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From: Dr. Lynton S. Land
Re: Virginia's Watershed Implementation Plan – Public Comments

The first paragraph opens with the usual qualitative platitude about the importance of Chesapeake Bay to Virginia. The 2004 Blue Ribbon Finance Panel concluded that the worth of the Bay is on the order of one trillion dollars. Presuming that half of one trillion dollars is the worth of the Bay to Virginia, $500 billion far exceeds the worth of the largest polluter, namely agriculture. The value of all field crops is only approximately $1 billion, similar to the value of poultry products to the State. The $800 million claimed for the cost of livestock exclusion stream fencing, something that should have been mandated decades ago, is also a drop in the bucket. Honest economics document the value of the Bay to society and the cost to society when regulations fail to reduce pollution in order to protect the profits of special interests that cause the pollution.

The preamble asserts that Virginians "… have already invested (billions of dollars) in Chesapeake Bay water quality …" There is no accepted scientific evidence that water quality has measurably improved. No credit can be taken for what has already occurred because it has had no measurable effect.

The utility of nutrient credit exchange between diverse sectors is an open invitation to massive loopholes, fraud and yet one more unnecessary bureaucracy.

These comments only address SECTIONS 5 through 9 and SECTION 11. The space devoted to each sector is disproportionate to the pollution caused by each sector. Agriculture is responsible for roughly half of Bay pollution and urbanization (Wastewater and Urban/Suburban Stormwater) is responsible for one third. The WIP should address the largest sources of pollution first, not "picking the low-hanging fruit" but "picking the biggest fruit." For example, septic systems cause approximately 5% of Bay pollution and pollution from silviculture is negligible. The land application of poultry litter causes approximately 12% of Bay nitrogen pollution and disposes of (squanders) about 25 million pounds of phosphorus (P) on Virginia fields, little of which is needed by crops. EPA's required P reduction is only about 2 million pounds. This WIP contains too much "clean it up" strategy, which must continue (and be funded) forever unless the source of the pollution is reduced or eliminated. There is not enough "stop the pollution at its source" strategy, especially for agriculture. Eliminating pollution at its source is always less expensive that cleaning it up later.

SECTION 5. WASTEWATER

Virginia has made significant progress in meeting WLAs (Tables 5.1.2 and 5.1.3). But discharge from pipes is not the only source of nutrient pollution from wastewater treatment facilities. Sewage sludge that is land-applied causes massive pollution because

it is such an inefficient fertilizer, pollution that is sanctioned by existing nutrient management plans. It is irrelevant whether the vector of pollution is point source or non-point source. The source of the pollutant is the wastewater treatment plant, which EPA has authority to regulate. Wastewater treatment plants must be held accountable for all the pollution they generate.

Using Blue Plains as an example, based on data posted at www.dcwater.com, the facility discharges about 370 MGD, with a phosphorus (P) concentration of 0.18 mg/L and a goal of limiting nitrogen (N) discharge to 7.5 mg/L. The annual direct P discharge to the water is 200,000 pounds per year, and once the goal is achieved, the annual N discharge will be 8.2 million pounds per year. "About one dry ton of sludge solids are produced for every 1 million gallons treated." Dry sludge contains about 2.5% N and 0.8% P, so 6.7 million pounds of N and 2 million pounds of P are trucked out of the plant each year. One order of magnitude more P is trucked out of the plant than is discharged directly to the water. If land-applied according to Virginia law so that 30% of the nitrogen is "crop available", then 70% of the nitrogen, or 4.7 million pounds per year is not used by the crop following land application, and 3 million pounds (45%) is never used by crops (Virginia Nutrient Management Standards and Criteria, Revised 2005, Table 9-1, or "Standards"). Nitrogen-based land application merely disposes of whatever P is in the waste with no regard for crop needs or P already present in the soil. If sludge is applied at a rate of 40 (wet) tons per acre (moisture content of 85%) to meet the N needs of the crop (90 pounds of "plant available" N, which translates into 300 pounds of N actually applied), then 96 pounds of P are disposed when crop P requirements are no more than about 30 pounds per acre, most of which is likely to be already present in the soil. No science can be cited to prove that such massive over-application of P is benign as far as water quality is concerned.

The volunteer Nutrient Credit Exchange should continue but not be expanded to include other sectors. Trading credits between very similar polluters, all regulated similarly, can be effective, but once different kinds of polluters are incorporated, the credits are nearly impossible to quantify and are subject to legal loopholes and fraud.

Because only three localities are served by a CSS, these outdated facilities must be eliminated by 2025, despite the cost stated on p. 43.

