Sage Policy Group, Inc.

The Impact of the Phase I Watershed Implementation Plan on Key Maryland Industries

Submitted by:

Sage Policy Group, Inc.

On behalf of:

Maryland State Builders Association

April 2011

Table of Contents

List of Exhibits....3

Executive Summary....4

Chesapeake Bay's Progress Does Not Come without Costs....6

Paying for Phase I....10

Conclusion....16

Appendix....18

Implan....20

List of Exhibits

Exhibit 1: Strategies and projects of Maryland Watershed Implementation Plan, Phase I (millions of dollars).....8

Exhibit 2: Who pays for the Maryland Watershed Implementation Plan, Phase I (millions of dollars) 11

Exhibit 3: Allocating costs for the Maryland Watershed Implementation Plan, Phase I (millions of dollars) 12

Exhibit 4: Summary of who provides revenue to pay for the Maryland Watershed Implementation Plan, Phase I 14

Exhibit 5: Economic costs of federal and state taxes used to fund Phase I 15

Exhibit 6: Economic costs of local taxes and impacts on housing industry 15

Exhibit 7: Economic costs on farmers and agricultural companies.....15

Exhibit 8: Economic costs on consumers 16

Exhibit 9: Summary of economic costs of Phase I projects.....16

The Impact of Chesapeake Bay Cleanup Costs on Maryland's Economy

Executive Summary

- Costs of Improving Bay Conditions are Concentrated

This report by Sage Policy Group, Inc. (Sage) focuses on one of the aspects of Chesapeake Bay restoration upon which less focus is often placed – the prospective cost to industry, consumers and taxpayers. The most recent plans for the Bay's clean up (embodied in Maryland Phase I Watershed Implementation Plan) encompass an array of actions addressing point and nonpoint sources of pollution (both publicly and privately owned), agricultural activities, public lands, and selected sources of air pollution.

Certain literature has pointed out the economic benefits associated with a cleaner Chesapeake Bay. This report does not suggest that there would not be important benefits associated with a healthier Chesapeake Bay, including for the state's hospitality and seafood industries. However, that literature largely fails to address the economic costs associated with the efforts, and this report attempts to detail the potential magnitude of those costs.

Costs for the first phase of the Watershed Implementation Plan (most elements implemented over the years 2012 through 2017) have been estimated preliminarily at over $11 billion based on implementation cost estimates made by the Maryland Department of the Environment (MDE), which is almost certainly a conservative estimate of costs. Three areas of the Phase I plan account for well over 90 percent of the total estimated costs. The largest cost category includes various actions proposed to reduce stormwater runoff associated with impervious cover and surfaces in the state's 10 largest counties and the state's highways and to take other steps to reduce this pollution such as legislation to reduce phosphorus in fertilizers. Collectively these actions account for almost **35 percent** of total costs.

Upgrading of waste water treatment plants and other point sources of discharges into the watershed constitute **31 percent** of the estimated costs. The great majority of these costs are for publicly-owned facilities or public sewer systems.

Finally, **almost 27 percent** of the total costs are related to the proposed reduction of airborne pollution that eventually contaminates the Bay either via direct precipitation into water bodies in the watershed or through runoff from the land. The majority of these air-pollution-related costs are for emission controls on power plants while almost all of the remaining costs result from Maryland's implementation of the California low emission vehicle requirements, which are expected to increase the cost of roughly 200,000 vehicles sold in the state each year by $1,000 per vehicle. Over the 6-year period of Phase I implementation, approximately 1.2 million cars would be affected by these requirements.

- Maryland's $11 billion of expenditures will not assure that goals are met

The $11 billion expenditure associated with Phase I will reduce both nitrogen and phosphorous emissions into the Bay. The Plan projects that at the end of Phase I, phosphorus loads will be reduced 57 percent while nitrogen loads will only be reduced 37 percent, which means the Plan would fall short of its 70

percent reduction estimate. Moreover, even if the estimate proves correct, the State of Maryland is embarking on a set of public policies that will most assuredly cost more than $11 billion, an amount equal to roughly 5 times the state's current budget shortfall.

