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March 13, 2007

To: Hon. L. Preston Bryant, Jr., Secretary of Natural Resources
From: Dr. Lynton S. Land, Emeritus Prof. Geological Sciences, U. Texas, Austin
Re: Chesapeake Bay and Virginia Waters Clean-Up Plan
Note: My focus is on "Bay Act" counties, Northumberland County in particular

Status of Impaired Waters

p. 1 The headwaters of almost all tidal estuaries are impaired because fecal Coliform bacterial levels exceed Federal standards for the harvesting of shellfish. I am gratified to see that the State admits that low dissolved oxygen levels caused by nutrient pollution are an additional cause of formal impairment. TMDL strategies must address this widespread, but often ignored, cause of impairment in small waterways. It is hardly "good news" if 411 river miles are removed from impaired status when 2,071 miles are added in 2006. The State needs to stop applauding a field goal when the team is losing 14 to 0.

Wastewater

p. 4 An annual reduction of 3 million pounds of nitrogen pollution from wastewater plants is much smaller than 21 million pounds of nitrogen land-applied each year using animal waste (poultry litter, municipal sewage sludge and manure) to no benefit of crops (December 2006 Bay Journal.) As Sec. Bryant correctly pointed out in his letter to me 02/28/07 "Not all of the nitrogen that is unused by the crop is lost to the environment ...". We could disagree about how much nitrogen is denitrified to harmless N₂ gas and how much is released as ammonia or nitrate and causes pollution, but I submit that the pollution caused by 21 million pounds of nitrogen being applied to the land to no benefit of crops is far greater than 3 million pounds. Denitrification is far less than 86% (1 - 3/21) efficient when corn, small grain and soybeans are grown in Virginia.

p. 4 The statement "... wastewater treatment is also the most cost-effective means of achieving and maintaining nutrient reduction goals." is not true, in my opinion. As reported in the February 2007 Bay Journal, the cost of upgrading the Blue Plains wastewater treatment plant to eliminate about 4 million pounds of nitrogen pollution is projected to be between \$500 million and \$1 billion. According to VDH and DCR (December 2006 Bay Journal), banning the land application of municipal sewage sludge would keep about the same amount of nitrogen, 4.4 million pounds, from being disposed on fields annually to no benefit of crops. Recognizing that not all the disposed nitrogen causes pollution, unlike the nitrogen in water discharged from wastewater plants, the cost saving for farmers of about \$3 million each year (50,000 acres * \$56/acre saved, according to JLARC Report #89) resulting from the land application of sewage sludge is a pittance compared to the cost of upgrading Blue Plains. This is true even if only half the land-applied nitrogen ultimately results in pollution of Chesapeake Bay and the costs of upgrading Blue Plains are spread over half-a-century. The 3 million pound reduction in

nitrogen pollution resulting from all the listed wastewater plant upgrades (p. 6 to 8), at a projected cost of \$600 million, must be compared with the cost of banning the land application of all animal waste, resulting in 21 million pounds of nitrogen no longer being applied to the land to no benefit of crops.

p. 10 Nutrient trading is a slower way to reduce pollution than simply mandating the necessary changes, largest polluter first. More cost sharing and use of bonds should be encouraged to spread costs over time. There is too much emphasis on “somebody else” (the State or Federal Government) paying for pollution reduction, when “The Polluter Pays” is still a valid edict. Nutrient trading can prove effective but it must not become convoluted, resulting in loopholes for special interests and diversion of funds that could usefully be applied to reduce pollution, to administrative and legal expenses. Nutrient trading should not be allowed to expand to include sources of pollution other than wastewater treatment plants.

p. 13 Discharge from boats is, quantitatively, an extremely minor problem in comparison to agriculture or wastewater treatment plants. People will undoubtedly continue to urinate overboard, but very few people are so stupid as to defecate directly into the water. The entire Bay should be designated as a NDZ. The cost of portable toilets ranges from about \$30 for a “Bucket Potty Seat” to about \$100 for a more substantial Portable Head. Boaters can afford that. “Lack of ... pump-out facilities”, “Insufficient resources for enforcement” and “.... resistance by local government and boat owners” are not valid reasons for failing to designate the Bay as a NDZ. Government should lead. It is better to have the regulations on the books than not. It is true that there already exist too many un-enforced regulations (e. g. riparian buffers for agricultural land, mandated septic pump-out), but at least some people will abide by the regulations whether or not they are enforced. For large boats, an overboard discharge law similar to Maryland’s should be enacted. The State needs to direct its resources in proportion to the problem, meaning that insignificant sources of pollution such as this, compared to agricultural practices and discharge from wastewater treatment plants, should not be given high priority.

