THE THOMAS JEFFERSON INSTITUTE FOR PUBLIC POLICY

POLICY ALTERNATIVES FOR CLEAN UP OF VIRGINIA WATERS

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Foreword

We all recognize the Chesapeake Bay as one of the greatest recreational assets and potential economic powerhouses in the Commonwealth of Virginia. That grand body of water suffers from modern day environmental hazards and we need a concerted effort to remove that harm and return the Bay to a vibrant resource for work and play.

Agriculture remains the single greatest cause of environmental damage to the Bay. Yet little is being done to encourage our farmers and ranchers to employ those practices that will enhance their economic well-being while improving the quality of the Chesapeake.

It was with this in mind that the Thomas Jefferson Institute teamed up with David Schnare, a well-respected and life-long free-market environmentalist, to look at the Chesapeake Bay and Virginia's rivers with an eye on how to clean up our waterways with the least amount of government command and control.

In the fall of 2005, the legislative commission looking at the future of the Chesapeake Bay, chaired by Appropriations Chairman, Delegate Vince Callahan, asked David Schnare to speak to them and to develop a policy paper on how Virginia could confront the issue of our polluted waterways in a way that brought market forces to bear in the policy.

The attached paper was written for commission member Kirk Cox and presented to the entire membership. It outlines a new and exciting approach to resolving the Chesapeake Bay pollution problem and helping to clean up our rivers at the same time. This paper brings best management practices to the table and knits them together with an appropriate market-oriented concept that keeps the focus on cleaning up our major waterways with less focus on the heavy hand of government control. Dr. Schnare maintains that substantial clean up of our waterways, including the Chesapeake Bay, is possible by spending much less money than has been proposed by the Department of Natural Resources (DNR) and by concentrating on Best Management Practices in agriculture.

Nothing in this paper is meant to influence the passage or defeat of any legislation. This paper does not necessarily reflect the opinions of the Thomas Jefferson Institute or its Board of Directors.

Michael W. Thompson, Chairman and President
Thomas Jefferson Institute for Public Policy
April 2006

POLICY ALTERNATIVES FOR CLEAN UP OF VIRGINIA WATERS

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ABSTRACT

It is a given that before determining how to pay for a project, one needs answers to the questions: "What do we have to do; when do we have to do it; and, how much will it cost." Indeed, it is mandatory to know "What happens if we don't do anything?" Members of the House Joint Resolution 640 Subcommittee posed these questions at the Subcommittee's September 29, 2005, hearing. They did not receive a straightforward answer to any of the questions. This paper attempts to answer them, reviews the state of knowledge needed to ensure cost-effective restoration of State waters (including the Chesapeake Bay) and proposes a phased approach that would target known sources of nutrients first while also relying first on the most cost-effective nutrient reduction measures. The proposal would allow Virginia to rapidly meet its Phosphorous and Sediment goals, and do no less Nitrogen reduction than those other proposals, and at a cost about one-third the current proposals.

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INTRODUCTION

It is a given that before determining how to pay for a project[1], one needs answers to the questions: "What do we have to do; when do we have to do it; and, how much will it cost." These were the questions posed by Delegate Cox at the September 29, 2005, meeting of the Subcommittee. To date, the Subcommittee received a single answer – one proposing the most expensive means available to reduce nutrients entering the Chesapeake Bay from point sources.[2] As discussed below, DNR's (Department of Natural Resources) proposal focuses exclusively on restoration of the Chesapeake Bay, thereby disregarding 40 percent of the Commonwealth's impaired waters – those which lie outside the Chesapeake Bay watershed and which the Subcommittee must also address. Nor does the DNR proposal reflect the practicality of alternatives to advanced chemical nutrient reduction treatment – alternatives that could reasonably reduce DNR's estimated cost of point-source treatment within the Chesapeake Bay watershed by 14% ($154 million) and speed restoration significantly. Indeed, the DNR proposal categorically rejects point source controls already successfully in place in Virginia and which more than double nutrient reduction, compared with the pollution controls DNR assumes. The DNR answer implies policy choices the Subcommittee need not and should not adopt.

This paper offers the Subcommittee an analysis of the alternative policies available to the Commonwealth under existing law and regulation. It begins with a summary of the law that authoritatively answers Chairman Vince Callahan's opening question at the September 29th meeting: "What happens if we don't do anything?" It then discusses the actions DNR must take prior to being able to rank restoration priorities (DNR admits it does not know the pollution sources for 54 percent of Virginia's impaired waters), followed by an analysis of options on ranking restoration priorities (where possible), the relative cost and cost-effectiveness of restoration alternatives, and schedules for implementation of alternative strategies. The paper concludes with a recommendation on funding, linking the implementation options with the funding sources previously discussed by the Subcommittee Staff[3] and endorses the core of the proposals made by Delegate Lingamfelter[4] .

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[1] House Joint Resolution 640 instructs the subcommittee to conduct a study and to: "determine the most effective means to provide a long-term funding source that will sufficiently and predictably generate the necessary revenue from sectors, including, but not limited to, state, federal, local and private sources, to fund the pollution reduction measures necessary to restore polluted waters identified on the Clean Water Act's "dirty waters" list. Specific attention shall be given to the Commonwealth's commitment and legal obligation to restore the polluted waters of the Chesapeake Bay and it tidal tributaries. House Joint Resolution No. 640, *see*: http://leg1.state.va.us/cgi-bin/legp504.exe?051+ful+HJ640ER (*Emphasis* added).

[2] *See*: "Estimated Needs: Water Quality Improvement Fund Quality 07-08 Biennium," Russ Baxter, Assistant Secretary of Natural Resources http://dls.state.va.us/groups/statewaters/meetings/092905/Baxter.pdf .

[3] "Additional Funding Considerations" *See*: http://dls.state.va.us/groups/statewaters/meetings/092905/AdditionalFundingConsiderations.pdf .

[4] Virginia Chesapeake Bay Clean-up Authority proposal. *See*: http://dls.state.va.us/groups/statewaters/meetings/092905/CleaningUpTheBay.pdf

I. WHAT IF WE DON'T DO ANYTHING?

Media reports on the Chesapeake Bay have accepted as an article of faith that Virginia is under a court order to limit discharge of nutrients into the waters of the Bay by 2010, and if Virginia does not, it will not only be in contempt of court, but could face loss of federal highway funds. This is completely false.

Restoration of the Chesapeake Bay rests on nothing more than a voluntary commitment amongst the states whose rivers discharge into the Bay.[5] Virginia suffers no legal consequences if it does not perform under that agreement and, indeed, none of the signatories to the agreement met their initial promises and have repeatedly chosen to extend deadlines and amend the agreement, rather than fund restoration from state revenues.

Under the Clean Water Act ("CWA" or "the Act"), Virginia shares responsibilities with the federal government, and in particular, the Environmental Protection Agency (Region III).[6] Under the Act, Virginia municipalities must apply "best practicable control technology" ("BPT") to remove "conventional" pollutants, which included nutrients.[7] This is the "secondary treatment" requirement that all Virginia municipalities have now met. The Act does not require municipalities to go beyond secondary treatment. In fact, EPA refused to redefine BPT to require greater nutrient removal, in part as the Act does not authorize such an extension.[8]

The Act also requires states to assess the quality of their waters, establish water quality goals, and if not met, to establish total maximum daily loads from point source and non-point source polluters. If Virginia refused to undertake such planning, the Act mandates that EPA conduct this planning. If Virginia did not do this work, the only risk it would face is loss of the state grant that partially pays for state costs of implementing the Act.

The commonly referenced "court order" also requires water quality assessment and the subsequent required actions – in essence, a court ordered implementation of the Act. The court order, however, is an order against EPA. EPA and Virginia made an agreement for Virginia to carry out the planning effort by 2010, in an attempt by EPA to avoid a court order. The court did not buy the approach, required more than the original agreement, and made the requirements of the order enforceable against EPA alone. As Virginia was not a party to the suit, the court could not and did not make the state responsible for carrying out the planning activities. This, however, is moot as the Commonwealth has fully performed under these agreements. If Virginia does not complete its planning by 2010, then EPA must do so by 2011, or be in contempt of court. The agreement, incorporated into the court order, has several intermediate deadlines – all enforceable against EPA, but not Virginia. Nothing in the order or the Act requires a

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[5] A full discussion of the voluntary agreements is presented in: U.S. EPA, Decision On Petition For Rulemaking To Address Nutrient Pollution From Significant Point Sources In The Chesapeake Bay Watershed, (June 13, 2005) *See*: http://www.epa.gov/water/cbfpetition/petition.pdf (page 6, et seq.)

