

Greg F. Rawl, P.G.

Professional Geologist

P.O. Box 1604

Fort Myers, FL 33902-1604



*Specializing in
Hydrogeology
and Water
Resources*

November 3, 2006

Roland Ottolini, P.E., Director
Natural Resources, Lee County Government
1500 Monroe St.
Fort Myers, FL 33901

Re: Review of WRS Report titled "Lee County Utilities Supporting
Documentation for the Wellfield Protection Ordinance Update"

Dear Mr. Ottolini,

Pursuant to your request, I have reviewed the above-referenced draft report by Water Resource Solutions (WRS) dated March 2005. My review has focused largely on the treatment of mine pits in the vicinity of potable water supply wellfields.

One of the recommendations included within the Lee County Groundwater Resource and Mining Study was for future Wellfield Protection Modeling to accurately simulate the interaction between surface water bodies and groundwater. This recommendation was made because of the obvious need to protect the public water supply wellfields that are interspersed with mine pits. This is especially important where mines have been excavated down through the entire thickness of the aquifer in the immediate vicinity of potable wellfields that withdraw water from the altered aquifer unit. Surface water bodies, such as mine pits, provide a ready conduit for dispersion of contaminants and subsequent introduction of the potential contaminants directly into the aquifer's production zone(s). This was not fulfilled in the Wellfield Protection Ordinance Update.

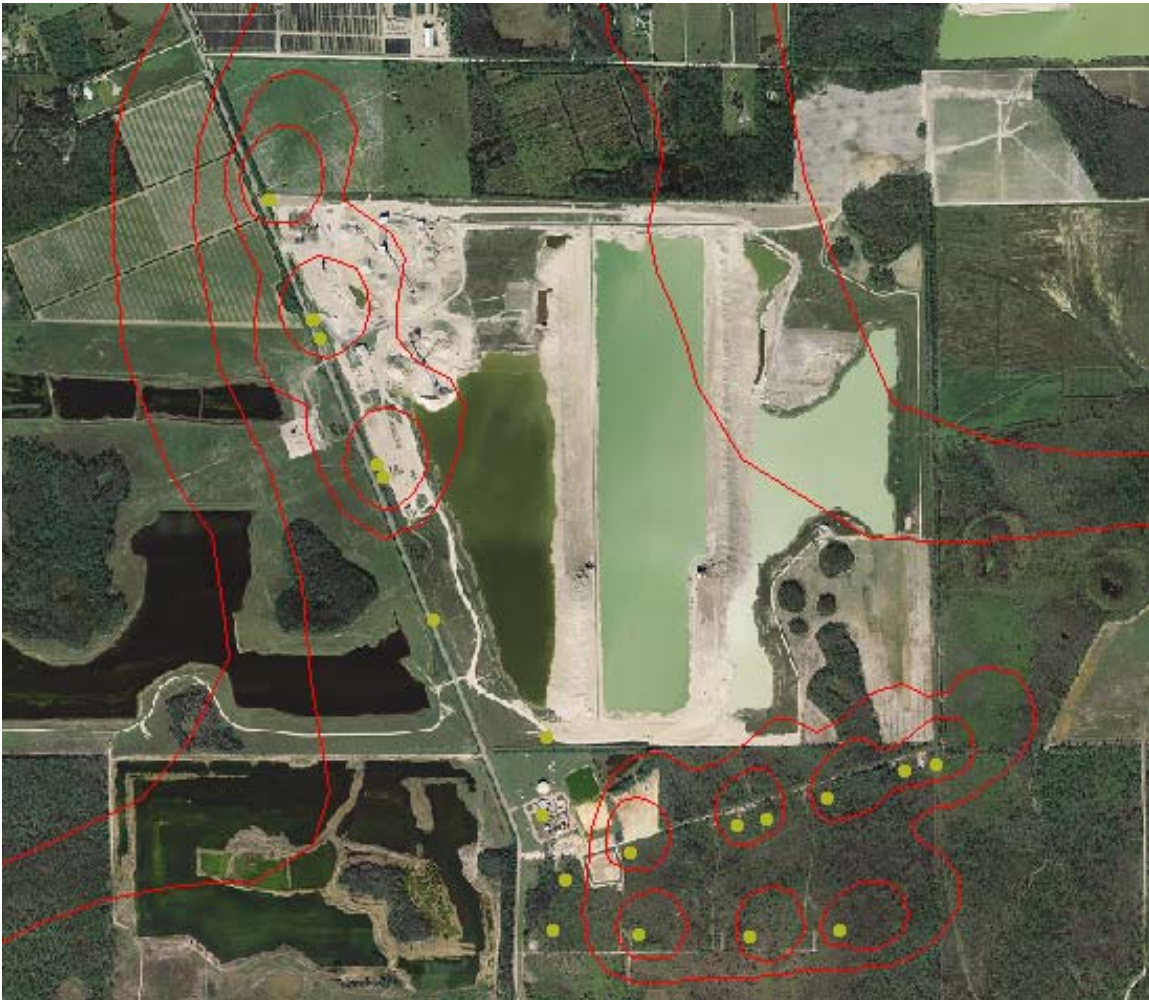
There is no discussion of the simulation of surface water bodies in the text of the report. Upon inspection of the simulation shape files and model input files, it was determined that WRS did not simulate any of the mine pits, even in cases where the pit was adjacent to a significant wellfield. Since the primary purpose of the wellfield protection modeling is to realistically simulate travel time contours in order to delineate reasonable zones for protection, a realistic model simulation is a necessary foundation for the establishment of the zones. In the real world, the interaction between surface water bodies and groundwater shape our hydrology in Southern Florida. This is especially true for wellfields, such as the Lee County Utilities Corkscrew and Green Meadows Wellfields, where the surface water bodies have been excavated to the full depth of the potable aquifer unit. In several cases, the mine pits have been constructed to within 500 feet of production wells.

