Appendix G
Stakeholder Comments on Phase I Report

HAZEN AND SAWYER
Environmental Engineers & Scientists

Hazen and Sawyer, P.C.
10002 Princess Palm Avenue
Registry One Building, Suite 200
Tampa, Florida 33619
(813) 630-4498
Fax: (813) 630-1967

MEMORANDUM

TO: Keith Hetrick, General Counsel, Florida Home Builders Association
Ellen Vause, Florida Onsite Wastewater Association
Trey Goldman, Florida Association of Realtors
Pam Tucker, Orlando Regional Realtor Association

FROM: Damann L. Anderson, P.E.

DATE: May 23, 2007

RE: Review of Phase 1 Wekiva Basin Nitrate Sourcing Study

My comments on the MACTEC Report of March 2007, entitled "Phase 1 Report Wekiva River Basin Nitrate Sourcing Study", are summarized in this memo. These comments are based on my review of the report documentation as well as the presentation on the report made at the May 17, 2007 TRAP meeting in Orlando.

This report is an attempt to document sources of nitrate nitrogen ***inputs*** to the Wekiva Basin, and to then estimate the potential nitrate ***loading*** from these sources to ground and surface waters in the basin. The report is based on a literature review of existing documents and data, and is not based on field work specifically conducted in the Wekiva Basin by the project team. A second phase of work on the project is proposed, which could include field work to further refine the estimated nitrate loading presented in this report.

Overall the report is well done considering the time and budget available. Considerable effort was expended trying to find literature documenting the sources and quantity of nitrate in the basin. I believe the nitrogen input quantities presented in the report are reasonable for the most part, although I have comments on some of them which are noted below. However, I do not agree with the loading estimates made in the report, and feel that there was considerable inconsistency in the methodology used to generate them. My specific comments are provided below.

General Comments

1. I support the use of the Wekiva Basin as the study area boundary, since it is the hydrologic boundary that is of importance to the river and springs. However, use of

the Wekiva Basin in contrast to the Wekiva Study Area (WSA) boundary that was used in previous studies, may cause confusion between the various parties involved in studying the Wekiva area. Consensus needs to be obtained so that all parties are talking about the same study area.

2. The term "Septic Tanks" as a source should be changed to Onsite Wastewater Treatment Systems (OWTS). Septic tanks are only one component of an OWTS and the use of the term septic tanks is generally perceived negatively by the public and others. The term is similar to calling a wastewater reclamation facility a "sewer plant".

3. Nitrate may be the principal nutrient of concern in the Wekiva Basin, but the study needs to address sources of other forms of nitrogen in the basin as well, especially organic and ammonia nitrogen. Organic, ammonia and other nitrogen forms that are applied to land can be transformed to nitrate via the nitrification process, therefore all forms of nitrogen should be considered in quantifying inputs.

Nitrogen Inputs to the Basin

Nitrogen inputs to the Wekiva Basin were estimated by source based on available data, previous studies, and scientific estimates. Inputs represent an estimate of the total amount of nitrogen going to the Wekiva Basin, and as mentioned previously, should include all nitrogen species due to the transformation of nitrogen that can occur when applied to land and water.

The nitrogen ***inputs*** are important to understand, because they represent the data used to subsequently estimate the nitrogen ***loadings*** to waters of the Wekiva Basin. In addition, the estimated nitrogen inputs give an idea of the magnitude of each source, and allow evaluations of nitrogen source reduction strategies. If specified nitrogen reduction goals can be achieved at the source (i.e. reduced inputs), then it would be likely that a reduction in nitrogen loading to the waters of the basin would also be achieved (i.e. reduced loadings). While an accurate estimate of nitrogen loadings is desirable, they are much more difficult to obtain and typically require extensive field work within the study area to determine.

My specific comments regarding the nitrogen inputs are as follows.

1. ***Fertilizer*** – the fertilizer nitrogen input of approximately 7000 MT/year seems reasonable to me. It is based on IFAS recommended rates of application yet it is considerably less than the total nitrogen of the fertilizer sold in Lake, Orange, and Seminole Counties in 2005 based on data from the Florida Department of Agriculture and Consumer Services (FDACS), which makes sense.

2. ***Domestic Wastewater Discharges*** – I disagree with the estimated domestic wastewater nitrogen inputs. First, I recommend putting the reclaimed/reused effluents in with the other domestic wastewater discharges, so that the source of the nitrogen is known to be domestic wastewater. This will increase the domestic wastewater input by at least 109 MT/year. Also, I do not believe that reclaimed water has much, if any, impact on fertilizer use in the residential sector. It may have an impact on agricultural and golf course fertilizer use. If this can be documented,

fertilizer use could be reduced by the reclaimed N amount and the reason noted. If we separate nitrogen from its source it will be more difficult to evaluate sources for nitrogen reduction strategies.

Second, the nitrogen inputs from domestic wastewater do not make sense relative to other wastewater sources. Based on an estimated value of 11.2 grams N per person per day as the nitrogen contribution to wastewater (U.S. EPA, 2002), the following calculation can be made based on the populations served from the MACTEC report:

Sewer: 265,000 people x 11.2 g N/person/day = 1083 MT N / year

OWTS: 160,000 people x 11.2 g N/person/day = 654 MT N / year

These raw input numbers would need to be reduced based on treatment performance, but since most of the wastewater treatment plants in the basin are not currently designed to remove nitrogen, the relative magnitude of the domestic wastewater input compared to the OWTS input should be similar. I think the problem is related to the fact that only nitrate-nitrogen was used in the calculation for domestic wastewater discharges whereas total nitrogen was used for OWTS. This is inconsistent and I believe total nitrogen should be used in both cases since land application of wastewater effluents will generally result in nitrification of the organic and ammonia nitrogen to nitrate nitrogen in the receiving environment. Also, elimination of many of the smaller treatment plants where data was not available may be underestimating the domestic wastewater input. Based on the raw nitrogen input calculation shown above, it is difficult to believe that domestic wastewater inputs of nitrogen are less than OWTS inputs.

3. ***Onsite Wastewater Treatment Systems (Septic Tanks)*** – I agree with the estimate for nitrogen inputs from OWTS, however, as mentioned above, this estimate is based on total nitrogen, not nitrate nitrogen. If nitrate was used to calculate the OWTS input, as was done for domestic wastewater discharges, the input from OWTS would be negligible, and this illustrates the inconsistency of the approach.