p. 16 With regard to septic systems, Virginia’s “grey water” laws must be changed. There is no reason for any discharge except from toilets to enter the septic tank. Septic tanks function much more efficiently if large volumes of water are excluded because there is more time for particle settling and microbial digestion of the solids. The pathogen load in water discharged from a typical house, except for the toilets, is less than the pathogen load to a typical property from wildlife and pet feces. In Strategy 2, straight pipes should be eliminated whenever they are detected. Period. That said, the Combined Sewage Overflow (CSO) from Blue Plains (and other facilities?) probably contributes more raw sewage to Chesapeake Bay than do straight pipes or failed septic systems. CSO appears not to have been considered, based on the statement on p. 11 that “.... discharges from permitted wastewater treatment facilities are rarely identified as the cause of water quality impairment” That statement may be true for the discharged water, but it is not true of other “discharges” such as sewage sludge and CSO. Expensive though it may be, CSO must be eliminated along with straight pipe discharges.

Agriculture and Forestry

p. 18 In Sec. Bryant's letter of 02/13/07, he and Directors Paylor and Maroon concurred with my statement "Agricultural fertilization practices are the largest source of nitrogen and phosphorus pollution of Chesapeake Bay." Given that replacing agricultural land with forest is not an option on a large scale, the only option is increase agricultural fertilization efficiency so that nutrients taken up by the crop are maximized, and nutrients released to the environment are minimized. Changes in agricultural fertilization practices associated with conservation tillage, unfertilized cover crops, split fertilizer application (as advocated in many places, such as p. 27 in DCR's "2005 Nutrient Management Standards and Criteria"), etc. all increase fertilization efficiency slightly, at a cost to farmers. But the most inefficient form of fertilization is the land application of animal waste (poultry waste, municipal sewage sludge and manure). An ultimate ban on the land application of animal waste should be an explicitly stated goal.

Relatively few farmers use animal waste. Accepting the figure from JLARC Report #89 that 50,000 acres receive municipal sewage sludge annually, and assuming that application rates for poultry waste and manure are similar, then according to the figures supplied to me by DCR, VDH and DEQ (December 2006 Bay Journal,) roughly 200,000 acres receive animal waste. There are approximately 4,300,000 acres of total farm cropland in Virginia. Less than 5% of farm acreage receives animal waste, meaning that the vast majority of farms are profitable without using animal waste as fertilizer. If the cost savings for farmers who use of poultry litter and manure are similar to the cost savings realized using municipal sewage sludge (JLARC Report #89), then farmers save, on average, \$1,173 per farm, or roughly \$11 million per year, state-wide (\$56/ acre * 200,000 acres.) Contrasted with the total estimated cost involved in upgrading wastewater treatment plants, \$1,500 to \$2,000 million (p. 5), banning the land application of animal waste is a cheap way to reduce pollution even taking into account the projected lifetime of the upgrades.

p. 19 Enforcing nutrient management planning as currently practiced, as is proposed for poultry litter, is not a satisfactory solution. When animal waste is used rather than chemical fertilizer, approximately twice as much nitrogen is applied as is needed by crops, and the amount of nitrogen applied cannot be reduced and still meet crop needs because of inefficiencies in the nitrogen source. Fertilizer uptake is more efficient when chemical fertilizer is used, especially if applied in split application. Irrespective of the fraction of nitrogen that is denitrified (converted to nitrogen gas so as not to constitute pollution), doubling the amount of applied nitrogen so as to meet crop needs at least doubles the pollution that would take place if chemical fertilizer were used. "Nitrogen Use Efficiency" does not closely approach 100% under the best of circumstances when chemical fertilizer is used (see the NUE page at www.VaBayBlues.org) and is obviously very much worse when animal waste is used.