[6] Congressional Research Service, "Clean Water Act: A Summary of the Law" (Jan 4, 2002), *See*: http://www.epa.gov/water/cbfpetition/petition.pdf .

[7] *Id*, at page CRS-4.

[8] : U.S. EPA, Decision On Petition For Rulemaking To Address Nutrient Pollution From Significant Point Sources In The Chesapeake Bay Watershed, (June 13, 2005), *see* http://www.epa.gov/water/cbfpetition/petition.pdf .

municipality or non-point source to turn over a single spade-full of dirt. The entire gravity of the action is to ensure Virginia has water quality standards, even if unenforceable.

The only forcing requirement under the water quality planning authorities of the Act is one that requires point sources to meet discharge limitations that Virginia concludes are necessary to achieve the water quality goals. Taking the BPT and water quality planning sections of the Act together, however, a permit requiring more than secondary treatment for nutrient removal is not federally enforceable under the authorities of the Act.[9]

Virginia, however, has the authority to require more than secondary treatment, and it is in the process of doing so at this time. Virginia's authority rises from state law, not federal law.[10] Under these proposed regulations, the Department of Environmental Quality will impose nutrient restrictions that will force municipalities to go beyond best practicable control technology (secondary treatment) and apply tertiary nutrient removal. Notably, it remains unclear whether EPA could bring an enforcement case against a Virginia municipality under Virginia laws and regulations. In general, the EPA has defined state laws as federally enforceable, and might take an action exclusively under the state authorities, but this would be an extremely rare event. The Department of Justice, which files such cases, would generally not accept a case exclusively under state law, especially if the State has initiated administrative or civil actions of their own.

In conclusion, Virginia is free to regulate and enforce its laws as it chooses. Under the Clean Water Act, state regulatory agencies generally attempt to harmonize regulatory enforcement with funding opportunities, a practice Virginia has followed.

Thus, in response to the question, "What if we don't do anything?, the answer is that Virginia is master of its own destiny and the Virginia legislature must decide what it can afford. The amount Virginia spends, the cost-effectiveness of its spending and the speed with which it spends – all control the amount and speed of Bay restoration. As discussed in the next section, this can significantly harm the economic viability of Virginia watermen, especially those who ply their trade in Virginia waters and coves.

II. WHAT DO WE KNOW AND WHAT HAVE WE ASSUMED?

DNR has done an outstanding job of assembling information about Virginia's waters. Based on data made available by DNR and its component units, the Appendix to this report provides a spreadsheet identifying each of the municipal point sources in Virginia, with information about their size, their location, the impairment status of the waters into which they discharge and the cost of alternative nutrient reduction and funding measures associated with each. The table also contains embedded links to the permit conditions on each facility, basic information on the facility (including compliance with current regulations), and fact sheets on the impaired water immediately downstream from each facility.

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[9] This has never been tested at law, but is the common interpretation by EPA's Office of General Counsel and Water Enforcement Division attorneys. Personal communications to the author. The Agency has chosen not to address this matter in writing, choosing instead to resolve matters through voluntary agreements under the Chesapeake Bay Agreement, and similar agreements in other major watershed.

[10] 9VAC25-31-50. *See*: http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC25-31-50 .

Information, alone, unfortunately, does not directly assist the Subcommittee. The Subcommittee needs the information presented in a manner that helps the Subcommittee understand its options. DNR's analysis of needed financing fails in this regard as it treats the Chesapeake Bay as a simple sink into which all rivers run and evaluates funding needs as though the goal is having reduced nutrients and sediments in the sink – treating the sink as a well mixed vessel with uniform water quality. That is not the case.

Virginia's waters flow within nine basic river basins, six of which fall within the Chesapeake Bay watershed. About 65 percent of the stream reaches fall within the Chesapeake Bay Watershed, and 38% (1,117) of those are impaired (25% of all reaches in the state). Outside the Chesapeake Bay watershed, 28% (463) reaches are impaired (10% of all reaches in the state). Not all impairments are equal, however.

Table 1 – Impaired Virginia Streams

	Stream Classifications						
	Does or will soon support uses or of Unknown Quality	Known Impaired Reaches (by impairment class)					
River Basin		4A	5A	5B	5C	5D	Total Impaired
Chesapeake Bay Watershed	**1843**	**52**	**670**	**285**	**60**	**50**	**1117**
Ches. Bay Coast	148	0	80	106	4	0	190
Potomac	484	39	214	33	13	13	312
James	826	8	229	7	24		268
Rappahannock	148	5	75	37	19	0	136
York	136	0	72	17	0	0	89
Chowan/Dismal Swamp	101	0	0	85	0	37	122
Non-Chesapeake Basins	**1169**	**78**	**363**	**0**	**8**	**14**	**463**
New	334	10	82	0	2	1	95
Tennessee/Big Sandy	384	21	111	0	0	1	133
Roanoke/Yadkin	451	47	170	0	6	12	235
Total	**3012**	**130**	**1033**	**285**	**68**	**64**	**1580**

Source: Final 2004 305(b)/303(d) Water Quality Assessment Integrated Report
http://www.deq.virginia.gov/wqa/ir2004.html

Impairment Classes.

FULLY SUPPORTING – Waters are supporting one or more designated uses
- EPA Category 1: Attaining all associated designated uses and no designated use is threatened.
- EPA Category 2: Some of the designated uses are met but there is insufficient data to determine if remaining designated uses are met.
  - Va. Category 2A - waters are attaining all of the uses for which they are monitored and there is insufficient data to document the attainment of all uses.
  - Va. Category 2B – waters are of concern to the state but no Water Quality Standard exists for a specific pollutant, or the water exceeds a state screening value. These waters are considered fully supporting with observed effects.

INDETERMINATE – Waters needing additional information
- EPA Category 3: Insufficient data to determine whether any designated uses are met
  - Va. Category 3A - no data are available within the data window of the current assessment to determine if any designated use is attained and the water was not previously listed as impaired.
  - Va. Category 3B - some data exists but is insufficient to determine attainment of designated uses. Such waters will be a prioritized for follow up monitoring.
  - Va. Category 3C- data collected by a citizen monitoring or other organization indicating water quality problems may exist but the methodology and/or data quality has not been approved for a determination of attainment of designated uses. These waters are considered as having insufficient data with observed effects. Such waters will be a prioritized for follow up monitoring.
  - Va. Category 3D – data collected by a citizen monitoring or other organization indicate that designated uses are attained however the methodology and/or data quality has not been approved for such a determination.

IMPAIRED – Waters are impaired or threatened but a TMDL is not needed.
- EPA Category 4A: impaired or threatened for one or more designated uses but does not require a TMDL because the TMDL for specific pollutant(s) is complete and US EPA approved.
- EPA Category 4B: impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements (such as VPDES limits under a compliance schedule) are reasonably expected to result in attainment of the Water Quality Standard by the next reporting period or permit cycle.
- EPA Category 4C: impaired or threatened for one or more designated uses but does not require a TMDL because the impairment is not caused by a pollutant and/or is determined to be caused by natural conditions.

IMPAIRED – requiring a TMDL
- EPA Category 5: Waters are impaired or threatened and a TMDL is needed.
  - Va. Category 5A - the Water Quality Standard is not attained. The AU is impaired for one or more designated uses by a pollutant(s) and requires a TMDL (303d list).
  - Va. Category 5B –the Water Quality Standard for shellfish use is not attained. One or more pollutants remain requiring TMDL development.
  - Va. Category 5C – the Water Quality Standard is not attained due to suspected natural conditions. The AU is impaired for one or more designated uses by a pollutant(s) and may require a TMDL (303d list). Standards for these waters may be re-evaluated due to the effects of natural conditions.
  - Va. Category 5D - the Water Quality Standard is not attained where TMDLs for a pollutant(s) have been developed but one or more pollutants remain requiring TMDL development.
  - Va. Category 5E – effluent limited waters are not expected to meet compliance schedules by next permit cycle or reporting period.

Impairments caused by nutrients and sediments generally fall within Category 5 impaired waters and the impairments are to benthic populations and dissolved oxygen quality. The benthos is the population of organisms living on the bottom of streams and other waters. These provide food for fish, crustaceans and mollusks. Fish, crustaceans and mollusks need oxygen to survive – oxygen dissolved into the water. If benthic and dissolved oxygen quality are impaired, then fish, crustaceans and mollusks cannot survive in those waters. These are the impairments of concern in the Chesapeake Bay and the basis for efforts to control nutrient and sediment

loadings, as sediments cover and thus kill the benthos organisms (and mollusks), while nutrients cause algae to consume dissolved oxygen, leaving too little for fish, crustaceans and mollusks .