4. ***Atmospheric Deposition*** – I disagree with the estimated nitrogen input from atmospheric deposition. The Orlando metropolitan area is a large urban area, not unlike others in the state. The airshed for Orlando probably includes the entire Wekiva Basin, and there should be studies available to document this. My point is that I do not think a rural deposition rate such as that for the Indian River Lagoon site near Sebastian, is applicable to the Wekiva Basin. In addition, I believe the atmospheric deposition input estimate should include all nitrogen forms, not just nitrate. Similar to the discussion above, non-nitrate nitrogen from atmospheric deposition would be nitrified to nitrate in most receiving environments, especially that which fell on land. Last, the Conceptual Model of Nitrate Inputs (Figure 2-2) shows nitrogen from Atmospheric Deposition only being transported to surface water. I believe that nitrogen from deposition would also infiltrate pervious land and be a source of nitrogen to groundwater as well.

   Considerable study, including field monitoring of atmospheric deposition of nitrogen has been conducted in the Tampa Bay region, as part of the Tampa Bay National

Estuary Program. It was estimated that the nitrogen contributions from atmospheric deposition in the Tampa Bay watershed are 7.3 (±1.3) kg/ha/year, including both wet and dry deposition and nitrate and ammonia nitrogen (Poor, Pribble, and Greening; 2001. Atmospheric Environment 35, p. 3947). I believe this may serve as a reasonable estimate for the Wekiva Basin N-deposition as well.

Nitrogen Loadings to Waters of the Basin

Only a portion of the nitrogen inputs to the Wekiva Basin eventually reach groundwater or surface waters of the Basin. Therefore, each of the nitrogen input estimates in the report were further evaluated in an attempt to quantify that portion of each source that reached waters of the basin. The estimated mass of nitrogen that reached waters of the basin for each source was referred to as the nitrogen loading from that source. The loading estimates were based on the portion of each input that reached surface waters or the water table (surficial aquifer), and were not meant to represent the loading to the Floridan aquifer or the springs. Although this is explained in the report, it is not clear that this is the case for all sources, and I believe this should be clarified, especially in the executive summary. The nitrogen inputs pie chart should also appear in the executive summary.

While the nitrogen inputs were, for the most part, based on available data, previous studies, and scientific estimates, many assumptions were needed to estimate the nitrogen loading to waters of the basin from each source. Since specific studies in the Wekiva area were lacking, there is considerable uncertainty surrounding these loading estimates, and this uncertainty is discussed in Section 3.3 of the report. It is emphasized that additional work and considerable field monitoring would be needed to reduce these uncertainties and more reliably estimate the loadings from each source.

Table 1 below shows the nitrogen inputs estimated for each source, the amount of each input that was estimated to reach waters of the basin (the nitrogen loadings), and the percent difference between input and loading for each source. As the table shows, the difference between input and loading ranges from 0% for Domestic Wastewater to 92% for Atmospheric Deposition. Since all nitrogen inputs are applied to the same basin, with the same hydrology, and mostly applied to land, it is difficult to believe that there could be this range of differences between inputs and loadings. It appears to me that similar mechanisms would be responsible for reducing the source inputs: plant uptake, volatilization, denitrification, and flow out of the basin. While there are likely some differences in how these mechanisms apply to each source, I would not think that differences between 0 and 90+% would occur in the same basin. Therefore, I believe these differences may result from inconsistency in how the nitrogen loadings were derived from the nitrogen inputs.

A simple example will illustrate what I mean. The residential fertilizer nitrogen loading to groundwater was calculated using an assumed groundwater concentration below the areas designated as residential land use. The assumed groundwater concentration was based on several experimental studies of turfgrass fertilization. A value of 3 mg N/L was derived from these studies after applying them to a range of lawn care practices (see MACTEC report p. 2-18 to 2-20). In addition, the loading was calculated based on the estimated recharge rate to the Floridan Aquifer. This method seems reasonable, but includes losses in nitrogen from all the mechanisms mentioned previously, as well as some dilution if these experiments

Table 1. Comparison of Nitrogen Inputs to Loadings in the Wekiva Basin (from MACTEC Report)

SOURCE	INPUT TO BASIN		LOADING TO WATERS		% DIFF
	Mass (MT/yr)	% of Total	Mass (MT/yr)	% of Total	
Fertilizer	7050	75%	972	54%	- 86%
Livestock	1128	12%	108	6%	- 90%
OWTS	564	6%	396	22%	- 30%
Atm. Deposition	470	5%	36	2%	-92%
Domestic WW	189	2%	189	10%	0%
Natural	- -	- -	108	6%	na
TOTALS	**9400**	**100%**	**1800**	**100%**	**- -**

were performed in the field. A nitrogen mass reduction of 86% from input to loading for residential fertilizer was obtained using this methodology.

In contrast, the OWTS (septic tank) nitrogen loading was calculated based on the total mass of nitrogen released from septic tanks and a 30% reduction factor to account for an estimate of nitrogen that reaches the top of the shallow groundwater (the water table) directly below the area of the OWTS drainfield. These two methods are grossly inconsistent with each other, however the residential fertilizer methodology probably yields a better estimate of the actual loading that potentially impacts Wekiva Springs and River.

If this same methodology was used for OWTS, the following worst-case nitrogen loading from OWTS could be estimated the same way. Assuming an average drainfield size of 450 square feet, and a total nitrogen concentration of 40 mg/L in the shallow groundwater directly below the drainfield area (on the high end of the range reported in previous studies), the following nitrogen loading could be calculated assuming a 10.6 inches per year average weighted recharge rate for residential areas in the Wekiva Basin (from MACTEC report):

$$\frac{65{,}399 \text{ OWTS} \times 450 \text{ ft}^2 \text{ drainfield area} \times 10.6 \text{ in/year} \times 40 \text{ mg N / L}}{4.244 \times 10^8 \text{ (conversion factor)}} = 29.4 \text{ MT N/year}$$

This is far less than the 396 MT N/year used as OWTS loading in the report. As this example shows, if the methodology used for determining residential fertilizer loading was applied to nitrogen from OWTS, a similar reduction (90%+) from input to loading would be obtained.

There are numerous other examples of inconsistencies in the way loadings were derived from inputs in the report. For the most part, the data needed to accurately determine loadings from inputs is not available. Therefore, to recommend load reduction strategies based on these loading calculations is inappropriate. Far too much effort and expense may be applied to sources that do not contribute significantly to the problem. As I have said before, we have limited financial resources available to address the nitrogen loading problems in the Wekiva Basin. These resources should be applied to those solutions that yield the largest nitrogen load reduction per dollar spent.