SECTION 6. AGRICULTURE

Agriculture is responsible for half of Bay nutrient pollution. The land application of animal waste causes half of agricultural pollution, or 25% of Bay pollution. The most cost-effective way to reduce agricultural pollution is to increase fertilization efficiency, but the WIP does not seriously address this kind of effort. Replacing conventional chemical fertilizers with "Controlled- (Timed- or Slow-)" release fertilizers is a strategy that is ignored. The five "priority practices" for the State (p. 51) do not include the cheapest action that can be taken that would impact the fewest farmers, namely to impose P-based land application of animal waste as a precursor to a complete ban.

Table 6.4-2 is the "meat" of the WIP and contains 34 entries for "Delivery Mechanism(s) to Achieve Agricultural BMP Implementation Levels." The five "priority practices" are incorporated, and are addressed specifically below in italicized, bold-face type for emphasis. Combining similar entries in Table 6.4-2, such as buffers, conservation plans, cover crops, nutrient management, etc., the number of strategies is reduced to 20, as summarized on pages 60 through 65. These strategies can be categorized as:

STOP POLLUTING: Agricultural land retirement, ***livestock stream exclusion***, mortality composting, phytase, upland tree planting of agricultural land and Nursery/Greenhouse regulation stop or significantly reduce pollution from entering the Bay.

SOP UP THE POLLUTION LATER: Entries such as buffers, cover crops and wetland and non Urban stream restoration do not eliminate the source of pollution, but merely sop it up.

Buffers are always important because agricultural or landscape fertilization can never be 100% efficient. According to EPA (EPA/600/R-05/118, October 2005, Riparian Buffer Width, Vegetative Cover, and Nitrogen Removal Effectiveness: A review of Current Science and Regulations. www.epa.gov/ nrmrl/pubs/600R05118/600R05118.html.) buffers must be wider than 35 feet to be effective. Regulations, especially Bay Act ordinances in the tidewater, must be changed to reflect this fact. In Northumberland County, §54-16.C.4.b states "Agricultural activities may encroach within the landward 75 feet of the one-hundred-foot-wide buffer area when agricultural best management practices which address erosion control, nutrient management, and pest chemical control are being implemented on the adjacent land." A 25-foot buffer is not effective. These kinds of loopholes must be closed and 100 foot forested buffers mandated irrespective of the tiny amount of farm acreage that must be taken out of production. The last paragraph on p. 53 certifies this loophole by stating "Another key provision of the Bay Act regulations allows for agricultural encroachments into the required 100-foot buffer ….." No justification for this practice can be given to protect water quality, and the only justification is to protect agricultural profits.

Cover crops are an expensive way, usually subsidized with tax dollars, to sop up excess nutrients that never should have been applied in the first place. Cover crops act as "slow release" fertilizers in the sense that they retain some of the nutrients that otherwise would need to be supplied by chemicals or animal waste. But pollution is not reduced as much as could be achieved with slow release chemical fertilizers. If cover crops become a major part of the WIP strategy, then they must be applied (and subsidized) forever. Obviously, it is cheaper to fertilize more efficiently in the first place rather than sop up the excess fertilizer that farmers apply to maximize their yields, at taxpayer expense.

UNCERTAIN: Other entries have an uncertain or unproven effect on reducing pollution. ***Conservation tillage***, including no-till, is desirable to reduce sediment (and P) pollution, but the practice may or may not prevent N from entering waterways. To quote from p. 44

of Agriculture and the Nitrogen Cycle, SCOPE Report #65, A. R. Mosier, Ed. "Conservation tillage is used on nearly 40% of land in maize production in the United States. Requirements for N in no-till systems differ from those in tilled systems and, depending on how N is managed, NUE [Nitrogen Use Efficiency] may be either lower or higher than with tillage. At present, no significant differences have been found among tillage systems in terms of N rates used by U. S. farmers, timing of N application, or tools of N management (Christensen, 2002, Bulletin 664, USDA.)"

As long as ***nutrient management*** plans permit nitrogen-based land application of animal waste and sanction use of the P-Index instead of the "soil-test P" method, they sanction unnecessary pollution to the benefit of special interests and they do not protect water quality.

Prescribed Grazing may or may not be effective in reducing pollution. More emphasis needs to be placed on chemical crop fertilization practices that are currently only about 65% efficient, rather than on field grazing of small numbers of animals.

Animal waste management reduces pollution only if the waste is landfilled or used as biofuel. Most of the pollution occurs when the animal waste is disseminated widely on the land, not directly from the CAFO itself.

Water control structures are subject to catastrophic failure and are temporary stopgaps.