Table 2 identifies the distribution of impairments in each of Virginia's major river basins that directly affect the health of fish, crustaceans and mollusks. Most notably, despite diligent, competent and extensive investigation by Virginia staff and citizens, the source of impairments remains unknown for 55 percent of these waters. In the specific case of Benthic and Dissolved Oxygen impaired waters, the source of the problem is unknown 43 percent of the time. Subtracting natural sources, the known target for nutrient reduction has been identified in only 34 percent of benthic and dissolved oxygen impaired waters. Of these, only 17 waters are impaired by point sources, not all of which are municipal waste water treatment facilities.

Looking exclusively at the Chesapeake Bay watershed, only 10 reaches have been identified as impaired by point sources. The Appendix identifies the six municipal facilities that impair river basins within the Chesapeake Bay watershed. As discussed below, these six plants would require a total of not quite $50 million to install nutrient reduction measures as necessary to address all known point sources of nutrient-related impairments to Virginia waters within the Chesapeake Bay watershed. This is considerably less than the $1.11 billion DNR claims is needed to control nutrients from point sources, and reflects the massive distortion of the assumption that the Chesapeake Bay is a simple sink requiring nutrient controls on all municipal facilities.

Table 2 –Impairments of Virginia Streams

River Basin	Category 5 Impaired Waters						
	Fecal & Bacterial			Benthic & DO			
	Point Source	Non-Point Source	Unknown Source	Natural Source	Point Source	Non-Point Source	Unknown Source
Chesapeake Bay Watershed	**7**	**93**	**277**	**61**	**10**	**42**	**123**
Ches. Bay Coast	0	0	39	4	1	3	32
Potomac	0	56	43	5	2	16	27
James	6	36	87	10	6	11	35
Rappahannock	0	0	50	3	0	0	3
York	0	0	8	3	1	12	13
Chowan/Dismal Swamp	1	1	50	36	0	0	13
Non-Chesapeake Basins	**4**	**118**	**82**	**15**	**7**	**54**	**22**
New	0	40	22	2	0	11	1
Tennessee/Big Sandy	3	21	27	4	1	33	18
Roanoke/Yadkin	1	57	33	9	6	10	3
Total	**11**	**211**	**359**	**76**	**17**	**96**	**145**

Source: Final 2004 305(b)/303(d) Water Qualitiy Assessment Integrated Report, Chapter 3.3.
See: http://www.deq.virginia.gov/wqa/pdf/2004ir/irch33ay04.pdf

It is important to note that DNR's costing assumption of the Bay as a simple sink is not only inconsistent with its own data, but with its assessments of the impairments on the Bay itself. As shown in Figure 1, the Virginia portion of the bay consists of 8 segments. The two into which the Potomac and the James basins flow are not considered impaired by Virginia waters, although the portion of the Bay receiving Potomac waters is considered a Maryland impaired water. The most southern portion of the Bay is simply not impaired. Of the remaining, the source of impairments in the two north-eastern segments are listed as "unknown".[11] The other four are impaired by "Nonpoint Sources, Point Sources and Sources Outside State Jurisdiction".[12] In other words, we don't know the actual sources, other than it had to come from somewhere in Virginia, Maryland, the District of Columbia or points further north and west.

Figure 1 –Segments of the Chesapeake Bay Impaired, in part, by Virginia

[11] *See*: http://gisweb.deq.virginia.gov/deqims/factsheet2004.cfm?tmdlid=VACB-C10E-POC and http://gisweb.deq.virginia.gov/deqims/factsheet2004.cfm?tmdlid=VACB-C10E-TAN

[12] *See*: http://gisweb.deq.virginia.gov/deqims/factsheet2004.cfm?tmdlid=VACB-R01E-CB6, http://gisweb.deq.virginia.gov/deqims/factsheet2004.cfm?tmdlid=VACB-R01E-CB7, http://gisweb.deq.virginia.gov/deqims/factsheet2004.cfm?tmdlid=VACB-R01E-MOB and http://gisweb.deq.virginia.gov/deqims/factsheet2004.cfm?tmdlid=VACB-R01E-CB5.

Because DNR does not know the actual sources of impairments to water quality in the Chesapeake Bay, it has had to make a hard choice. They chose to focus on municipal point sources because they can use permits and grants to control nutrient emissions from these sources, and if they force nutrient reduction at every plant, they will have ensured reductions at the plants that actually cause the problems, although they will never know which were the real problem.

In so doing, DNR discounts the larger and more important known source of nutrients into Virginia waters and the Bay – agricultural croplands. In so doing, it misses the opportunity for potentially massive and extremely cost-effective nutrient reductions available from broad application of best agricultural management practices.[13] As shown in Table 3, Ag BMPs, alone, may be able to reduce the phosphorus loadings to the rivers and the Bay enough to meet the Chesapeake Bay Agreement goals for Virginia. No one can say whether this is sufficient to ameliorate the dissolved oxygen problems, but as algae need both phosphorus and nitrogen, the DNR approach misses the opportunity to use a significantly lower cost approach that may solve the dissolved oxygen problem in parts of the Bay and many of the impaired rivers. As for benthics, this is mostly a sediment problem, one for which point source controls offer no relief whatever.

Table 3

Percent of Virginia nutrient pollution eliminated by point sources funding plans and by conservation crop tilling practices

	TN	P	Sediment
Water Quality Goal	***34 %***	***39 %***	***21 %***
Maximum Point Source Reductions:			
○ under the "Dollar a Week" plan	10 %	7 %	none
○ under the $50 Million/yr plan	6 %	4 %	none
Continuous No-Till Crop Management Reductions:			
○ **1 million acres**	**11** %	**34.8**%	**66.3** %
○ 500,000 acres	5.5%	17.6%	33.1 %

DNR adopted its approach because it lacked information needed to pinpoint restoration efforts. When the source of impairments is unknown for about half the impaired rivers and streams and is completely unknown for the Bay itself, one alternative is to wait for better information before making large investments. A better approach is to use the information available to target known problems and implement step-wise, cost-efficient pollution controls that allow assessment of improvements over time, leaving the decision to make higher cost investments to a point in time when it becomes clear what is needed. The next section offers one such incremental approach.

[13] DNR does not ignore these potential reductions, but its watershed management plans deeply underestimate the amount of reductions available and their funding proposals reflect no more than a minor commitment to this massive opportunity. *See*: Schnare, "Options for Clean Up of State Waters", September 29, 2005, http://dls.state.va.us/groups/statewaters/meetings/092905/CleanUpOptions.pdf.

III. WHAT DO WE HAVE TO DO AND WHEN DO WE HAVE TO DO IT

Currently available information allows targeting of immediate investment opportunities. Those opportunities include point and non-point sources and should require integration of point-nonpoint source solutions, where they are cost effective. A second step would target impaired waters where sources may be unknown, but which likely reflect low-cost opportunities with high potential payoffs. A third step would come after assessment of the effectiveness of the first two phases. Unlike the basic DNR costing proposal, this approach would address all nine river basins and the Chesapeake Bay.

A. Phase I – Known Sources

Point Sources: Nine municipal facilities are known to cause nutrient-based impairments to Virginia waters, only 2 of which contribute to impaired sections of the Chesapeake Bay. Of these 9, the first four shown in Table 4 are specifically targeted for state funds. Three of the four do not contribute to impairments in the Bay. The total amount DNR would grant and loan these facilities is shown in the column entitled "Advanced Chemical Treatment Cost".