I believe that relatively accurate estimates of nitrogen inputs to the Wekiva Basin can be made. As stated above, I also believe that the relative distribution of nitrogen inputs will reflect the distribution of nitrogen loadings, with minor deviations between sources. For these reasons, the relative contributions of each nitrogen source should be based on estimated inputs until such time that field data is available to more accurately calculate loadings from each source in a consistent fashion. In the meantime, strategies to reduce nitrogen inputs can be developed for those sources that make the largest contribution to nitrogen in the Wekiva Basin. It is likely that reductions in these inputs will yield corresponding reductions (on a percent of load basis) in nitrogen loading to waters of the basin.

I would be happy to assist in any way I can to improve the nitrogen input and/or loading estimates for the Wekiva Basin. I believe my experience in land treatment of wastewater and groundwater hydrology could prove useful, at least for refining the estimates for wastewater sources. A team effort in developing these estimates would save time, potentially lead to buy-in from stakeholders, and reduce controversy over the nitrogen sources and their corresponding loads in the basin.

From: Martinez, Rich [Rich.Martinez@Scotts.com]
Sent: Monday, December 10, 2007 6:36 PM
To: Robert Mattson; Wible, Chris
Cc: Erich Marzolf; Casey Fitzgerald; Ed Lowe; Larry Battoe; Mary Brabham; Hall, Bonnie; Livingston, Eric; Hicks, Richard W.; Ferraro, Chris; budellr@doacs.state.fl.us; jblair@fsu.edu; Eberhard_Roeder@doh.state.fl.us
Subject: RE: Fertilizer use in the Wekiva River basin, Florida

Thanks for your interest and feedback Rob. I look forward to further study of the Wekiva River basin, as it can provide greater insight to all of us.

To answer your questions, the 35.4 million pounds of nitrogen represents all Do-It-Yourself (DIY) applications to lawns in the state for all manufacturers as sold from all consumer outlets. It does not include any commercial application, unless they purchase consumer product at a consumer retail outlet (which we would report in our tonnage data; we don't believe this to be significant).

We agree that the amount of commercial application is significant and must be estimated in a separate way. Likewise, DIY applicators have a fundamentally different situation on their lawn than most professionally managed turf, in that it is undernourished and hungry (good absorber of nutrients). It would be beneficial to get an idea of the actual ratio of DIY to commercial application in the Wekiva River Basin and the relative acres treated of each. It is particularly relevant since the data in the report is being widely used to draw conclusions about DIY, not just commercial application.

Is there some sort of population/household count for Wekiva that we could evaluate versus state totals? I ask because it still seems that the quoted 8.7 million pounds of nitrogen is too high a percentage of the state total nitrogen sold. Every town can't be over the average!

I look forward to speaking with you further on this topic and remain committed to developing better data for the models. Please let me know how I can help.

Rich

From: Robert Mattson [mailto:rmattson@sjrwmd.com]
Sent: Monday, December 10, 2007 10:27 AM
To: Wible, Chris; Martinez, Rich
Cc: Erich Marzolf; Casey Fitzgerald; Ed Lowe; Larry Battoe; Mary Brabham; Hall, Bonnie; Livingston, Eric; Hicks, Richard W.; Ferraro, Chris; budellr@doacs.state.fl.us; jblair@fsu.edu; Eberhard_Roeder@doh.state.fl.us
Subject: Fertilizer use in the Wekiva River basin, Florida

Chris:

We want to express our thanks to you and Rich Martinez for your review of and comments on the "Phase 1" Nitrate Sourcing Study in the Wekiva River Basin, conducted for us by the firm MACTEC Engineering and Consulting. As you and I have discussed on the phone, this report (using funds provided by FDEP) was produced for the District by MACTEC under a contract agreement, which has now been completed and closed. The report has been submitted to FDEP and is now made available to the public on their website. It is our intent to revisit the estimates made by MACTEC in the future, using a combination of new data (we are actively planning some new studies with FDEP), information submitted by you and other interested stakeholders (septic tanks, agriculture, etc.), and presently ongoing studies being conducted on turf grass fertilization by the University of Florida/IFAS (Drs. Trenholm, Sartain, etc.).

At present we cannot revise or amend the figures for nitrogen/nitrate inputs and loads in the MACTEC report for residential fertilization without also similarly revisiting estimates made for other sources (including septic tanks, agricultural fertilization, atmospheric deposition and wastewater disposal). The Florida Dept. of Health recently conducted additional studies of the loads of nitrate from septic tank drain fields in the Wekiva Basin (prompted in large part by concerns of the septic tank and real estate developer industries). Those studies have recently been completed and would need to be considered in a re-analysis of the MACTEC results. Similarly, we are planning (with FDEP) to conduct homeowner surveys and groundwater field studies focusing on residential fertilizer use in the Wekiva Basin and would like to have those results available for a re-analysis, as well as the results of the detailed turf grass studies currently being conducted by UF/IFAS for the FDEP. We are also looking at issues related to the N loads from irrigation with re-use or reclaimed water, which is treated wastewater piped from a municipal sewage treatment facility and used for irrigation (including on home lawns, as well as public areas, rights-of-way, parks, etc.). This practice is widespread and increasing in the Wekiva Basin. MACTEC made the assumption (admittedly a simplifying assumption) that N loads from re-use water offset (i.e., replaced) fertilizer use. Recent anecdotal evidence indicates this may not be so (which would increase the estimates of fertilizer application).

We believe the figures you and Rich have submitted, in combination with the MACTEC estimates of nitrogen loads from residential fertilizer use legitimately represent the lower (your data) and upper (MACTEC) boundaries of the potential loads of N from residential fertilizer in the Wekiva Basin. With that in mind, we had the following questions/comments on your information:

1) For the estimates you provided for Orange, Seminole and Lake Counties (3.4 million lbs N) and Rich's figure for Florida (35.4 million lbs N); does this represent sales of Scotts products only? Does it include other manufacturers (e.g., Spectrum Brands, "generic" label, others)? Do the figures reflect all types, formulations, and sizes of product, or only certain sizes (or certain formulations, such as lawn product only), and does it include all points of sale or only "big box" vendors such as Wal Mart, Home Depot, Lowes, etc? Are sales from smaller nursery and garden operations included, along with smaller retail businesses (Ace Hardware, Farm and Garden stores, other vendors which typically cater to agricultural interests such as feed stores)? If all these are not included wouldn't the figures quoted represent an underestimate? Do you have data which allow estimates of all sales, including from these smaller venues and other manufacturers' products?

2) Do the figures above include bulk sales to commercial applicators (Tru Green/Chemlawn, etc.), as well as fertilizer sales to smaller lawn and landscape maintenance companies? We believe that to only focus on the "DIY" market underestimates the amount of fertilizer actually being used/applied on all residential land uses in the Wekiva Basin (see comments 4 and 5, below), and particularly if these figures only represent Scotts' sales.