- Quantifiable Impacts are Large

Based upon its IMPLAN-based modeling, the study team has quantified the economic costs that will be borne by key Maryland economic segments due to the funding requirements of Phase I. **Impacted industries would collectively shrink by over $10 billion over the course of implementation. Maryland's economy would also support 65,000 fewer jobs (measured in job-years) over the course of implementation. These jobs would be associated with $2.8 billion in lost wage/salary income. The average job lost would pay nearly $43,000/year. These losses would be experienced from roughly 2012 to 2017. The losses in any given year of that period would depend on the rate of Phase I expenditures in that year and other factors.**

- Certain Impacts that have not been Quantified

This report does not consider potentially broader impacts upon the state's economy. For example, if home prices rise in the state, more residents are likely to choose to live in Virginia, Pennsylvania, the District, Delaware or West Virginia. If those out-of-state residents work in Maryland, governments in the state incur public services costs without offsetting tax revenues. Such long-distance commuting would also work against the goals of Maryland's Smart Growth policies. This out-migration could cause retailers and certain employers to relocate to these states. If energy prices rise, other businesses, including manufacturers, could choose to relocate elsewhere. As of the time of this writing, Maryland continues to hemorrhage manufacturing employment despite industry job growth in the balance of the nation. All of this would further impact Maryland's attractiveness to business and its business climate rankings, which already fall far short of Virginia's and other highly competitive states. The combined economic impact of these effects could be massive over time and have not been included in this analysis.

- Policy Implications

From a public policy perspective, this suggests that Maryland's implementation program should strive to retain at least the current level of economic development competitiveness vis-à-vis Virginia and other Mid-Atlantic states. In other words, Maryland's contributions to Bay restoration should be commensurate with the contributions of other states, thereby allowing Maryland's industries to continue to effectively compete. Of course, even this may not represent sufficient consideration to local business interests given the ongoing emergence of competition on a global scale.

It is important for stakeholders to understand that even though the EPA provides a significant amount of guidance regarding Total Maximum Daily Loads (TMDLs) and the amount of permissible pollution accommodated by the Bay, the State of Maryland has considerable control regarding implementation details. This State-based control should be exercised with caution and with sufficient consideration of other societal interests. As a final point, to the extent that implementation can emphasize the use of Maryland-based businesses and technologies, the harm to impacted funding industries can at least be partially offset by the emergence of new businesses and innovations.

The Impact of Chesapeake Bay Cleanup Costs on Maryland's Economy

Chesapeake Bay's Progress does not come without Costs

The Chesapeake Bay is an unparalleled regional resource for Marylanders and many others. Correspondingly, intense focus has been placed upon its well-being. Since 1972, Section 303(d) of the federal Clean Water Act has required states to identify waters that do not meet water quality standards. For each of the listed waters, states are to determine the maximum amount of pollution that the waters can accommodate and still meet standards. The maximum amount of pollution is termed a Total Maximum Daily Load or TMDL.[1]

In 1996, the U.S. EPA listed certain sections of the Virginia portion of the Chesapeake Bay as "impaired." In 2000, Bay watershed partners signed the Chesapeake 2000 Agreement to identify the actions required to achieve water quality standards. The EPA has laid out a three-phased planning process. The Phase I Plan was to have been developed by the end of 2010. The Plan also establishes interim target loans, with the EPA setting the year 2017 to achieve 60 percent of the implementation and 2025 as the deadline for the achievement of final target loads. In its Phase I implementation plan, Maryland has set more ambitious goals—a 70 percent reduction of key pollutant loads by 2017 and the achievement of final goals by 2020.[2]