Table 4

On list of 46	Facility	River Basin	Nutrient Impairment From Point Source	Nutrient Impairment from NPS	Advanced Chemical Treatment Cost	Irrigation/CNT Cost
POINT SOURCE NUTRIENT IMPAIRMENT						
Chesapeake Bay Watershed Basin						
X	Covington	James	✓	✓ (Ag & Urban)	$6,300,000	Geo-Infeasible
X	Richmond (DWF only)	James	✓		$32,100,000	Geo-Infeasible
X	Clifton Forge	James	✓		$5,200,000	$2,650,000
X	Onancock	Chesapeake Bay	✓		$3,700,000	$1,900,000
	Alleghany Co - Lower Jackson RIVER WWTP	James	✓	✓ (Ag & Urban)	$5,854,106	$2,977,053
	Massanutten STP	Potomac	✓		$5,854,106	$2,977,053
Non-Chesapeake Bay Watershed Basins						
	Christiansburg Town	New	✓	✓ (Ag & Urban)	$8,284,455	$4,192,228
	South Hill WWTP	Roanoke/ Yadkin	✓		$5,854,106	$2,977,053
	Henry Co PSA	Dan	✓	✓ (Ag & Urban)	$8,284,455	$4,192,228
				TOTAL	$81,431,230	$21,865,615

If, however, seven of these nine plants used spray-irrigation in place of advanced chemical treatment, and the irrigated fields applied continuous no-till crop management, rather than a nutrient reduction to the river basin of 40% (of nutrients in the waste water from these facilities), their nutrient reduction to the river would be 180% of nutrients in their waste water, due to a 90% reduction of nutrients due to spray irrigation and continuous no-till and the elimination of chemical nutrients typically applied to the crops. The savings would also be large. In place of a $47.3 million cost for the four DNR targeted facilities, a known-source, cost-efficient approach would produce significantly more nutrient reduction for only $21.9 million,

less than half the cost. The total Phase I point source costs for the Chesapeake Bay basin would be $49 million for six plants versus $43 million for the four DNR List of 46 plants.

Non-Point Sources: As discussed above, the source of benthic and dissolved oxygen impairment in 96 waters result from non-point sources (NPS), the vast majority of which are rural. Considering the activities found on the 145 waters where the source of the benthic and dissolved oxygen impairment is unknown, most of these are likely agricultural NPS sources as well. These approximately 230 rural waters account for nearly 90 percent of Virginia waters with benthic and dissolved oxygen impairments.

About 60 percent of agricultural NPS nutrient discharges come from croplands, a number which includes 80% of manure wastes. The remainder of NPS nutrient loadings come from hay crops, pasture and manure storage.[14] There are approximately 1,000 small grain and corn crop farmers in Virginia. The total cost for WQIF incentives that spur use of continuous no-till crop management, and related other agricultural best management practices that reduce nutrient loadings to Virginia waters, is approximately $50,000 per farm, or $50 million statewide (plus $5 million for essential new technology-transfer Soil and Water District staff).[15]

By weight, about 40% of sediment discharges into Virginia waters come off crop lands, the remainder from hay fields and pasture land.[16] As shown in table 4, use of continuous no-till on crop lands would produce three times Virginia's sediment reduction goal for the Bay. This non-point sediment discharge is the single biggest threat to benthic health in Virginia's waters and accounts for nearly all rural stream benthic impairments. Continuous no-till crop management, combined with cover crops and other related agricultural BMPs used to increase the carbon base in fields (collectively: "CNT"), prevents over 95% of sediment runoff. Thus, agricultural nutrient controls from CNT also produce the sediment reduction sought in Virginia waters and in the Bay.

The total cost of a Phase I (program) that addresses known sources of benthic and dissolved oxygen in all Virginia river basins would sum to about $117 million, $41 million of which would be in loans under the state revolving fund. It would take about 3 years to implement this phase, considering the management challenges discussed in the final section of this paper.

B. The James River as a Phase I example

The James River basin contains about 1,094 identifiable "waters" (sections of the James or sections of tributaries to the James). Of these, 268 are listed as impaired and 62 of those have benthic or dissolved oxygen impairments. The basin contains four municipal facilities that are the source of benthic or dissolved oxygen impairments, only three of which are on the DNR list of 46. Figure 2 shows the location of these facilities and the impaired waters (all causes).

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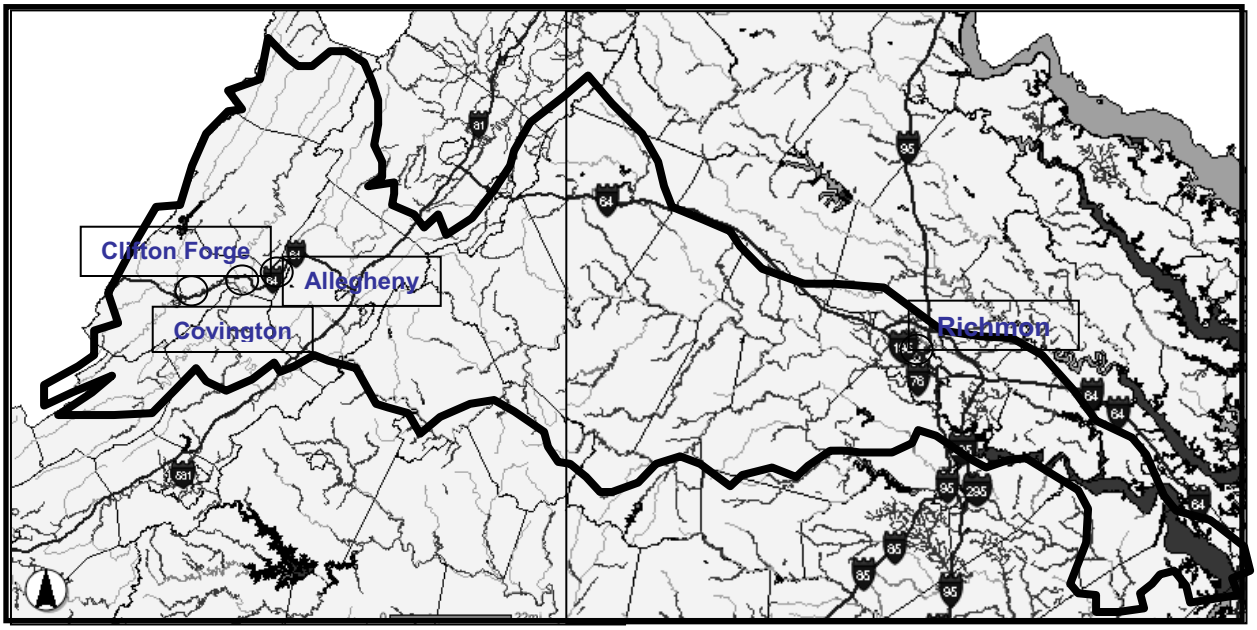
[14] The EPA Chesapeake Bay Program generates estimates of sources of nutrients into the bay. These figures were drawn from estimates provided by EPA in the spring of 2005. EPA Contact gshenk@chesapeakebay.net

[15] *See*: Schnare, "Options for Clean Up of State Waters", September 29, 2005, http://dls.state.va.us/groups/statewaters/meetings/092905/CleanUpOptions.pdf.

[16] *Op cite.* (note 14).

As discussed above, the James River Basin makes no contribution to impaired sections of the Chesapeake Bay. Notably, 9 large municipal facilities (greater than 20 MGD) discharge directly to the lower James, but do not cause nutrient impairments in the Chesapeake Bay. The James River Estuary (the mouth of the river), however, is impaired and of considerable economic interest to the state for its potential mollusk and crustacean fisheries. Although most agricultural non-point sources of nutrients and sediment in half the Lower James have already been controlled by use of CNT practices, the estuary benthic environment is still not in sufficiently good health to allow for a return to the historic production of oysters, clams and other near-shore marine catch. This appears to be predominantly a sediment problem, rather than a nutrient problem.

Figure 2 – the James River Basin



A Phase I program for this basin would address many of the elements of the James River Tributary Strategy, but would significantly depart from certain policies. Under the current DNR strategy, "all wastewater treatment plants [must] have some minimum role in the nutrient reduction efforts within the Virginia Bay watershed," and that involvement would not be dependant upon the effectiveness of non-point source achievements.[17] Based on the discussion above, only four of the 19 municipal facilities are known to cause impairments and thus require immediate address. The 18 Soil and Water Districts within the basin would have the major responsibility for a Phase I program and their major duty would be to export the CNT successes in the Lower James to the Middle and Upper James segments. Joint use of spray irrigation and CNT in two of the western facilities would likely speed adoption of these inexpensive and essential agricultural best management practices. In place of a point-source driven program

[17] "Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the James River, Lynnhaven and Poquoson Coastal Basins" (March 2005) at p. 49, http://www.naturalresources.virginia.gov/Initiatives/TributaryStrategies/FinalizedTribStrats/james.pdf.

expected to cost $420 to $460 million, a Phase I approach would cost approximately $44 million for point sources and perhaps as much as an additional $22 million for an agricultural BMP incentives program.