3) In general your data and MACTEC seem to reasonably agree on application rates (about 3 lbs/1000 square feet of lawn). The difference seems to be in the acreages over which it is applied. As I mentioned, the actual data used by MACTEC is found in Appendix D of their report. The figures Rich quoted for acreage of lawn in the state (780,000 ac) and area of lawn per household (0.2 ac or 50% of lot area) seem low to us, especially in the Wekiva Basin area, which has a mix of upscale, estate-sized homes with large lots, rural ranchettes, and older homes on larger lots. As you may see in Appendix D, MACTEC took the acreage of low, medium and high density residential and used correction factors for % impervious surface (which are used in stormwater modeling throughout the state), and this ranges from ~15% impervious (85% lawn/garden area) for low density residential to 67% impervious (13% lawn/garden area) for high density residential. In looking at the dominance of low and medium density residential (in terms of acreage), I would estimate that more like 65-80% of an "average" lot is lawn/garden in the Wekiva Basin.

4) The amount of fertilizer applied from commercial applicators could be quite substantial in the Wekiva Basin and appears to be not quantified by anyone at present. The national estimate of use of lawn care services (12.5% of households, as quoted by Rich) appears to us to be an underestimate in the Wekiva Basin, again, especially considering the more affluent character of much of the area. We have concerns over the technical validity of

using national averages to apply to this area, or even to Florida in general. I have driven through neighborhoods throughout the basin area and have seen the small green tags indicating recent lawn service by a commercial applicator on one-third to half the home lawns (33-50%). Again, do sales of fertilizer product within the State of Florida cover bulk sales to these commercial applicators, or are they purchasing their product out-of-state, direct from the manufacturer, and bringing it into the basin (or in the case of a smaller, local lawn care company, purchasing wholesale at an agricultural vendor and using on home lawns)? Also, what application rates do they (commercial lawn service firms) typically use and how many applications/year?

5) In Florida, what we map as "Residential" land use includes single-family detached homes (with lawns), but also includes multi-family housing (apartments, condominiums, duplexes, etc.). The latter are included in what is mapped as high density residential, with some in medium density residential as well. Lawns associated with these are more likely to be serviced by a commercial applicator, reiterating that the points raised in (4), above, are somewhat important. Again, to only focus on the traditional single-family home/DIY market for "lawn" fertilizer would underestimate (perhaps substantially, we believe), the actual amount of fertilizer N being applied to residential lands of the basin.

I hope the above is helpful and indicates some of the issues we feel need to be addressed.

Robert A. Mattson, CEP, CSE
Environmental Scientist V
St. Johns River Water Management District
(386) 329-4582
rmattson@sjrwmd.com

From: Wible, Chris [mailto:Chris.Wible@Scotts.com]
Sent: Tuesday, December 04, 2007 11:51 AM
To: Robert Mattson
Cc: Casey Fitzgerald
Subject: RE: Fertilizer Use in Wekiva River Basin

Rob, please let me know when you are available to work on revisions to the fertilizer estimates in the Wekiva River Basin phase 1 report. I am in the office the remainder of the week and would like to spend some time on this with you.
I referenced the state tonnage information for Lake, Orange and Seminole counties and found a total of 3.4 million pounds of lawn and garden nitrogen in all three counties combined (8.7 million lbs was estimated in the phase 1 report which equates to 20 lbs N for every person living in the basin). The 8.7 appears too high, 3.4 may be a better, conservative, estimate of input.

Thanks Rob,

Chris Wible
937-243-2396 cell
937-644-7012 office

From: Wible, Chris
Sent: Friday, November 30, 2007 9:51 AM
To: 'rmattson@sjrwmd.com'; 'cfitzgerald@sjrwmd.com'
Cc: 'jblair@fsu.edu'
Subject: RE: Fertilizer Use in Wekiva River Basin
Importance: High

Rob, per your phone message, I am resending the information Rich Martinez provided regarding the fertilizer use estimates and acreage estimates found in the Wekiva River Basin analysis. The numbers in the report assume that consumers apply product nine time (9) per year on average in the Wekiva basin.

Please contact me at 937-644-7012 to discuss.

Thank you Rob,

Chris Wible

From: Martinez, Rich
Sent: Wednesday, October 24, 2007 11:06 AM
To: rmattson@sjrwmd.com
Cc: jblair@fsu.edu; Wible, Chris
Subject: Fertilizer Use in Wekiva River Basin

Rob,

I wanted to provide some input on the Wekiva River Basin analysis you shared at the October 11th meeting in Gainesville. It appeared to me that some of the information you presented and the information I presented did not match up very well concerning residential fertilizer use quantity. I detail below what I think the differences are and their implications. I am interested in your thoughts on the analysis.

In that presentation you showed inputs into the Basin of 9400 metric tons of total nitrogen, 42% from residential fertilizers (3948 metric tons of nitrogen = 8.7 million pounds of nitrogen from residential fertilizers). The load to the water was 1800 metric tons of total nitrogen, 20% from residential fertilizers (360 metric tons of nitrogen = 794,000 pounds of nitrogen from residential fertilizers), approximately a 9% loss of total nitrogen applied.

You also indicated the assumptions on fertilizer load were based on 75% participation at the BMP rate (~4 to 6 pounds of nitrogen per thousand square feet treated). In the Phase 1 Wekiva River Basin Nitrate Sourcing Study it indicates there are 415,000 acres in the Wekiva River Basin with 21% of the land designated as residential.

I believe the values shown and the assumptions are significantly higher than actual application rates as calculated using the fertilizer tonnage data reported to the State in combination with data on the number of homes with lawns, average lawn size, and homeowner research determining participation levels. The data inputs and calculations are shown below.

Florida State Level Data

1. Based on tonnage data **~ 35.4 million pounds of nitrogen were applied in the Do-It-Yourself (DIY) homeowner segment in 2005**.

1. There are **780 thousand acres of home lawn** (3.9 million home lawns at an average of 0.2 acres per lawn or 8,700 square feet per lawn) in Florida.

1. Based on national averages, **37.5% of homes with lawns participate in DIY lawn care and 12.5% hire a lawn care service** (total 50% participation).

1. The **average DIY homeowner applies 2.78 pounds of nitrogen per thousand square feet of lawn per year**.
    a. Calculation: 35.4 million pounds of nitrogen divided by (780,000 acres X 37.5% participation X 43.56 thousand square feet per acre) = 2.78 pounds of nitrogen per thousand square feet of lawn per year.
    b. Note that if homeowner participation is higher than 37.5%, the average pounds of nitrogen applied per lawn goes down since the pounds of nitrogen sold remain constant (based on actual sales).
    c. If average lawn size is greater than 0.2 acres, the average pounds of nitrogen applied per lawn goes down since the pounds of nitrogen sold remain constant (based on actual sales).