Key measures of progress include reductions in nitrogen and phosphorus pollution. According to the State of Maryland, since 1985, the state has reduced nitrogen pollution by 33 percent and phosphorus pollution by 38 percent despite a 29 percent increase in population through 2009. According to the State, Maryland was the "first to commit to implement state-of-the-art technology on all of the State's 69 large wastewater treatment plants" and was "the first State to place stringent air pollution controls on power plants . . . reducing nitrogen emissions by over 75% from coal fired power plants by 2013."[3]

Despite some obvious reductions in nitrogen and phosphorous pollution, for the most part, these efforts appear to have achieved modest results on a macro level. The Chesapeake Bay Foundation (CBF), the premier advocate for cleaning up the Bay, has a target score of 70 out of 100 as the definition of a "saved Bay" where a perfect score of 100 would reflect conditions in 1600 before Europeans settled in Maryland. In December 2010, CBF released its most recent assessment of the Bay, a score of 31, certainly better than the 2008 score of 28. Neither score, however, is substantially higher than the worst conditions for the Bay in the early 1980s, roughly a quarter of a century ago, when CBF indicates that the score would have been 23. Despite recent improvements, CBF still sees the Bay as "a system dangerously out of balance."[4]

[1] From Maryland Phase I Watershed Implementation Plan – Executive Summary, 12/03/2010, p. ES-1.
[2] Ibid., p. ES-1.
[3] Ibid., p. ES-3.
[4] Chesapeake Bay Foundation, "2010 State of the Bay Report Released" and "Bay Area Facts," http://www.cbf.org/

This report by Sage focuses on one of the aspects of Chesapeake Bay restoration upon which less focus is often placed – the prospective cost to industry, consumers and taxpayers. The most recent plans for the Bay's cleanup encompass an array of actions addressing point and nonpoint sources of pollution (both publicly and privately owned), agricultural activities, public lands, and selected sources of air pollution. The major categories for these strategies and representative projects are shown in Exhibit 1. A complete list of these projects can be found in the Appendix to this report. These plans are considered the first phase of a three-phase project that will stretch over the next 10 years.

Also, certain literature has pointed out the economic benefits associated with a cleaner Chesapeake Bay. This report does not suggest that there would not be important benefits associated with a healthier Chesapeake Bay, including for the state's hospitality and seafood industries. However, that literature largely fails to address the economic costs associated with the efforts, and this report attempts to detail the potential magnitude of those costs.

Costs for the first phase of the Watershed Implementation Plan (most elements implemented over the years 2012 through 2017) have been estimated preliminarily at $11 billion based on cost data developed by MDE, which is almost certainly a conservative estimate of costs. For example, costs for upgrading six major private and public industrial treatment plants and 477 minor industrial dischargers are not included in this tally. Although the cost of emission controls for power plants is estimated to cost $1.8 to $3 billion, **the estimate in Exhibit 1 uses the low end of that range**. In certain cases applying to agricultural operations, it is assumed that **allocating land to permanent buffer status carries no cost,** although if this land is currently productive, income may be lost.

There are also issues of ongoing annual costs and total costs. Most of the costs for individual projects are finite in their scope and typically pertain to capital improvements scheduled to be achieved in the period from 2012 to 2017. At least one cost, however, is ongoing. By adopting the California vehicle emission standards, Maryland will be adding a total of approximately $200 million annually to the costs of cars and trucks sold in the state. The value of 6 years of this added cost is included in the $11 billion estimate of the Phase I Plan implementation. But the annual cost of $200 million will apply to each year beginning in 2011 and will continue on after Phase I costs are expended in the 2012 - 2017 period. Because this analysis concentrates on the 6-year period from 2012 through 2017, the added vehicle costs are confined to that period.