C. Known Non-Sources

DNR's impaired water quality fact sheets impeach the presumption that all point sources cause benthic and dissolved oxygen impairments in Virginia waters. DNR's impaired waters fact sheets identify only nine of Virginia's 96 municipal wastewater facilities (9%) as the cause of benthic or dissolved oxygen (nutrient-related) impairments.[18] Of these nine, only 6 are within the Chesapeake Bay watershed. In contrast, DNR proposes the first grants and loans to three facilities, not one of which has been found to constitute a source of impairment of Virginia waters of any kind (fecal, benthic, dissolved oxygen, toxic chemicals or fish/shellfish restrictions). Among its list of 46 facilities to be funded in the '07-'08 biennium, 17 facilities (37%) discharge into waters that DNR has concluded do not suffer from any impairment of any kind. The price tag for DNR-proposed treatment on these 17 facilities is more than $125 million in grants and loans.

A particularly egregious targeting of a "known non-source" is DNR's inclusion of the Timberville facility in the "list of 46". This facility uses spray irrigation in place of advanced chemical treatment, achieving a more than 90 percent reduction in nutrients reaching the Shenandoah river, as compared with a 40 percent reduction available from advanced chemical treatment. This facility does not discharge into a nutrient-impaired water. DNR has placed the facility on its "list of 46", and would have the facility expend $2.5 million, apparently to replace a working installation with chemical treatment at twice the cost and with less than half the nutrient reduction. The better solution is to leave the relatively new Timberville facility in place, but have the cropland onto which the effluent is sprayed use CNT methods, thus ensuring the nutrients not used by crops remain fixed in the soil. This would also reduce sediments otherwise flowing into the river. Of course, Timberville is not the only "known non-source" on the list of 46.

Eight of the "list of 46" facilities discharge into benthic or dissolved oxygen impaired waters. Notably, DNR does not consider any of the 8 to be the source of the benthic or dissolved oxygen impairment. The cost of DNR-proposed treatment on these 8 facilities is more than $65 million in grants and loans. In seven of these 8 cases, the facilities could use spray irrigation and CNT, at a total cost of $20 million for the 7, compared with a $39.5 million price tag for advanced chemical treatment at the seven facilities. The spray irrigation/CNT approach would also quadruple nutrient reductions at these seven plants, as compared with chemical treatment, and would produce significant reductions in agricultural NPS nutrient and sediment discharges, which DNR believes are the sources of impairment to these waters. Even this $20 million may not be cost-effective as use of CNT practices on all the cropland discharging into these eight waters may be sufficient to meet water quality goals. If it were, Virginia need expend less than a million dollars using CNT in place of $65 million for chemical treatment.

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[18] *See* the Appendix. Note, DNR has identified more than 96 municipal facilities, but EPA data bases, which depend on state data, identify only the 96 described in the Appendix.

Arguably, each of the facilities on the "list of 46" contribute significant nutrient loadings to the Chesapeake Bay, even though only 4 actually impair Virginia waters. Phase II addresses when and whether to fund advanced treatment at these plants.

D. Phase II – Ensuring Cost-Efficiency and Trading Non-Point Source reductions

As discussed above, application of agricultural best management practices on all 1.1 million acres of small grain and corn cropland would cost approximately $55 million, and, in conjunction with Phase I, would result in Virginia meeting Phosphorus and sediment goals under the Chesapeake Bay agreement. The current DNR "list of 46" proposal, alone, would cost $460 million in grants and loans, and would not achieve any of the goals. Further, use of spray irrigation and CNT crop management (on the irrigated fields) at the qualified list of 46 facilities would produce two to four times the nutrient reduction at one-fourth to one-seventh the cost.

These facts support three policies: (1) grants and loans should not go to point sources without first examining the effectiveness of Phase I efforts; (2) no grant or loan should go to a facility until it has fully explored the cost-effectiveness and utility of spray irrigation (w/ CNT) in place of advanced chemical nutrient reduction; and (3) creation of a nutrient trading program that would produce nutrient reduction on agricultural lands in place of advanced chemical nutrient reduction at a point source.

Phase II need not wait for completion of Phase I activities. The second and third policies should immediately apply to any municipal facility seeking funds for nutrient reduction. Further, the improvements on water quality from any nutrient reduction technique, including CNT and related agricultural best management practices, is observable within 6 to 18 months.

Early Phase I information on the benefits of the most cost-effective techniques should fill the existing data gap in two ways. First, it will help determine the source of nutrient-related impairments where they are now unknown, allowing better targeting for grants and loans. If control of agricultural sources does not sufficiently reduce nutrients, only then would Virginia need to expend its grants and loans on higher-cost solutions – first at facilities where spray irrigation is feasible, and then, as a last resort, using the highest cost advanced chemical nutrient reduction. Second, a non-point source – point source nutrient trading program will speed the development of information needed to implement Phase II policies and will create the environment for other NPS nutrient reduction activities, including cost-effective urban and suburban NPS reductions.

E. Phase III – Use Lowest Cost Point Source Treatment at Every Municipal Facility in the Chesapeake Bay

Conceivably, Virginia will be unable to withstand the unfounded presumption that every municipal point source in the Chesapeake Bay watershed must install nutrient reduction technology. A final Phase III – "Throw in the towel and the bathroom sink" alternative would have every facility use its least cost treatment option, without trading with non-point sources.

This would involve all municipalities on the Chesapeake Bay Watershed not included in Phases I and II.

IV. "How Much Will It Cost"

Table 5 displays the estimated costs of the DNR proposal and the alternatives offered above.

Table 5 – Alternative Costs for Nutrient Reduction in the Chesapeake Bay Watershed

	FY '06		FY '07 – '08		Out Years (to 2010)		Total
Element	**Grants**	**Loans**	**Grants**	**Loans**	**Grants**	**Loans**	
DNR List of 46 (I)*	$41 M	$41 M	$302 M	$302 M	$208 M	$208 M	$1,102 M
DNR List of 46 (II)*	$40 M	$40 M	$124 - $164 M	$124 - $164 M			$ 898 M– $1,058 M
DNR PS non-46** Remainder					$285 - $325	$285 - $325	
DNR NPS (all Ag)			$90 M		$150 M		$ 240 M
						Total	$1,342 M
Phase I – (PS)			$41 M	$41 M			$ 82 M
Phase I – (NPS Ag)	$50 M		$55 M		$ 30 M		$135 M
Phase II – (Low Cost PS)			$17 M	$18 M			$ 35 M
Phase II – (Last Resort Low & High Cost PS)					$126 M	$126 M	$252 M
						Total	$ 504 M
	Total Program Costs (2006 - 2010)				**Grants**	**Loans**	**Total**
	DNR (I) & Ag				$791 M	$551 M	$1,342 M
	Phased Alternative				$319 M	$185	$ 504 M
	Phase III (Kitchen Sink Remainder)				$274	$275	$ 549 M

* DNR has provided two sets of estimates, a set of budget estimates prepared by DEQ and incorporated into the Appendix, and those presented by Deputy Secretary Baxter to the Subcommittee at the Sept. 29, 2005, hearing (*See*: http://dls.state.va.us/groups/statewaters/meetings/092905/Baxter.pdf). The Budget estimates are shown as DNR (I) and the Deputy Secretary's estimates are shown as DNR (II).

** DNR did not cost the nutrient reduction needs for the remaining 50 systems. The costs are estimated based on regression of the costs of the 46 facilities with their respective millions of gallons per day of discharge, a common estimator for cost.

V. Managing the Process

At the September 29, 2005, hearing of the Subcommittee, Delegate Lingamfelter, a member of the Subcommittee, clearly identified the challenges Virginia must confront when implementing a complex initiative that will cost from one-half to one billion dollars and require

participation by a diverse set of stakeholders.[19] In his presentation, Delegate Lingamfelter proposes several policies that appear essential to successful restoration of the Bay.

- **Do not tie restoration to the so-called 2010 deadline.**

  That deadline involves only planning, not implementation, and has no relationship to the availability of engineering capacity, funding capacity or basic information on sources of impairments.

- **Rank work within phases to meet phased objectives and align funding to these phases.**

  Because we can identify some clear nutrient targets (both point source and non-point source), and because we do not know the source of others, there is a natural phasing that takes advantage of what we know and what we don't. The proposal offered above begins with an attack on known sources, using lowest cost approaches. A second phase builds off the knowledge rising out of the first phase and addresses likely next-best targets. Virginia would need some part of a third phase, high cost, phase only when it know there were no better alternatives.

- **Schedule biennium funding based on realistic expectations.**

  In the absence of multi-year funding, and in light of many competing needs, State funding must be carefully aligned with the reasonably expected needs.