Wekiva River Basin Data

1. Acres of lawn calculation: 415 thousand acres X 21% residential X 50% lawn area = **43,575 acres of home lawn**.
    a. Note the lawn is ~50% of total acreage when adjusted for the house, driveway/sidewalks, patio, pool, landscape area, etc. If you have a better value based on Florida, let me know.

1. Acres of home lawn participating: 43,575 acres of home lawn X 50% participation = **21,788 acres of home lawn being fertilized** (DIY and lawn service).

1. **If** the stated **8.7 million pounds of nitrogen** from residential fertilizers was **applied to** the **21,788 acres of home lawn** being treated, that would be an **average application rate of 399 pounds of nitrogen per acre or 9.2 pounds of nitrogen per thousand square feet**.
    a. Calculation: 8.7 million pounds of nitrogen divided by 21,788 acres = 399 pounds of nitrogen per acre.
    b. Calculation: 399 pounds of nitrogen per acre divided by 43.56 thousand square feet per acre = 9.2 pounds of nitrogen per thousand square feet per year.

1. **9.2 pounds of nitrogen per thousand square feet per year is highly unlikely** when compared to the calculated average homeowner rate of 2.78 pounds of nitrogen for DIY and even assuming a lawn service average high rate of 6 pounds of nitrogen per thousand square feet.
    a. Weighted average DIY and lawn service rate calculation: DIY homes are 75% of participating homes and lawn service is 25% of participating homes.
    b. **Weighted Average Pounds of Nitrogen Calculation =** (75% X 2.78 pounds nitrogen per thousand square feet) + (25% X 6 pounds of nitrogen per thousand square feet) = **3.58 pounds of nitrogen per thousand square feet per year.**
    c. **3.58 pounds of nitrogen per thousand square feet per year is less than 39% of the calculated 9.2 pounds of nitrogen shown in item 3.**
    d. The **recalculated value for nitrogen input from residential lawns** is 3.58 pounds nitrogen per thousand square feet X 43.56 thousand square feet per acre X 21,788 acres of home lawn = **3.4 million pounds of nitrogen** (versus the 8.7 million pounds of nitrogen in the report).

1. This calculation suggests that either the 9400 metric tons total input is overstated or that residential fertilizer being 42% of the total input is greatly overstated.

1. Likewise, the load to water is also greatly overstated, as turf researchers estimate typical nitrogen loss at less than 2% versus the reported 9% or the 23% loss calculated from the revised input from item 4d of 3.4 million pounds of nitrogen (794,000 pounds of nitrogen divided by 3.4 million pounds nitrogen = 23%).

A second check is comparing the total nitrogen input in the Wekiva River Basin to the reported State tonnage data total. The 8.7 million pounds of nitrogen input in your presentation represents 25% of all the DIY nitrogen in the state (8.7 divided by 35.4) or approximately 14% of the total DIY plus lawn service nitrogen (assumes the rate calculate above in 4c). It seems that would represent more of the state population than actually resides in the Wekiva River Basin.

I am interested in providing data and assisting in the analysis so we can get to the best models of nutrient flow. The work and results are important since they drive many decisions for action around the state. I will contact you in the upcoming weeks to see if we can collaborate on further data sharing and analysis. I look forward to our discussion.

If you have any questions in the meantime, please feel free to contact me. Thank you.

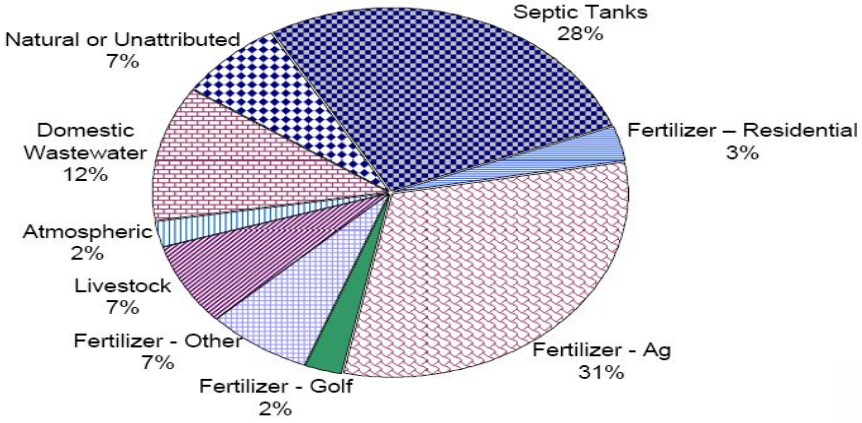
Rich Martinez
Chief Environmental Officer
The Scotts Miracle-Gro Company
Work Phone: 937 644-7371

From: Wible, Chris [Chris.Wible@Scotts.com]
Sent: Thursday, December 13, 2007 4:09 PM
To: Robert Mattson
Cc: Erich Marzolf; Casey Fitzgerald; Ed Lowe; Larry Battoe; Mary Brabham; Hall, Bonnie; Livingston, Eric; chris.finkbeiner@myfloridahouse.gov; Hicks, Richard W.; Ferraro, Chris; Jerry.Brooks@dep.state.fl.us; budellr@doacs.state.fl.us; jblair@fsu.edu; Eberhard_Roeder@doh.state.fl.us; Martinez, Rich
Subject: RE: Fertilizer use in the Wekiva River basin, Florida

Rob, Thank you for the feedback, background and additional questions you raised. I believe we will develop very accurate input and load values as we challenge ourselves to dig deeper and consider all the relevant information. I appreciate your prompt and thorough feedback and look forward to further collaboration with you and your colleagues.

We appreciate the fact that you are re-evaluating and refining the supporting data for the Phase I report. While we cannot revise or amend the report at this point, it is important to continue the dialogue and pursue refinements to better characterize the magnitude of the inputs and loads in the Wekiva River Basin since this information is often cited and applied to other communities.

The input values we provided for residential fertilizer use in the basin include both homeowner DIY and professional (detailed below) and they confirm the concern that was expressed by the FL Department of Health that "fertilizer could be overestimated by a factor of 2". Adjusting the input value to remove the 2x overestimation and the corresponding leaching/runoff rate, the magnitude of residential fertilizer loadings is quite different. The graphic below incorporates only these two revisions.