In the case of phosphorus (P), my experience as a member of the Technical Advisory Committee to DCR demonstrated to me that, at that time, the State had no intention of restricting the land application of animal waste and the regulations were manipulated, in my opinion, so as not to restrict land application. My correspondence is all posted at www.VaBayBlues.org. At the first meeting (June 17, 2004) we were told that

goals should be “easy to implement, avoid loopholes, limit pollution, etc.” But a goal was also to “Minimize farmers expenditures on fertilizer...” The state must decide whether to continue the existing practice of promoting the land application of animal waste in order to “minimize farmers expenditures on fertilizer...” or to begin to phase out land application in order to improve water quality in Chesapeake Bay. According to Dr. A. N. Sharpley (editor of “Agriculture and Phosphorus Management: The Chesapeake Bay”, 1999, CRC Press, p. 66). “... much of the crop land in the Chesapeake Bay watershed is now considered “optimum” or “excessive” in phosphorus from an agricultural perspective and hence needs little additional phosphorus, from any source, to ensure that economically optimum crop yields are attained.”

Rather than mandate the “Soil Test P” method (analyze the soil for P and apply only as much P as needed by the crop as set forth in DCR’s “Standards”) a decision was made by DCR to allow the “Phosphorus Index” (PI) to be used. I objected to the science on which the PI is based (see www.VaBayBlues.org.) Seven scenarios were presented to the committee (see p. 2 of the minutes of the July 26, 2004, meeting), none of which would have allowed any P application using the Soil Test P method. In the case of the PI, application would have been precluded in two scenarios, 2 scenarios would have permitted application at crop removal (CR) rate (ignoring the P level already in the soil) and 3 scenarios would have permitted application at 1.5 times CR rate. In my opinion, the PI still violates 12VAC5-585-550.A "The applied nitrogen and phosphorus content of biosolids shall be limited to amounts established to support crop growth." because the amount of P “... established to support crop growth ...” is documented in DCR’s “Standards.” What possible explanation is there, other than to promote disposal of animal waste in the guise of “free fertilizer,” for allowing P application at CR rate, ignoring P already present in the soil, as would be allowed for all scenarios under the Poultry Waste Management Act? Even worse, what possible explanation, other than to promote land application, exists for allowing 1.5 times CR to be applied? Why is animal waste application sanctioned for soybeans when farmers do not use chemical nitrogen fertilizer to grow them because the legumes “fix” nitrogen? Why is land application of animal waste allowed on winter cover crops, which are meant to retain excess nutrients and release them when the crop is incorporated in the spring? All these positions prove to me that cheap disposal of an unwanted product (animal waste) and small cost-savings for a few farmers currently trump the State’s concern for water quality.

The way to significantly reduce agricultural fertilizer pollution is not just to apply nutrient management regulations regarding animal waste, or even to stiffen them. The least efficient forms of fertilization must be abandoned altogether. The word “inorganic” in the sentence on p. 46 of DCR’s “Standards” “Phosphorus applications from inorganic nutrient sources shall not exceed crop nutrient needs over the crop rotation based on a soil test.” should be replaced by the word “all.” Mandating the “Soil Test P” method would severely restrict the land application of animal waste without adversely affecting crop productivity and would reduce nitrogen and P pollution considerably. An outright ban can be justified in those watersheds where “jurisdictional loading caps” must be imposed, or where bacterial levels in tidal waterways restrict the harvesting of shellfish. The cost to the few farmers who use animal waste, and a few special interests like poultry growers and sewage sludge spreaders, must be balanced against the vastly larger

economic value of Chesapeake Bay as stated on p. 47 of “Tributary Strategies,” as documented in an article in the October 2004 Bay Journal “Chesapeake’s value worth more than the sum of its parts” by R. Hanmer of EPA, and the explicit wishes of Virginians for improved water quality.

Alternatives to land application exist, such as using animal waste as biofuel. Methane can be generated anaerobically and the animal waste, or the residue after methane extraction, can be (and is being) combusted without contributing to global warming. Phosphorus is a non-renewable resource, and existing high-grade reserves will be exhausted within the life times of children being born today at current rates of extraction. Phosphorus can be recovered from the ash after combustion and then used as a much more efficient fertilizer. The current cost to society of landfilling sewage sludge, less than \$5 per customer each year, is less than the human health, administrative and environmental costs of land applying it, in my opinion, if those costs are all honestly cost-accounted.