- **Fund the most cost-effective projects first**.

  The size of the need and the knowledge that Virginia can exploit nutrient reduction techniques far less expensive than advanced chemical treatment demands a mechanism to ensure cost-efficient solutions are used first. The phased approach discussed above builds from this policy.

- **Establish an Authority to manage this massive restoration program.**

  Virginia already has a complex bureaucracy working on Chesapeake Bay issues. Although the Chesapeake Bay program has been restructured in the past few years, it is clear the elements in DNR have only partially succeeded in coordination efforts within DNR much less with the Department of Agriculture and Consumer Services.

  A program coordinator reporting directly to both the Secretaries of Natural Resources and Agriculture may help bring the disparate efforts together more effectively, but program coordination alone will not solve the problem. It is not clear, however, that a new Authority is the answer. That authority would either duplicate existing services or draw those services into a new organization, forcing that staff to abandon some work that is not well aligned with an Authority's function.

[19] *See*: http://dls.state.va.us/groups/statewaters/meetings/092905/CleaningUpTheBay.pdf .

A lower cost and more manageable alternative would be a limited-term strike force that has access to resources within DNR and Agriculture. Its role would be to target all nutrient-related funding (including loans and bond activities) using all available information and expanding the information base, ensure cost-effective, nutrient reduction, facilitate that funding, provide technical assistance, train and coordinate with local staff and manage major implementation projects. Of single importance on such a strike force would be individuals already successful in fostering implementation of key agricultural NPS best management practices and low-cost point source treatment.

- **Increase Bonding Capacity and Establish "Chesapeake Bay" revenue-based bonds**

  Rather than force Bay restoration to compete with other essential public needs, including other environmental programs, transportation, Medicaid and public safety, a bond program could generate the funds needed for restoration. The Chesapeake Bay Foundation suggests that Virginians would be willing to generate large funds to pay for restoration. Such promises don't translate into support for tax increases, but may well translate into investment in such bonds. Further, the pool of potential bond buyers would stretch well outside the borders of the Commonwealth. Legislative action to expand bonding capacity and a well marketed bond effort could produce all needed funds without resorting to further encroachment on the general fund.

  A second element of the bond approach deserves attention. The proposal would target half the bond funds at non-point source programs. Based on a hard look at the cost of agricultural BMPs and the highly expensive and low cost-effectiveness of urban BMPs, this 50%-50% division of bond funds probably requires considerable review, as does the total bond amount initially proposed. Delegate Lingamfelter has acknowledged that he offered his proposals to open the debate and this element of his bond proposals may deserve additional attention.

CONCLUSION

Virginia has the opportunity to be the first state to successfully restore its rivers and meet its commitments to restoration of the Chesapeake Bay. Current proposals fail to use existing knowledge about how to target clean-up activities to ensure Virginia meets its goals in the most timely and cost-effective manner possible, using known cost-effective measures. This paper reviews the state of knowledge needed to ensure cost-effective restoration and proposes a phased approach that would target known sources of nutrients first while also relying first on the most cost-effective nutrient reduction measures. The proposal would allow Virginia to rapidly meet its Phosphorous and Sediment goals, and generate as much Nitrogen reduction as other proposals, and at a cost about one-third (37%) of the other proposals.

- End -

About the Author

Dr. David Schnare is an attorney and Senior Environmental Specialist in the Office of Enforcement and Compliance Assurance (Compliance) at the United States Environmental Protection Agency (EPA). He is Vice Chair of the Regulatory Initiatives Committee for the American Bar Association. He is also CEO of Schnare and Associates, Inc., a professional corporation providing legal representation, legal and policy analysis and information brokering services.

Bringing his "balanced" environmental views to his community, Dr. Schnare is the Chairman of the Environmental and Land Use Committee of the Occoquan Watershed Coalition, an organization of 143 homeowners associations in western Fairfax County, Virginia. He has also served as a Member of the Fairfax County Environmental Quality Advisory Council and on the Citizens' Advisory Council of the Virginia-Maryland Regional College of Veterinary Medicine at the Virginia Polytechnic Institute and State University (Virginia Tech). Most recently, he Co-Chaired the Occoquan Watershed Task Force, a group appointed by the Chairman of the Fairfax County Board of Supervisors to make a thorough assessment on the status of the watershed and to make recommendation on how to ensure its continued protection.

Dr. Schnare's honors include: Law Review at George Mason University School of Law; Inns of Court (GMUSL); Sigma Xi (Science Honorary); Delta Omega Service Award (Public Health Honorary); National Science Foundation Research Fellowship; LEGIS Fellowship; and the U.S. Public Health Fellowship. He was awarded the EPA Bronze Medal on four occasions, the EPA Assistant Administrator for Enforcement's Personal Recognition Award, the Vice President's Hammer Award and a U.S. Department of Justice Certificate of Commendation. He is an Honorary Member of the Water Quality Association.

Dr. Schnare earned his JD in 1999 from George Mason University School of Law. While attending law school (and working full-time at EPA) he was the Hogan (Environmental) Essay winner and served on the Law Review and the Inns of Court. He graduated Cum Laude (Order of the Coif). He holds his PhD in Environmental Management from the University of North Carolina-Chapel Hill, a Master of Science in Public Health-Environmental Science from the University of North Carolina School of Public Health, and a Bachelor's Degree from Cornell College in Mt. Vernon, Iowa where he majored in chemistry and mathematics.