Stream restoration is a "sop-up" practice that may or may not reduce pollution depending on the surrounding land use.

Precision/decision agriculture is only effective in reducing pollution if it reduces fertilizer application and is unlikely to be widely applied because of the expense.

MEANINGLESS: Manure transport does not reduce pollution, but just moves the pollutant from one place to another, whether or not it is in the Bay watershed. It is highly desirable (p. 64) that waste-to-energy technology be developed, which should include P-recovery. High grade P ores will be depleted at about the time liquid hydrocarbon reserves are depleted, worldwide, within the lifetimes of children being born today. There is no longer any excuse to squander P by land application in the name of cheap disposal when the non-renewable resource should be recovered. Investing in renewable energy "credits" to promote waste-to-energy conversion is far preferable to investing in cover crops, forever, and allowing farmers to continue to over-fertilize in perpetuity.

I summarized the magnitude of pollution caused by the land application of animal waste in the December 2006 Bay Journal, and have added a column to incorporate P:

	Tons applied	x	fraction N	x	fraction N not used	=	Tons potential N pollution	fraction P
Sewage sludge	247,000	x	0.02	x	0.45	=	2,226	0.007
Poultry litter	557,600	x	0.03	x	0.40	=	6,690	0.025
Cattle, swine	234,200	x	0.03	x	0.60	=	4,200	0.015
							13,116	

JLARC report #89 states that 50,000 acres out of about 3,500,000 cropped acres in Virginia receive municipal sewage sludge and farmers save about $56/acre. Total savings for less than 2% of farm acreage (50/3500) is only about $1,173 per farm. The cost of N pollution has been estimated at $0.91 to $2.21 per pound (Jour. Agricultural and Resource Economics, 2002, 27(2): 420-432). If roughly 200 pounds of nitrogen are land applied from sewage sludge but not sequestered in the crop and the cost of pollution is only $0.50/pound, the farmer saves $56/acre but the pollution costs society $100 per acre. Again, honest economics demonstrate that the cost of current pollution practices is borne by society in order to protect the profits of a few special interests. Virginia requires nitrogen-based nutrient management plans for the land application of sewage sludge, which assume that 30% of the nitrogen is "crop available." Nutrients are managed to provide for the crop and not to protect water quality and 70% of the nitrogen is potential pollution. The Phosphorus-Index is highly subjective, poorly grounded in hard science and has astronomical P caps. The only P-application criterion that is truly protective of water quality is the "Soil test P method" using realistic crop requirements such as listed in "Standards." In the case of sewage sludge, if 1730 tons of P (247,000 * .007) are applied annually and the crops only remove 750 tons (50,000 * 30 / 2000), assuming that crops sequester 30 pounds of P per acre, then nearly 1000 tons, or 2 million pounds are disposed (squandered) to no benefit of crops just by this single practice. Banning the land application of sewage sludge alone would meet EPA's P-reduction goal. Poultry litter, which causes more than twice as much P pollution as does sewage sludge, is similarly regulated to provide nutrition for the crop and for cheap disposal, not to protect water quality. Imposing P-based land application of all animal waste would over-achieve EPA's P-reduction goal, while protecting farm productivity and water quality. The only reason not to impose P-based land application is to protect the profits of the waste production and disposal industries.

The land application of sewage sludge (biosolids) must be banned, not only because it is the least efficient fertilizer in common use and causes more pollution than any other form of fertilizer, but because it also causes health problems for a few people and disseminates substances like pharmaceuticals on the land with unknown long term, but worrisome, consequences. Wastewater plants must find alternate uses for the waste, ideally energy production and phosphorus recovery. Even the cost of landfilling (a properly designed landfill can be harvested for methane), spread among all the customers served by the wastewater facility, amounts to a cost no more than a couple bags of junk food each year per hook-up. A credit program for generating power from non-fossil fuels is desirable.

Until a ban can be phased in, land application of all animal waste should be P-based, as is currently the unenforced law for sludge stated in the Virginia Administrative Code 9VAC25-32-600 "The applied nitrogen and phosphorous content of biosolids shall be limited to amounts established to support crop growth." There is absolutely no scientific justification for piling P on the land as is now being done except to protect the profits of

the producers and spreaders of the waste. P-based land application would have no negative impact on agricultural productivity and would better protect water quality.