While some of the new data points you described below will not be available for a few years, other studies have been completed and can be used to refine the other input sources and corresponding groundwater loading estimates. We believe it is important to incorporate this information as it becomes available to help provide direction to state and local decision-makers. I have provided additional information below to answer your questions and included a few additional opportunities that we should collectively address over the coming months.

As Rich stated, the 35.4 million pounds of nitrogen for the state of Florida represents DIY homeowner applications, it does not represent professional lawn care. The analysis specific to the Wekiva River Basin (3.4 million lbs) was inclusive of both DIY homeowner use and professional lawn care service.

In a separate analysis, we developed a usage estimate for lawn applications in Lake, Orange, and Seminole Counties (professional and consumer) based of publicly available state tonnage data. This analysis includes all registrants, not only the Scotts Company. It includes all sizes and product forms for all registrants (Spectrum Brands, generics and commodity suppliers) and includes the "big box" stores as well as the smaller nursery and hardware store accounts, and professional lawn service products. This analysis concurred with the estimate that Rich Martinez developed. Since we know the amount of product we sell in the state, by county, as well as our market share, and have access to the

Florida Tonnage data by fertilizer grade and county, we can arrive at usage estimates in multiple ways. A few points to note regarding the Florida tonnage data analysis:

If a products had dual uses (residential lawn use and garden use), it was included in the estimate of lawn fertilizer nitrogen A number of products fell into this category (10-10-10, 20-10-20, etc).

If a product is sold to a retailer outside of the county and subsequently shipped into the county for sale at retail, it would not be captured in the Lake, Orange, or Seminole County tonnage data. The majority of Scotts lawn products are sold at the "big box" stores and are shipped directly to the individual stores. A smaller percentage is sold at hardware, nursery, mass merchants and approximately half of these shipments are store direct. The remaining sales would be derived from a distributor servicing these counties which may or may not be located within and captured in these three counties. Lawn products are heavy and bulky making multiple-step distribution inefficient (expensive), most are shipped to and reported in the county where they will be sold. The same reporting issue would occur for professional lawn care: a customers serviced by a lawn care operator located outside the county would be reported in the operators county

All lawn and garden product nitrogen reported for all of Lake, Orange, and Seminole Counties were included in the estimate although the Wekiva River Basin area only occupies a portion of each of these counties. This would serve to overestimate lawn use data.

The 8.7 million lb estimate in the Phase I Report represents over 250% of all residential lawn fertilizer nitrogen in Lake, Orange, and Seminole Counties combined.

The tonnage data analysis included all "non-farm" lawn and garden products, both bulk and non-bulk as well as Scotts and all other registrants. As stated above, if a lawn care service provider located outside of Lake, Orange, or Seminole Counties purchased bulk product for subsequent use within the counties, the data would not be captured in the county data. This is estimated to be a low amount of tons due to the fact that all of Orange County tonnage has been attributed to the Wekiva River Basin while the Basin only represents a small portion of the county. If a lawn care service provider located within the three counties purchased fertilizer from a registrant, either bulk, bag, or liquid, it would be included in the reported tonnage.

Our data and MACTEC data agree closely on the 3.0 lb/1,000 sq ft estimate as you stated although our estimate is the average rate for fertilizers users only (DIY and lawn care) while the MACTEC estimate is the average rate for 100% of the residential lawn acres in the Wekiva River Basin (65,130 acres). We estimate 2.78 lb N/1000 for homeowners in FL and 6.0 lbs N/1,000 for professionals in FL. Based on percent DIY participation and percent professional participation a weighted average of 3.58 lbs N/1,000 sq ft was determined for residential lawn use. The percent participation and the total acres treated in the low, median, and high density areas may be the reason for the high estimation in the MACTEC report. As noted in the June 30, 2007 FL Department of Health report Nitrogen Impact of Onsite Sewage Treatment and Disposal Systems in the Wekiva Study Area, the "fertilizer input could be overestimated by a factor of two". Our analysis agrees with this statement:

> The estimate of fertilizer inputs was based on recommended application rates, while other inputs were more closely related to literature values of observed inputs. A large difference exists between fertilizer sales data from the Department of Agriculture for fiscal year 2004-2005 and these estimated application rates. About twice as much fertilizer is estimated to have been used than was actually sold in 2004/2005. Based on sales data, the contribution by fertilizer inputs could be overestimated by a factor of two. If adjustments are made based on the sales data this reduces fertilizer contributions to 53% and increases onsite system contributions to 13%. Figure 2 shows the percentage of inputs to the environment using the recommended application rates for fertilizers.

We used our national data of 12.5% of households utilize professional service providers. We do not have data specific to professional lawn care use in the Wekiva River Basin and you point out that the number of customers is likely above average in the area . We may be able to query the lawn care service industry to determine whether the subject counties, or the basin residents, have a significantly higher participation rate than the state or the national average. The tonnage data reported in Lake, Orange, and Seminole Counties includes all bagged, liquid and bulk fertilizers sold to these companies located in the three counties. If product was sold to a location within the county it would be captured in the tonnage data. Recall that we included all of the county data in the analysis (Lake, Orange and Seminole) while the Wekiva Basin only occupies a portion of these counties.

Lawn care service providers in FL typically apply up to 6.0 lbs N/1,000 per year. The number of applications and rate per application vary by provider but the 6.0 lb/1,000 cap applies across the state. This would apply to both single family detached homes and to multi-family homes and commercial properties.

Rob, a very useful data point is the number of households in the Wekiva Basin all well as a breakout per the low, median, and high density areas. This would help verify the reasonableness of the usage assumptions. I found data that indicates an average household size of 2.6 in the Wekiva River Basin, which would yield 166,153 total households in the basin. This produces an average lawn size of 0.39 acres per household and an average nitrogen use rate of 50 lbs per year for every household (over 250 lbs of lawn fertilizer for every household per year). These values are extremely high when compared to other areas. Useful information would include the percentage of housing units that are multi-family, the percentage of households in low density and medium density areas, etc? We can likely utilize lawn care serve information to help define the lot sizes in the basin and size of lots that are being maintained by professional lawn care.

On a separate note, we are interested in understanding the significance of groundwater dilution on the estimated load calculations for residential fertilizer use. The study made reference, on two occasion, to the fact that residential fertilizer leachate data did not account for groundwater dilution and that all other source types had included groundwater dilution. Can an estimate be developed and should this be included in the estimated groundwater concentrations for residential fertilizer? The dilution factor is not included in the graphic above.