Exhibit 1. Strategies and projects of Maryland Watershed Implementation Plan, Phase I (millions of dollars)

Strategy	*Representative projects*	*Estimated cost*	*Share of total*
Point Sources	Major waste water treatment plant upgrades, major and minor industrial and major federal dischargers, sewer system repairs to prevent overflows	$3,483	31.0%
Urban Stormwater	MS4 Phase I permitted counties, SHA MS4 Phase I and II, MS4 Phase II (two counties, larger municipalities, and federal facilities)	$3,983	35.4%
Septic Systems	Continue upgrade of new/failing septic systems in critical area, septic hookups to ENR plants, upgrade all systems in critical area	$474	4.2%
Agriculture	Cover crops, Soil Conservation & Water Quality Plans, stream protection, technical assistance for soil conservation districts	$210	1.9%
Animal Waste, Biosolids, Phosphorus	Manure transport, manure incorporation technology, animal waste structures	$19	0.2%
Fertilizer and Manure Applications	Nutrient management compliance, decision/precision agriculture, 100-foot CAFO setbacks	$43	0.4%
Natural Filters on Public Land	Wetland restoration, streamside forest buffers, other tree planting, natural filters on other public lands	$25	0.2%
Air	Maryland Healthy Air Act, diesel engine retrofit program, low emission vehicle requirement	$3,001	26.7%
Total		**$11,238**	**100.0%**

Source. Maryland's Phase I Watershed Implementation Plan for the Chesapeake Bay Total Maximum Daily Load

While there are reasons to suspect that these cost estimates are conservative, in at least one major instance, the Plan indicates that some alternatives may be less costly. The estimated cost to address stormwater runoff from the state's highways is $1 billion, almost 10 percent of the total. State Highway Administration officials have reportedly indicated that the most cost effective practices could reduce these costs by as much as two-thirds.[5]

Three areas of the Phase I plan account for well over 90 percent of the total estimated costs. The largest cost category includes various actions proposed to reduce stormwater runoff associated

[5] University of Maryland, Maryland Department of Planning, et al, "Maryland's Phase I Watershed Implementation Plan for the Chesapeake Bay Total Maximum Daily Load," p. 5-34.

with impervious cover and surfaces in the state's 10 largest counties and the state's highways and to take other steps to reduce this pollution such as legislation to reduce phosphorus in fertilizers. Collectively these actions account for over 35 percent of total costs.

Upgrading of waste water treatment plants and other point sources of discharges into the watershed constitute 31 percent of the estimated costs. The great majority of these costs are for publicly-owned facilities or public sewer systems.

Finally, almost 27 percent of the total costs are related to the proposed reduction of airborne pollution that eventually contaminates the Bay either via direct precipitation into water bodies in the watershed or through runoff from the land. The majority of these air-pollution-related costs are for emission controls on power plants while almost all of the remaining costs result from Maryland's implementation of the California low emission vehicle requirements, which are expected to increase the cost of roughly 200,000 vehicles sold in the state each year by $1,000 per vehicle.

Even if more cost-effective practices and strategies are identified or certain cost estimates turn out to be gross overestimates, the $11 billion estimate will likely prove to be an underestimate of the ultimate costs of the Plan. The goals for Phase I reductions in nitrogen and phosphorus are the achievement of 70 percent of the ultimate goal. Costs for an inevitable, additional phase of activities are generally excluded from this estimate, although the Phase I Plan clearly identifies the need for more pollution reduction after Phase I to meet overall Plan goals.[6]

Indeed, the Phase I Plan estimates that, of the 10.33 million pounds of nitrogen that need to be eliminated to meet the Plan's goals for 2020, the efforts undertaken in Phase I between 2012 and 2017 will still leave Maryland 6.46 million pounds short of its goal. That is, the investments and costs of Phase I will only accomplish 37 percent of the reduction needed to meet the long-range target.[7]