Permit No.	On list of 46	Facility	MGD	Pop	Watershed	River Basin	Receiving Water	Impairment	CSO	Nutrient-based Impairment PS	Nutrient-based Impairment NPS	Traditional Plant Total Cost	Irrigation/CNT Total Cost	Irrigation/CNT WQIF Cost (50% STP +Ag Incentive)
POINT SOURCE NUTRIENT IMPAIRMENT														
Chesapeake Bay Watershed Basin														
VA0025542	X	Covington	3	6,471	Upper James.	James	Jackson River	PS & NPS Ag & Urban P	No	Urban	Ag & Urban	$6,300,000	Geo-Infeasible	Geo-Infeasible
VA0063177	X	Richmond (DWF only)	70	74,999	Middle James	James	James River	NPS Urban N/P/Sed	Yes(31)	Urban		$32,100,000	Geo-Infeasible	Geo-Infeasible
VA0022772	X	Clifton Forge	2	5,772	Upper James	James	Jackson River	PS Urban P	No	Urban		$5,200,000	$2,650,000	$1,350,000
VA0021253	X	Onancock	0.25	2,728	Western Lower Delmarva	Chesapeake Bay	Onancock Creek	DO-PS Urban P	No	Urban		$3,700,000	$1,900,000	$975,000
VA0090671		Alleghany Co - Lower Jackson RRIVER WWTP	2	3,093	Upper James.	James	Jackson River	PS & NPS Ag & Urban P/Sed	No	Urban	Ag & Urban	$5,854,106	$2,977,053	$1,513,527
VA0024732		Massanutten STP	2	2,709	Upper Potomac	Potomac	Quail Run	PS Benthic (DO)	No	Urban		$5,854,106	$2,977,053	$1,513,527
Non-Chesapeake Bay Watershed Basins														
VA0061751		Christiansburg Town	4	8,641	Upper New	New	Crab Creek	PS & Ag NPS P	No	Urban	Ag & Urban	$8,284,455	$4,192,228	$2,121,114
VA0069337		South Hill WWTP	2	4,862	Roanoke Rapids	Roanoke/ Yadkin	Flat Creek	Benthic (PS discharges)	No	Urban		$5,854,106	$2,977,053	$1,513,527
VA0069345		Henry Co PSA	4	5,630	Upper Dan.	Dan	Smith River (lower)	Benthic (PS discharges)	No	Urban	Ag & Urban	$8,284,455	$4,192,228	$2,121,114
NPS NUTRIENT IMPAIRMENT														
Chesapeake Bay Watershed Basin														
VA0064793	X	Middle River	5.3	4,830	Shenandoah	Potomac	Middle River	NPS Ag N/P/Sed	No		Ag	$10,300,000	$5,200,000	$2,625,000
VA0020460	X	Vint Hill	0.95	7,974	Middle Potomac-	Potomac	South Run	Benthic unknown source	No		Ag	$4,500,000	$2,300,000	$1,175,000
VA0026514	X	Dahlgren SD*	1	3,064	Lower Potomac	Potomac	Williams Creek(a)	DO (unknown source)	No		Ag	$1,600,000	$850,000	$450,000
							Williams Creek(b)	DO (unknown source)			Ag			
VA0075434	X	HRSD-West Point	0.6	504	Mattaponi	York	Mattaponi River	NPS Ag N/P	No		Ag	$7,200,000	$3,650,000	$1,850,000
VA0028819	X	Mathews CH	0.1	2,210	Great Wicomico-Piankatank	Chesapeake Bay	Put In Creek	DO (unknown source)	No		Ag	$2,600,000	$1,350,000	$700,000
VA0021288	X	Cape Charles	0.25	1,895	Western Lower Delmarva	Chesapeake Bay	Chesapeake Bay	Benthic unknown source	No		Ag	$3,800,000	$1,950,000	$1,000,000
VA0075191	X	Parkins Mill	2	34,317	Conococheague-Opequon	Potomac	Opequon Creek	NPS Ag & Urban N/P/Sed	No		Ag & Urban	$9,530,000	$4,815,000	$2,432,500
VA0063690	X	Henrico Co.	75	2,885	Conococheague-Opequon	James	Lower James	NPS Ag & Urban N/P/Sed	No		Ag & Urban	$25,300,000	Geo-Infeasible	
VA0025291		Fishersville Regional STP	2	5,701	Shenandoah	Potomac	Christians Creek	NPS Ag N/P/Sed	No		Ag	$5,854,106	$2,977,053	$1,513,527
VA0065552		Opequon Water Reclamation	16	9,437	Conococheague-Opequon	Potomac	Opequon Creek	NPS Ag N/P/Sed	No		Ag	$22,866,547	$11,483,274	$5,766,637
VA0060194		Proctors Creek WWTP	27	14,433	Maury	James	James River	NPS Ag & Urban N/P/Sed	No		Ag & Urban	$36,233,465	Geo-Infeasible	
Non-Chesapeake Bay Watershed Basins														
VA0020940		Big Stone Gap WWTP	2	6,392	Powell	`	Powell River	NPS Ag & Urban P	No		Ag & Urban	$5,854,106	Geo-Infeasible	
VA0052850		Virginia Tech	0.254	na	Upper New	New	Stroubles Creek	NPS Ag & Urban N/P/Sed	No		Ag & Urban	$3,732,412	$1,916,206	$983,103
VA0062685		Peppers Ferry Regional	9	na	Upper New	New	New River	NPS Ag N/P	No		Ag	$14,360,327	Geo-Infeasible	
												$153,730,964	$36,491,533	
URBAN NPS NUTRIENT IMPAIRMENT												**$252,210,456**		
Chesapeake Bay Watershed Basin														
VA0025151	X	Waynesboro	4	19,180	Shenandoah.	Potomac	South River	NPS Urban (benthic)	No		Urban	$8,600,000	$4,350,000	$2,200,000
Non-Chesapeake Bay Watershed Basins														
VA0067351		Scott County PSA	1.25	11,548	Holston. (TN)	Tennessee/ Big Sandy	Holston River	HG / NPS Urban (benthic)	No		Urban	$4,942,726	Geo-Infeasible	
SHELLFISH & FISH RESTRICTION														
Chesapeake Bay Watershed Basin														
VA0081311	X	HRSD-York	15	12,606	York	York	Back Creek	Shellfish VDH Restriction	No			$37,200,000	Geo-Infeasible	
VA0081299	X	HRSD-Nansemond	30	34,230	Lower James	James	James River	Shellfish VDH Restriction	No			$23,500,000	Geo-Infeasible	
VA0081272		HRSD - James River STP	20	47,707	Lower James	James	Newmarket Creek	Shellfish VDH Restriction	No			$27,727,244	Geo-Infeasible	
Non-Chesapeake Bay Watershed Basins														
VA0025020		Western Virginia WTP	42	52,285	Upper Roanoke	Roanoke/ Yadkin	Roanoke	NPS Urban Sed. Fish VDH Restriction PCB	No			$54,461,080	Geo-Infeasible	
VA0020362		South Boston WWTP	2	6,802	Lower Dan	Roanoke/ Yadkin	Dan River	Fish VDH Restriction DDT	No			$5,854,106	$2,977,053	$1,513,527
VA0020451		Altavista Town - WTP	3.6	5,999	Upper Roanoke	Roanoke/ Yadkin	Staunton River	Fish VDH Restriction PCB	No			$7,798,385	$3,949,193	$1,999,596
VA0026409		Colonial Beach	2	4,650	Lower Potomac	Potomac	Monroe Creek	Shellfish VDH Restriction	No1			$5,854,106	$2,977,053	$1,513,527
VA0060593		Danville City - Northside	24	17,062	Lower Dan	Roanoke/ Yadkin	Dan River	Fish VDH Restriction PCB/DDT	No			$32,587,942	Geo-Infeasible	
VA0060844		Blacksburg VPI	9	na	Upper New	New	New River	Fish VDH Restriction PCB/DDT	No			$14,360,327	Geo-Infeasible	
VA0090531		Buchanan Cnty PSA	2	1,528	Upper Levisa	Tennessee/ Big Sandy	Levisa Fork River	Fish PCBs	No			$5,854,106	Geo-Infeasible	
SWIMMING IMPAIRMENT														