> sources, with some dilution and/or other chemical transformations. In this study shallow groundwater concentrations, generally within 20 ft of the water table, were used to estimate concentrations in water recharging the Floridan. For one source type (residential fertilizer use) representative groundwater concentrations were not found in the technical literature, and leachate concentrations from experimental plots were used in lieu of groundwater data. Leachate concentrations would likely be higher than groundwater concentrations, due to dilution, and this could lead to overestimation of the importance of residential fertilizer source type, compared with agricultural sources.

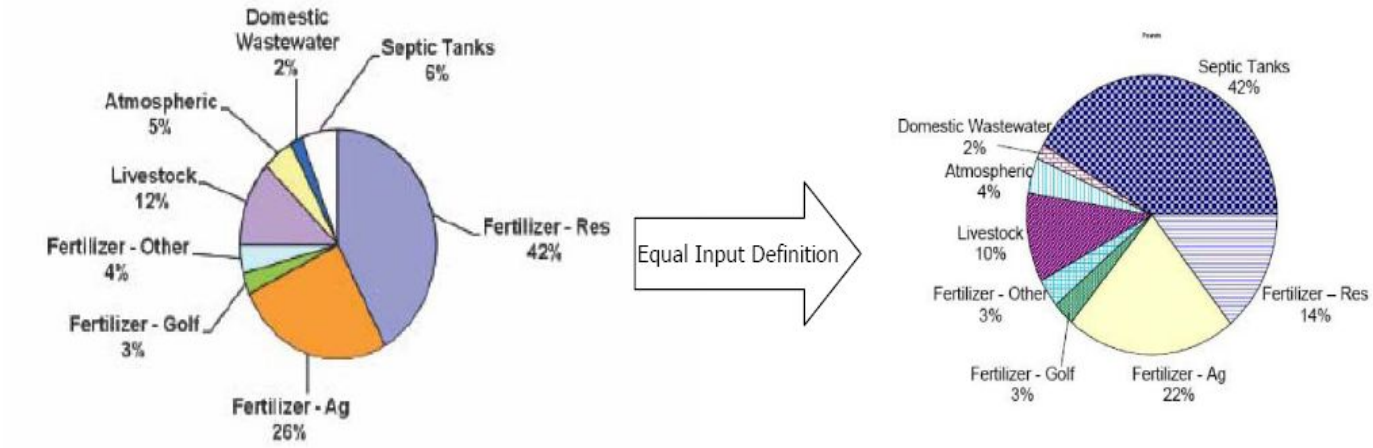
We would also like to understand more about the soil interactions with the septic tank leachate to determine whether it would be appropriate to apply this same factor to turf leachate. The MACTEC report states that 70% of the nitrogen leachate from septic tanks reaches groundwater. Should we apply this same factor to fertilizer nitrogen leachate since the soil interactions would be the same for both nitrogen sources? The 70% factor is not included in the graphic above.

> See Section 2.3.3 for the procedure for estimating the number of septic tanks, their distribution by land use in the Wekiva Basin, and the N released per tank. According to Anderson and Otis (2000), 50 to 90% of the N released from septic tanks reaches the water table. In this study it was assumed that 70% of the N released by septic tanks is delivered to groundwater as NO_3-N, i.e., 14 lb/yr.

Rob, we had also discussed, the "Input" graphic and my concern that it was being used out of context in a number of local communities. The graphic is intended to illustrate all the environmental contributions that have the potential to impact groundwater and to facilitate prioritization of research efforts (defining load potentials). It does not represents loads to groundwater but is being improperly used in this context. Any communications you or your colleagues can make in this regard would be helpful to local decision-makers. Lee County, for example, cited the input graphic as giving "perspective to the order of magnitude of the problem in Lee County".

It also appears that the "Input" graphic is not consistent in how inputs quantities are defined. Fertilizer inputs, agricultural inputs, and atmospheric inputs are all defined as the total amount entering the environmental but the septic input represents only an estimate of the amount of leachate rather than the total amount entering the environment (156 - 400 lbs N/tank/yr). Its seems that the fertilizer inputs should also be defined as the estimated amount of leachate for this graphic to accurately illustrate the ratio of inputs from these different sources. Conversely, the septic input should be the total amount entering the environment, similar to the total amount of fertilizer entering the environment (amount sold). Below is the original graphic and a revised graphic with septic inputs treated similar to the fertilizer and other input sources.

NITROGEN **INPUTS** TO THE WEKIVA BASIN, PARTITIONED BY SOURCE TYPE



Thank you Rob, I will be attending the December 17 Task Force meeting in Apopka and the January meeting in Tallahassee and look forward to seeing you there. It would be great if we could schedule some time to meet and review our notes. I can arrive early or stay late to accommodate your schedules. Otherwise, let's schedule some time early next year to meet with you and your colleagues to review our information and establish some deliverables to help refine the modeling efforts.

With Best Regards,

Chris Wible
The Scotts Miracle-Gro Company
937-644-7012

From: Martinez, Rich
Sent: Monday, December 10, 2007 6:36 PM
To: Robert Mattson; Wible, Chris
Cc: Erich Marzolf; Casey Fitzgerald; Ed Lowe; Larry Battoe; Mary Brabham; Hall, Bonnie; Livingston, Eric; Hicks, Richard W.; Ferraro, Chris; budellr@doacs.state.fl.us; jblair@fsu.edu; Eberhard_Roeder@doh.state.fl.us
Subject: RE: Fertilizer use in the Wekiva River basin, Florida

Thanks for your interest and feedback Rob. I look forward to further study of the Wekiva River basin, as it can provide greater insight to all of us.

To answer your questions, the 35.4 million pounds of nitrogen represents all Do-It-Yourself (DIY) applications to lawns in the state for all manufacturers as sold from all consumer outlets. It does not include any commercial application, unless they purchase consumer product at a consumer retail outlet (which we would report in our tonnage data; we don't believe this to be significant).

We agree that the amount of commercial application is significant and must be estimated in a separate way. Likewise, DIY applicators have a fundamentally different situation on their lawn than most professionally managed turf, in that it is undernourished and hungry (good absorber of nutrients). It would be beneficial to get an idea of the actual ratio of DIY to commercial application in the Wekiva River Basin and the relative acres treated of each. It is particularly

relevant since the data in the report is being widely used to draw conclusions about DIY, not just commercial application.

Is there some sort of population/household count for Wekiva that we could evaluate versus state totals? I ask because it still seems that the quoted 8.7 million pounds of nitrogen is too high a percentage of the state total nitrogen sold. Every town can't be over the average!

I look forward to speaking with you further on this topic and remain committed to developing better data for the models. Please let me know how I can help.