The philosophy of this WIP does not hold farmers sufficiently responsible for the pollution they cause and places too much emphasis on taxpayers paying farmers to stop or reduce pollution. Several quotes from A. R. Mosier, Ed., Agriculture and the Nitrogen Cycle, are appropriate:

> "Improvements need to be made to the currently low efficiency with which fertilizer N is used within production systems if we are to continue to meet the global demands for food, animal feed, and fiber and minimize environmental problems." (p. xix)

> "The low efficiency in the developed world occurs because farmers often apply excess N as insurance against low yields." (p. 8) Farmers do not pay for the pollution they cause so they have no bottom-line incentive to reduce pollution.

> The goal must be to "… get the right nutrients in the right amount at the right time at the right place." (p. 202).

This WIP falls far short of moving toward that goal.

SECTION 7. URBAN/SUBURBAN STORMWATER

The regulations regarding "small MS4s" are very permissive and too nebulous to be effective.

Nutrient Management Plans (p. 71) that sanction nitrogen-based land application of animal waste and the use of the "Phosphorus Index" do not reduce pollution meaningfully. All nutrient management plans that involve animal waste should be P-based and adhere to the unenforced law for sludge stated in the Virginia Administrative Code 9VAC25-32-600 "The applied nitrogen and phosphorous content of biosolids shall be limited to amounts established to support crop growth." The amounts of nutrition are defined in "Standards."

The actions to be "considered" (p.78-79) should be mandated.

SECTION 8. ONSITE WASTEWATER

The assumption of each person loading at about 9 pounds of N per year is too high. It is widely accepted that the average adult excretes about 1 kilogram of N per year, mostly in the urine. The use of the number 8.92 pounds per year is a clear indication that the authors of this document do not understand the concept of "significant digits" as they cannot justify 8.92 as opposed to 8.91 or 8.93, irrespective of the fact that the number is too high by a factor of about 4!

Rather than require citizens to spend large amounts of money on maintenance-intensive onsite systems that purport to reduce pollution, but may not do so, it is better to keep nutrients out of septic systems rather than try to sop them up later. The smaller the water and solids load to a septic system, the more efficiently the system operates, the longer it

lasts and the less pollution it causes. Virginia's grey water laws must be modernized. There are more bacteria from animal waste on most people's property than there are bacteria in the "grey water." There is no excuse to put anything but "black water" (water from toilets) into septic systems. The "grey water" can be discharged directly to the drainfield or to a cistern where it can be used for irrigation. Garage disposals are an easily eliminated source of solids to septic systems and should be banned, especially in the tidewater.

SECTION 9. FOREST

Erosion caused by harvesting operations is small and although increasing implementation from 83% to 95% is desirable, funding is better spent elsewhere. Forests are "sinks" for nitrogen and the more forested land in the watershed, the better. According to the USGS NAWQA database, the nitrate concentration in groundwater beneath forested land is about 0.5 ppm compared to the concentration in acid rain approximately one order of magnitude higher, and not too different from the average nitrate concentration in groundwater beneath agricultural land (3.8 ppm). Given the massive pollution caused by agriculture, it is not a good use of time and money to address these kinds of tiny sources of pollution.

SECTION 11. OTHER MANAGEMENT PROGRAMS

Shoreline erosion – The program operates efficiently but does not affect undeveloped land, so its impact on pollution is trivial.

Clean Marina Program – The program is desirable but has no significant effect on nutrient or sediment pollution.

No Discharge Zones (NDZs) – All tidal creeks, and indeed, all of Chesapeake Bay should be NDZs, and the policy for the Bay should be uniform in Virginia and Maryland. EPA bears the responsibility for slowing progress by requiring that adequate pump-out facilities be present before a NDZ can be designated. Anyone wealthy enough to have a boat with a head can afford to plan ahead to pump out at existing facilities, just as they must plan ahead to take on fuel.

To summarize, this WIP does not place enough emphasis on reducing the largest source of pollution at its source. Inefficient agricultural fertilization is the largest source of Bay pollution and the WIP must address this undisputed fact by mandating increases in the efficiency of fertilization. A ban on the land application of animal waste must be phased in, preceded by mandated P-based land application. There is no science to support the benign nature of massive P disposal on the land. P is not an inert chemical element like gold. The only reason not to mandate P-based land application is to protect the profits of special interests. P-based land application would not negatively impact agricultural productivity.

Modern studies, even as reported in Scientific American (Feb. 2010, p. 69), find that "… less fertilizer does often does not mean fewer crops." "Simply reducing total application

to many crops is an excellent starting point; in many cases, fertilizer doses are well above the level needed to ensure maximum yield in most years, resulting in disproportionately large losses to the environment." Ultimately, conventional chemical fertilizers must be replaced with controlled-release fertilizers and a pollution tax on conventional fertilizer may be required to achieve that goal.

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