The projected results for phosphorus are somewhat better. Of the 585,000 pounds of annual phosphorus pollution that the overall endeavor seeks to eliminate by 2020, the Phase I Plan projects that despite the required investments and related efforts, the reductions in phosphorus will fall 250,000 pounds short of this goal. This projection would have Maryland achieving 57 percent of the targeted goal by 2017.[8] The $11 billion expenditure associated with Phase I will reduce phosphorous emissions into the Bay by 57 percent, short of MDE's stated goal of 70 percent. However, given the uncertainty regarding the effects of the Implementation Plan, it is conceivable that the Plan would fall short of this estimate. Moreover, even if the estimate proves correct, the State of Maryland is embarking on a set of public policies that will most assuredly

[6] Ibid., see 4.0 Gap Analysis in plan which indicates that a substantial effort will be required between 2017 and 2020 to reach the plan's ultimate goals of reducing nitrogen and phosphorus levels in the bay.
[7] Ibid. p. 4-4
[8] Ibid, p. 4-5

cost more than $11 billion, an amount equal to roughly 5 times the state's current budget shortfall.

For both nitrogen and phosphorus, the $11 billion expenditures of Phase I are expected to leave Maryland well short of its ultimate goals for this plan to clean up the Bay. Since the $11 billion expenditure will occur over the 2012 - 2017 period and the final goals are targeted for achievement in 2020, there would be substantial need for more spending and, presumably, spending at higher annual rates during the 2017 - 2020 period if Maryland wishes to attain those final goals. In other words, the burden to be borne by industry and taxpayers is slated to expand over time. The balance of this report focuses upon the impact of Phase I costs on Maryland's economy.

Paying for Phase I

The implementation plan for Phase I provides only the most general guidance regarding how individual elements would be funded. Various government sources at the federal, state, or local level are identified. This information is occasionally quite specific, for example, the Bay Restoration Fund is funded by a $30 annual fee on each housing unit that uses an onsite septic system. Far more common, however, is a general discussion of the history of state, federal, and local funding of major projects.

Certain projects exclude government sources as likely sources of finance. For example, stormwater management efforts for highways are assumed not to involve local government monies. Agricultural projects typically are assumed to include cost sharing between state government and farmers or agricultural companies with the government share being provided through incentives. Actions on public land are funded through state government. Costs directly borne by industry are not always included in the plan. The exception is the cost for power plants to comply with air quality regulations. The one clear example of costs borne directly by consumers is the increased cost of cars and other vehicles incurred in complying with the stricter vehicle emission standards.

Exhibit 2 lists the principal direct funders of the various strategies and projects. This identification of the direct funders is not exhaustive, but does represent those who will directly pay for the vast majority of the costs associated with the Phase I Plan.

Because the discussion of funding generally avoids specific cost allocations, it is not possible to assign specific costs to the various funding sources with overwhelming confidence. Nevertheless, a general understanding of who will directly bear these costs can be made by reviewing the available funding strategies articulated by the Phase I plan.

Exhibit 2. Who pays for the Maryland Watershed Implementation Plan, Phase I (millions of dollars)

Strategy	*Estimated cost*	*Who pays*
Point Sources	$3,483	• Waste water treatment plants: federal, state, local governments • Sewer systems: federal, state, local governments • Federal and industrial dischargers: federal government, private industry
Urban Stormwater	$3,983	• Local government efforts: federal, state, local governments • Highways: federal, state governments
Septic Systems	$474	• All projects: state, local governments, property owners/purchasers/home builders
Agriculture	$210	• All projects: state government, farmers
Animal Waste, Biosolids, Phosphorus	$19	• All projects: state government, farmers, poultry companies
Fertilizer and Manure Applications	$43	• All projects: state government, farmers All provisions here apply to agricultural uses of fertilizer and not to residential or other no agriculture use.
Natural Filters on Public Land	$25	• All projects: state government
Air	$3,001	• Power plants: utilities, power companies • Vehicles: new vehicle purchasers
Total	**$11,238**	
Source. Maryland's Phase I Watershed Implementation Plan for the Chesapeake Bay Total Maximum Daily Load		

Exhibit 3 summarizes this estimated allocation of costs. For point sources and urban stormwater initiatives, the assumption for this analysis is that most projects will be publicly funded equally by federal, state, and local governments. This simplifying assumption could easily overstate or understate contributions from any of these levels of government. The lack of specificity for how current plans would be funded, however, precludes precise estimates. Any public funds, of course, are ultimately borne by taxpayers.[9] An exception to this three-way split is the allocation of costs for urban stormwater actions relative to highways, where this $1 billion cost is assumed to be evenly split between federal and state governments.

