good vertical interconnectedness throughout the upper aquifer.

Of primary concern is the location and orientation of the contact between the gabbro sill and mudstone as shown on Plate 2a. This feature may be located beneath the proposed sump. What are the groundwater monitoring implications of this feature? The location of this contact should be depicted on the site maps and cross-sections. It is interesting that unusual vertical gradients were encountered in that area.

Title 15A NCAC 13B .1623 Rule References

**(a)(4)(6)** requires the presentation of Stratigraphic cross-sections which identify lithologic and hydrogeologic units. The cross-sections provided do not identify lithologic or hydrogeologic units. Interpretations presented on page 21 of the text are not depicted on the cross-sections. Also, graphic logs on the cross-sections show several different bedrock types yet no lithologic contacts are shown between the borings. Figures 9a through 9C should be revised to be consistent with interpretations presented in the text.

**(a)(4)(7)(B)** requires the development of an understanding of seasonal water table fluctuations through the evaluation of long term water level data. Table 1 shows several sets of water level readings collected over a five month period. This table states that the readings collected during this time represent the full range of groundwater fluctuation. Without significant amounts of supporting information and analysis, these readings can not be construed as representing the long term range of water table fluctuations. The table should be revised to more accurately present the data.

**(a)(9)** requires the presentation of maps depicting the direction of groundwater flow. Several potentiometric maps are provided which generally meet this requirement. However, the consultant completed an exercise which compares the morphology of the water table surface using the water levels from P1-13S then the water level from P1-13D. They infer various groundwater flow directions from the maps. Please have the consultant justify creating meaningful water table maps using the data from P1-13D which is screened well below the water table surface.

**(a)(12)** requires the identification of geologic and hydrogeologic features which should be considered in developing a monitoring strategy. The Design Study identifies several bedrock types but does not identify geologic contacts on a map of the site. There is a geologic map included, Plate 2A, which shows a gabbro sill intruded near the sump area. For this site, the map is too general. A smaller scale map based on drilling and outcrop data should be generated. The author should make some attempt to demonstrate the site geology with a map that shows how the field data supports the consultants conclusions. There is also a diabase dike located near the proposed leachate collection impoundment. However the proposed monitoring system does not seem to account for any preferential flow resulting from the dike.

**(b)(1)(B)** require the applicant to characterize the hydrogeologic properties of the landfill and leachate impoundment area. As previously mentioned, special attention should be paid to lithologic contacts. Also, the hydrogeologic characteristics of the diabase dike should be discussed in relation to monitoring.

**(b)(2)(B)** requires the collection of technical information necessary to design an effective monitoring system. It appears that sufficient technical information has been collected, but, the interpretation is difficult to reconcile with fundamental hydrogeologic principles. These difficulties are addressed in the general comments section at the beginning of this memo.

Water Quality Monitoring Plan

**(b)(3)** A complete evaluation of the monitoring system can not be completed until the above questions are resolved. A few comments can however be presented at this stage. The last sentence of paragraph 1 on page 18 states that "artesian" pressures may result in completely submerged well screens in the final monitoring well network. Any monitoring wells that equilibrate in such a way as to degrade the ability to detect contaminants will have to be reinstalled. Also, monitoring wells MW-13, MW-14, MW-15, and MW-16 are proposed in locations that are subject to flooding. The section does not generally allow the installation of monitoring wells in areas subject to flooding. Unfortunately, the proposed location of the leachate lagoon is in a flood plain. If the applicant wants to move forward with the proposed lagoon location, some special measures will be required to protect the monitoring system during times of flooding.

In conclusion, please have the applicant or their consultant review the above comments and amend the Design Study as needed. Although there are some fundamental hydrogeologic concepts to be clarified, the work completed clearly indicates a very complex geologic setting. Lithologic contacts, intrusive bodies, and a complex history of tectonic deformation make interpretations of the hydraulic regime difficult. As a result of the complexity, a very conservative monitoring system will be required.

Jim -

I have printed out the Permit to Construct for Haywood County and dated it for Tuesday, October 27 (comment period ends 10/26).

It is paper clipped together and is the last item in the Haywood County file folder, file cabinet in my cube, top drawer (don't confuse it with the 'draft' permits which are also paper clipped).

Jack Horton is having SRK send in 2 additional copies each of the engineering report, design hydro report, and construction plans for distribution.

As of today, Thursday pm, we have not have any calls, letters, or contact of any sort from the public comment period.

If you want to sign this thing, it's ready.

If you do sign it, let's just fax it to Jack for now. I'll make all the copies and stamp the books and plans for distribution when I get back from SWANA.

J Horton phone = 828-452-6625

J Horton fax = 828-452-6715

Thanks,

Bill

Bill Sessoms
NC Division of Waste Management
401 Oberlin Road, Suite 150
Raleigh, NC 27605-1350
(919) 733-0692 extension 266 (919) 733-4810 fax
sessomswd@wastenot.enr.state.nc.us
http://www.enr.state.nc.us/ENR/