Rich

From: Robert Mattson [mailto:rmattson@sjrwmd.com]
Sent: Monday, December 10, 2007 10:27 AM
To: Wible, Chris; Martinez, Rich
Cc: Erich Marzolf; Casey Fitzgerald; Ed Lowe; Larry Battoe; Mary Brabham; Hall, Bonnie; Livingston, Eric; Hicks, Richard W.; Ferraro, Chris; budellr@doacs.state.fl.us; jblair@fsu.edu; Eberhard_Roeder@doh.state.fl.us
Subject: Fertilizer use in the Wekiva River basin, Florida

Chris:

We want to express our thanks to you and Rich Martinez for your review of and comments on the "Phase 1" Nitrate Sourcing Study in the Wekiva River Basin, conducted for us by the firm MACTEC Engineering and Consulting. As you and I have discussed on the phone, this report (using funds provided by FDEP) was produced for the District by MACTEC under a contract agreement, which has now been completed and closed. The report has been submitted to FDEP and is now made available to the public on their website. It is our intent to revisit the estimates made by MACTEC in the future, using a combination of new data (we are actively planning some new studies with FDEP), information submitted by you and other interested stakeholders (septic tanks, agriculture, etc.), and presently ongoing studies being conducted on turf grass fertilization by the University of Florida/IFAS (Drs. Trenholm, Sartain, etc.).

At present we cannot revise or amend the figures for nitrogen/nitrate inputs and loads in the MACTEC report for residential fertilization without also similarly revisiting estimates made for other sources (including septic tanks, agricultural fertilization, atmospheric deposition and wastewater disposal). The Florida Dept. of Health recently conducted additional studies of the loads of nitrate from septic tank drain fields in the Wekiva Basin (prompted in large part by concerns of the septic tank and real estate developer industries). Those studies have recently been completed and would need to be considered in a re-analysis of the MACTEC results. Similarly, we are planning (with FDEP) to conduct homeowner surveys and groundwater field studies focusing on residential fertilizer use in the Wekiva Basin and would like to have those results available for a re-analysis, as well as the results of the detailed turf grass studies currently being conducted by UF/IFAS for the FDEP. We are also looking at issues related to the N loads from irrigation with re-use or reclaimed water, which is treated wastewater piped from a municipal sewage treatment facility and used for irrigation (including on home lawns, as well as public areas, rights-of-way, parks, etc.). This practice is widespread and increasing in the Wekiva Basin. MACTEC made the assumption (admittedly a simplifying assumption) that N loads from re-use water offset (i.e., replaced) fertilizer use. Recent anecdotal evidence indicates this may not be so (which would increase the estimates of fertilizer application).

We believe the figures you and Rich have submitted, in combination with the MACTEC estimates of nitrogen loads from residential fertilizer use legitimately represent the lower (your data) and upper (MACTEC) boundaries of the potential loads of N from residential fertilizer in the Wekiva Basin. With that in mind, we had the following questions/comments on your information:

1) For the estimates you provided for Orange, Seminole and Lake Counties (3.4 million lbs N) and Rich's figure for Florida (35.4 million lbs N); does this represent sales of Scotts products only? Does it include other manufacturers (e.g., Spectrum Brands, "generic" label, others)? Do the figures reflect all types, formulations, and sizes of product, or only certain sizes (or certain formulations, such as lawn product only), and does it include all points of sale or only "big box" vendors such as Wal Mart, Home Depot, Lowes, etc? Are sales from smaller nursery and garden operations included, along with smaller retail businesses (Ace Hardware, Farm and Garden stores, other vendors which typically cater to agricultural interests such as feed stores)? If all these are not included wouldn't the figures quoted represent an underestimate? Do you have data which allow estimates of all sales, including from these smaller venues and other manufacturers' products?

2) Do the figures above include bulk sales to commercial applicators (Tru Green/Chemlawn, etc.), as well as fertilizer sales to smaller lawn and landscape maintenance companies? We believe that to only focus on the "DIY" market underestimates the amount of fertilizer actually being used/applied on all residential land uses in the Wekiva Basin (see comments 4 and 5, below), and particularly if these figures only represent Scotts' sales.

3) In general your data and MACTEC seem to reasonably agree on application rates (about 3 lbs/1000 square feet of lawn). The difference seems to be in the acreages over which it is applied. As I mentioned, the actual data used by MACTEC is found in Appendix D of their report. The figures Rich quoted for acreage of lawn in the state (780,000 ac) and area of lawn per household (0.2 ac or 50% of lot area) seem low to us, especially in the Wekiva Basin area, which has a mix of upscale, estate-sized homes with large lots, rural ranchettes, and older homes on larger lots. As you may see in Appendix D, MACTEC took the acreage of low, medium and high density residential and used correction factors for % impervious surface (which are used in stormwater modeling throughout the state), and this ranges from ~15% impervious (85% lawn/garden area) for low density residential to 67% impervious (13% lawn/garden area) for high density residential. In looking at the dominance of low and medium density residential (in terms of acreage), I would estimate that more like 65-80% of an "average" lot is lawn/garden in the Wekiva Basin.

4) The amount of fertilizer applied from commercial applicators could be quite substantial in the Wekiva Basin and appears to be not quantified by anyone at present. The national estimate of use of lawn care services (12.5% of households, as quoted by Rich) appears to us to be an underestimate in the Wekiva Basin, again, especially considering the more affluent character of much of the area. We have concerns over the technical validity of using national averages to apply to this area, or even to Florida in general. I have driven through neighborhoods throughout the basin area and have seen the small green tags indicating recent lawn service by a commercial applicator on one-third to half the home lawns (33-50%). Again, do sales of fertilizer product within the State of Florida cover bulk sales to these commercial applicators, or are they purchasing their product out-of-state, direct from the manufacturer, and bringing it into the basin (or in the case of a smaller, local lawn care company, purchasing wholesale at an agricultural vendor and using on home lawns)? Also, what application rates do they (commercial lawn service firms) typically use and how many applications/year?

5) In Florida, what we map as "Residential" land use includes single-family detached homes (with lawns), but also includes multi-family housing (apartments, condominiums, duplexes, etc.). The latter are included in what is mapped as high density residential, with some in medium density residential as well. Lawns associated with these are more likely to be serviced by a commercial applicator, reiterating that the points raised in (4), above, are somewhat important. Again, to only focus on the traditional single-family home/DIY market for "lawn" fertilizer would underestimate (perhaps substantially, we believe), the actual amount of fertilizer N being applied to residential lands of the basin.

I hope the above is helpful and indicates some of the issues we feel need to be addressed.

Robert A. Mattson, CEP, CSE
Environmental Scientist V
St. Johns River Water Management District
(386) 329-4582
rmattson@sjrwmd.com