The entire section “Implement nutrient management on lands receiving poultry litter” favors the continued land application of the highly polluting product. The poultry industry will certainly vigorously resist any changes in the current permissive policy. The State must decide what is best for all Virginians and Chesapeake Bay, and not just for a small industry.

p. 21 Mandating phosphorus reduction in animal waste (which does not affect municipal sewage sludge) by using an enzyme such as Phytase is an unsatisfactory strategy. It may transpire that there are currently unknown harmful effects of the enzyme on animal and/or human health, and meat could not be certified as “organic.” Additionally, the reduction in pollution is too small, compared with an outright ban on the land application of animal waste, to be economically worthwhile, even if it ever achieved the projected results and was enforced.

Developed and Developing Lands

p. 25 “Implementation and compliance of erosion and sediment control programs” would be aided if the Chesapeake Bay Preservation Act were enforced, and strengthened to mandate a 100 foot RPA irrespective of land use. Currently, agricultural fields can get away with a 25 foot buffer, which accomplishes very little, even it is enforced. It is well known that a riparian buffer, along with marshes if possible, removes significant amounts of nutrients from both surface runoff and groundwater. It must be recognized that groundwater is currently massively contaminated with nitrate, primarily as the result of agricultural practices (see www.VaBayBlues.org), and enforcing and strengthening existing law with respect to riparian buffers (including mandated stream fencing for livestock exclusion) would result in pollution reduction.

p. 28 The septic pump-out requirement incorrectly states that the most important reason for enforcing existing law is “... to reduce impairments caused by high levels of fecal Coliform bacteria.” It is unproven that improperly maintained septic systems are the predominant source of bacteria that cause impairment of tidal waters and restrictions for the harvesting of shellfish (See also Potential Problem Area #7 on p. 17) despite the fact

that DEQ has advocated humans as the primary source of bacteria. I disagree with DEQ's conclusion, and have outlined my objections in previous letters, posted at www.VaBayBlues.org. At a recent Conservation Symposium in Lancaster County, attended by Mr. Jeff Corbin, Dr. James Wesson of VMRC stated categorically that wildlife are the source of bacteria. I agree with him, and emphasize that uncertainty still exists with regard to the source of the bacterial contamination. Blanket "blame" on septic systems for bacterial contamination of waterways (and ignoring the land application of sewage sludge, that contains over a billion Coliforms per truckload) is not warranted at the current state of scientific knowledge. The reason to inspect septic systems is to identify those few that are failing or have straight pipe discharge so they can be repaired/replaced, and to minimize the nutrient load to the groundwater from all the remainder by ensuring that the septic tank is not filled with solids.

p. 30 Strategy #3 could be as strengthened. It would be useful if the State summarized operative and successful administrative frameworks for pumpout enforcement so each county is not forced to re-invent the wheel.

Summary

Point source pollution is adequately addressed by this plan, but the largest source of pollution of Chesapeake Bay, from non-point sources, is not. The efficiency of agricultural fertilization practices must be improved if water quality in Chesapeake Bay is to improve significantly. Phasing out the least efficient fertilization practice, the land application of animal waste, would:

- 1) be the most cost-effective way to reduce nutrient pollution and begin to meaningfully improve the efficiency of agricultural fertilization practices. The cost of eliminating 21 million pounds of nitrogen applied to the land annually with no benefit to crops certainly does not even closely approach \$4,200 million, proportional to the projected \$600 million cost of achieving a pollution reduction of 3 million pounds of nitrogen by upgrading wastewater treatment plants.
- 2) affect very few farmers, assuming that approximately 200,000 acres currently receive animal waste out of 4.3 million acres of total farm cropland in Virginia.
- 3) not place undue burden on the small number of farmers who now choose to use animal waste, assuming that the \$1,173 annual cost saving per farm from use of sewage sludge similarly applies to other forms of animal waste.
- 4) require disposal by other means. At current landfill prices, customers of major facilities would see increases in their annual bills of less than \$5 per year.
- 5) encourage use of animal waste as a biofuel by generating methane and/or incineration, neither of which contributes to global warming, along with the recovery of phosphorus, a non-renewable resource.