The presence of surface water bodies or mine pits can have significant effects on the travel time contours, which are used to delineate the wellfield protection zones in Lee County. If the methodologies utilized to delineate these zones are unrealistic, then any entity that is unhappy with having to comply with the ordinance can question their validity and thus subject the entire ordinance to scrutiny.

An even more significant problem is the fact that using faulty modeling can result in protecting some areas where the threat of contamination is minor, while at the same time not protecting other areas where the potential threat of contamination is significant. This is inconsistent with the original intent of the ordinance. With the continuing expansion of existing mines that are in close proximity to the County's wellfields, this problem is going to be aggravated in the future and it needs to be dealt with proactively.

Inserted below, on the next page, is a figure that was created by overlaying the results of the WRS modeling contours on top of aerial photographs taken last year. The WRS Surficial Aquifer Wellfield Protection Zone Contours are shown in red and the light green circles indicate the locations of various wellheads. The innermost travel contour is the six month travel time, followed by the one year, five year and finally the ten year as you move radially away from the well head. The area covered in the figure is approximately four square miles in size. The travel time contours that delineate the various zones that are shown in the figure would look totally different if the mine pits were simulated in the model. In a realistic

simulation the travel time contours are drawn or elongated towards the mine pits and would not be as aerially extensive as the ones projected by WRS. In the example below, only one pit is included in either the six month or one year travel time zones. However if it were realistically conceptualized and simulated, at least half of the pits shown below would be in either the six month or one year travel time zone. Furthermore, pits when intersected should be assumed to be entirely within the appropriate travel time zone, as a result of the mixing within surface water bodies. Also the active pit shown below will ultimately retain a configuration with the interconnection of the various pits in keeping with their mining permit from the County. This should also be factored into the zone delineation.



Corkscrew Water Treatment Plant, Adjacent Wellfield & WRS Delineated Surficial Aquifer Wellfield Protection Zones

A number of wellfields in Lee County are constructed in a high hydraulic conductivity aquifer where one of the characteristics of this aquifer is a phenomenon known as secondary porosity. The most productive wellfields in the County are located in these regions of high hydraulic conductivity. Secondary porosity significantly changes travel times within the aquifer, enabling the movement of groundwater through preferential flow paths. This allows the groundwater to move much faster and therefore a greater distance in a given time period. Neither the report, nor the modeling attempts to even cursorily address the impact of secondary porosity on the travel times upon which the wellfield protection zones are predicated. This has been shown to be a significant factor in numerous studies in Florida.

Another recent study completed by the USGS discusses the effects of secondary porosity, Application of carbonate cyclostratigraphy and borehole geophysics to delineate porosity and preferential flow in the karst limestone of the Biscayne aquifer, SE Florida by Cunningham et al, 2006. When mine pits are located so close to wellfields, and visa versa, the risk of wellfield pathogen contamination from surface water can present a significant threat. If sufficient travel times are afforded in the aquifer, the pathogens will die prior to reaching the wellheads. Having an accurate travel time determination for the wellfields would be beneficial for the Utilities to understand and guard against this problem. The ones presented in the update are inaccurate and thus misleading.

My preliminary review of the model and report has raised numerous questions in other areas related to the actual groundwater flow model development, model boundary conditions, the model's hydrologic water budget and balance, the report and model's depiction of the hydrostratigraphy, the wellfields modeled, the model's simulation of withdrawals from other permitted & permit exempt uses, wellfield pumpage rates used in the model calibration and the correctness of the actual wellhead locations. All of the afore mentioned factors play a meaningful role in determining the model's accuracy. Insufficient information is provided in the report to answer the many questions raised in my review. Give enough time to evaluate the model input and output files, some of these questions might possibly be answered. However, in light of the major problems with the model conceptualization pertaining to the dismissal by WRS of the role of significant surface water bodies in the

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most susceptible surficial aquifer units, these issues are somewhat secondary. They however are still important and should have been addressed in the report.

My last comment is not directly related to the report or the modeling and deals with the Ordinance threshold. The original wellfield protection ordinance stipulates protection "for present public utility potable water supply wells and wellfields which are permitted to pump 1,000,000 gallons of water per day or more". This means that a community with a wellfield that is permitted to pump less than 1 million gallons per day is not provided with protection by the ordinance(s). Conceivably this could leave a community with as many as four thousand people without protection from the ordinance. As a result of this high threshold, there are sizable communities in Lee County that are not protected by the ordinance. I would recommend review of this threshold to determine if this is still deemed an appropriate level of protection.

I am happy to meet with you to discuss this matter further at your convenience. Please feel free to call me if you have any questions or comments.

Very Truly Yours,

A handwritten signature in blue ink, appearing to read 'G. Rawl', with a stylized flourish at the end.

Greg F. Rawl, P.G.

Cc: Wayne Daltry
Mary Gibbs
Paul O'Connor
Charlie DiFelice
Anura Karuna-Muni