Chesapeake Bay Watershed Basin														
VA0089915	X	Hanover Cnty Totopotomoy	5		2,008 Pamunkey	York	Totopotomyoy Creek	pH, fecal	No			$12,000,000	$6,050,000	$3,050,000
VA0025143	X	Arlington*	40		152,922 Middle Potomac-	Potomac	Four Mile Run	NPS fecal	No			$51,590,000	Geo-Infeasible	
VA0060640	X	North River	16		2,872 Shenandoah	Potomac	North River	NPS fecal	No			$23,000,000	$11,550,000	$5,800,000
VA0090263	X	SIL MRSS Timberville	1.93		4,147 Shenandoah	Potomac	N.F. Shenandoah	NPS fecal	Yes			$2,500,000	$50,000	$675,000
VA0061590	X	Culpeper	4.5		8,775 Rapidan-Upper Rappahannock	Rappahannock	Mountain Run	NPS fecal	No			$6,900,000	$3,500,000	$1,775,000
VA0025518	X	RWSA-Moores Creek	15		37,943 Rivanna	James	Moores Creek	NPS fecal	No			$18,300,000	$9,200,000	$4,625,000
VA0066630	X	Hopewell WWTP	50		18,872 Lower James	James	Gravelly Run-James	NPS fecal	No			$59,300,000	Geo-Infeasible	
VA0089125	X	Haymount	0.96		1,007 Lower Rappahannock	Rappahannock	Lower Rappahannock	Fecal (unknown origin), PCBs	No			$4,300,000	$2,200,000	$1,125,000
VA0060968	X	Aquia	8		28,468 Lower Potomac-	Potomac	Austin Run	Fecal (unknown origin)	No			$12,000,000	Geo-Infeasible	
VA0083411	X	Wilderness Shores	1.25	~	Rapidan-Upper Rappahannock	Rappahannock	Rapidan	Fecal (unknown origin)	No			$4,500,000	$2,300,000	$1,175,000
VA0021385	X	Orange	1.5		3,477 Rapidan-Upper Rappahannock	Rappahannock	Rapidan	Fecal (unknown origin)	No			$6,300,000	$3,200,000	$1,625,000
VA0024996	X	Falling Creek	10.1		30,353 Lower James	James	Grindall Creek	Fecal (unknown origin)	No			$6,000,000	Geo-Infeasible	
VA0081230	X	HRSD-Army Base	18		46,139 Hampton Roads	James	Elizabeth River	Fecal (unknown origin)	No			$37,100,000	Geo-Infeasible	
VA0083135		Farmville WWTP	2.4		3,721 Appomattox	James	James River	Fecal	No			$6,340,176	$3,220,088	$1,635,044
VA0024970	X	Lynchburg	22		20,590 Middle James	James	Middle James	Fecal	Yes (42)			$54,500,000	Geo-Infeasible	
VA0066877		ACSA Stuarts Draft WWTP	1.4		6,867 Shenandoah	Potomac	South River	NPS Ag & Wildlife Fecal	No			$5,125,002	$2,612,501	$1,331,250
VA0088609		Chesterfield County	na		14,433 Maury	James	Powhite Creek	Fecal (Unknown source)	No				maybe	
VA0025437		South Central Wastewater	23		47,362 Appomattox	James	Appomattox	NPS fecal	No			$31,372,767	Geo-Infeasible	
VA0076392		Little Falls Run WTP	13		9,546 Lower Rappahannock	Rappahannock	Rappahannock	NPS fecal / PCB (source unknown)	No			$19,221,024	$9,660,512	$4,855,256
Non-Chesapeake Bay Watershed Basins														
VA0020354		Lawrenceville	1.2		3,619 Meherlin	Chowan R. & Dismal Swamp	Rose Creek	PS fecal (not Lawrenceville)	No			$4,881,967	$2,490,984	$1,270,492
VA0025305		Martinsville City STP	8		11,727 Upper Dan	Roanoke/ Yadkin	Smith River	NPS fecal	No			$13,145,152	Geo-Infeasible	
VA0085952		Rocky Mount Town STP	2		6,311 Upper Roanoke	Roanoke/ Yadkin	Pigg River	NPS fecal	No			$5,854,106	$2,977,053	$1,513,527
VA0022390		BEDFORD STP	2		4,895 Upper Roanoke	Roanoke/ Yadkin	Johns Creek	Fecal & PS Overflow	No			$5,854,106	$2,977,053	$1,513,527
VA0020281		Wytheville WWTP	4		6,540 Upper New	New	Reed Creek	NPS Ag Fecal	No			$8,284,455	$4,192,228	$2,121,114
VA0025054		Bluefield Westside WWTP	5.3		10,798 Middle New	New	Bluestone River	Fecal & PS Overflow	No			$9,864,182	Geo-Infeasible	
VA0086304		Marion WWTP	3.4		7,337 Holston	Tennessee/ Big Sandy	Holston River	NPS - Ag fecal	No			$7,555,351	$3,827,675	$1,938,838
VA0077828		Coeburn Norton Wise	4		4,003 Upper Clinch	Tennessee/ Big Sandy	Guest River	NPS Urban fecal	No			$8,284,455	Geo-Infeasible	
TOXIC AND BENTHIC IMPAIRMENT OF UNKNOWN SOURCE														
Chesapeake Bay Watershed Basin														
VA0067423	X	Tangier Island	0.1	~	Western Lower Delmarva	Chesapeake Bay	Chesapeake Bay	Benthic unknown source	No		Urban	$2,800,000	Geo-Infeasible	
VA0025160	X	Alexandria S.A.	54		112,505 Middle Potomac-	Potomac	Hunting Creek	Ammonia				$69,120,000	Geo-Infeasible	
VA0062812	X	Front Royal	4		15,000 Shenandoah	Potomac	Shenandoah	PCBs	No			$4,800,000	$2,450,000	$1,250,000
VA0081264		HRSD - Chesapeake-Elizabeth	30		57,678 Lynnhaven-Poquoson.	Chesapeake Bay	Chesapeake Bay	NA/ Not shellfish	No			$39,878,988	Geo-Infeasible	
VA0024988		UOSA - Centreville	54		84,789 Middle Potomac	Potomac	Bull Run	Benthic unknown source	No			$69,043,172	Geo-Infeasible	
VA0081256		HRSD - Boat Harbor STP	25		31,795 Hampton Roads	James	Hampton Roads	Benthic (Source unknown)	No			$33,803,116	Geo-Infeasible	
VA0081302		HRSD - Williamsburg STP	22.5		7,221 Lower James	James	James River	Benthic N/P/Sed (Source unknown)	No			$30,765,180	Geo-Infeasible	
Non-Chesapeake Bay Watershed Basins														
VA0023922		Franklin City - STW	2		9,325 Blackwater.	Chowan R. & Dismal Swamp	Blackwater River	Hg (Unknown Source)	No			$5,854,106	$2,977,053	$1,513,527
VA0025194		Blackstone WWTP	2		709 Nottoway	Chowan R. & Dismal Swamp	Hurricane Creek	DO (unknown source)	No			$5,854,106	Geo-Infeasible	
VA0026531		Wolf Creek WTP	2.75		8,046 Holston	Tennessee/ Big Sandy	Wolf Creek	Benthic unknown source	No			$6,765,487	$3,432,744	$1,741,372
NO IMPAIRMENT														
Chesapeake Bay Watershed Basin														
VA0025364	X	Noman Cole	54		30,232 Middle Potomac-	Potomac	Pohick Creek	None	No			$16,000,000	Geo-Infeasible	
VA0020311	X	Strasburg	0.975		4,458 Shenandoah	Potomac	N.F. Shenandoah	None	No			$2,800,000	$1,450,000	$750,000
VA0024724	X	Dale Servic Corp. #1	4		73,684 Middle Potomac-	Potomac	Neabsco Creek	None	No			$1,100,000	Geo-Infeasible	
VA0026441	X	Mt. Jackson	0.6		2,467 Shenandoah	Potomac	N.F. Shenandoah	None	No			$4,100,000	$2,100,000	$1,075,000
VA0022802	X	Basham Simms (Purcellville)	1		6,692 Middle Potomac-	Potomac	Goose Creek	None	No			$5,400,000	$2,750,000	$1,400,000
VA0024678	X	Dale Service Corp. #8	4		84,397 Middle Potomac-	Potomac	Neabsco Creek	None	No			$1,100,000	Geo-Infeasible	
VA0091383	X	Broad Run*	20	~	Middle Potomac-	Potomac	Broad Run	None	No			$29,000,000	Uncertain	
VA0021172	X	Warrenton	2.5		10,733 Rapidan-Upper Rappahannock	Rappahannock	Great Run	None	No			$7,000,000	$3,550,000	$1,800,000
VA0025127	X	Fredericksburg	4.5		34,495 Lower Rappahannock	Rappahannock	Rappahannock	None	No			$6,300,000	Geo-Infeasible	

VA0076805	X	Remington	2.5	4,977	Rapidan-Upper Rappahannock	Rappahannock	Tinpot Run	None	No			$8,200,000	$4,150,000	$2,100,000
VA0090212	X	Mountain Run	0.3	6,227	Rapidan-Upper Rappahannock	Rappahannock	Rapidan	None	No			$8,700,000	$4,400,000	$2,225,000
VA0029521	X	Doswell	5.8	1,434	Pamunkey	York	North Anna River	None	No			$6,900,000	$3,500,000	$1,775,000
VA0073504	X	Caroline County Regional STP	0.5	958	Mattaponi	York	Polecat Creek	None	No			$3,900,000	$2,000,000	$1,025,000
VA0024899	X	Ashland	2	8,014	Pamunkey	York	Falling Creek	None	No			$2,600,000	$1,350,000	$700,000
VA0021105	X	Gordonsville	0.94	1,587	Pamunkey	York	Carver's Creek	None	No			$5,100,000	$2,600,000	$1,325,000
VA0020991	X	Buena Vista	2.25	7,106	Maury	James	Maury River	None	No			$5,500,000	$2,800,000	$1,425,000
VA0088331	X	Parham Landing	0.568	860	Pamunkey	York	Pamunkey River	None, but DO (unknown source	No			$9,500,000	$4,800,000	$2,425,000
VA0020346		Emporia WWTP	1.5	6,732	Meherin	York	Falling Run	None	No			$5,246,519	$2,673,260	$1,361,630
VA0081281		HRSD - Virginia Initiative	40	72,741	Hampton Roads	James	Elizabeth River	None	No			$52,030,731	Geo-Infeasible	
VA0088161		Lexington-Rockbridge Regional STP	3	8,848	Maury	James	Maury River	None	No			$7,069,281	$3,584,640	$1,817,320
VA0025658		Massaponax WTP	8	na	Lower Rappahannock	Rappahannock	Rappahannock	None	No			$13,145,152	$6,622,576	$3,336,288
VA0087718		DOC - Coffeewood	0.2	1,403	Rapidan-Upper Rappahannock	Rappahannock	Cabin Rranch	None	No			$3,666,793	$1,883,396	$966,698
Non-Chesapeake Bay Watershed Basins														
VA0089443		Hillsville WWTP	1.25	na	Upper New	New	Little Reed Island Ck	None	No			$4,942,726	$2,521,363	$1,285,681
VA0081248		HRSD - Atlantic STP	36	35,033	Albemarle	Atlantic	Atlantic Ocean	None	No			$47,170,034	Geo-Infeasible	

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"... a wise and frugal government, which shall restrain men from injuring one another, shall leave them otherwise free to regulate their own pursuits of industry and improvement, and shall not take from the mouth of labor the bread it has earned. This is the sum of good government, and this is necessary to close the circle of our felicities."

Thomas Jefferson

1801

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