Septic system costs entail specific actions on existing and future septic systems with per system costs averaging about $13,000.[10] The assumption for these costs is that state and local funding

[9] For example, funding for the $402 million Blue Plains cost refers to a Maryland share of $203 million with remaining funds derived from sources that "include the Biological Nutrient Removal (BNR) Grant, Supplemental Assistance, State Revolving Loan Fund, local or community funding or match, USDA Rural Development Funds, and other federal funding." It is difficult to determine the ultimate source or allocation of funding given funding alternatives such as these.

[10] Phase I Implementation Plan, p. 5-49.

would each account for 25 percent of total costs with the remaining 50 percent of funds being embedded in higher housing costs paid by consumers of that housing.

The various changes to farming and agricultural operations are assumed to be subject to state government incentives that cover 25 percent of costs with farmers or agricultural companies picking up the remaining cost. Certain agricultural initiatives involve the provision of greater volumes of technical assistance or more monitoring of plan activities and all these costs are assigned to state government. Costs of actions on public lands are allocated to state government. Finally, most air quality costs are assigned to industry, which must comply with regulations while the increased cost of cars and other vehicles are assigned to consumers.

Exhibit 3. Allocating costs for the Maryland Watershed Implementation Plan, Phase I (millions of dollars)

Strategy	*Estimated cost*	*Government share*			*Private share*		
		Federal	State	Local	Industry	Farmers	Consumers
Point Sources	$3,483	$1,161	$1,161	$1,161			
Urban Stormwater	$3,983	$1,493	$1,497	$993			
Septic Systems	$474		$119	$119			$237
Agriculture	$210		$104			$106	
Animal Waste, Biosolids, Phosphorus	$19		$5			$14	
Fertilizer and Manure Applications	$43		$10			$32	
Natural Filters on Public Land	$25		$25				
Air	$3,001				$1,801		$1,200
Total	**$11,238**	**$2,654**	**$2,921**	**$2,273**	**$1,801**	**$152**	**$1,437**
Source: Sage							

When allocating costs to those who will directly pay for these projects, it is important to consider how these direct funders will generate the revenue for these payments. Federal and state governments have an array of taxes and fees that can be deployed to generate revenue. Local governments have more limited revenue generation options with one major exception. Over three-quarters of the total costs of Phase I and all projects for which local government is assumed to be a direct funder involve public facilities that support housing and other development.

Maryland's counties have long histories with fees on new construction that are designed to compensate local governments for the fiscal impacts of new housing and other development. It

is not difficult to imagine that local governments in Maryland will turn to the housing industry as a source of new revenue to generate the billions of dollars of cost that Phase I may entail.

The study team's analysis indicates that a significant fraction of Phase I costs will be paid by the private sector. Farmers and the agricultural industry will be faced with an estimated $152 million in Phase I costs. Some of these costs may be passed on to consumers in the form of higher prices for agricultural products. The market for these products, however, is usually national in scope, if not international. Maryland-based farmers or agricultural companies have very limited abilities to determine prices for their products. It is assumed that farmers and agricultural companies will then need to absorb these costs, thereby reducing their profits. In some cases, where profit margins are particularly thin, this may mean farmers will exit the industry, opening up farming lands to development in the process. The assumption for this analysis, however, is that these costs will be absorbed and not force farmers to end their agrarian pursuits.

The costs associated with air quality regulations are likely to be borne by consumers. While the power industry will initially pay for compliance, it is assumed that these companies (unlike farmers) will have the ability to pass these new costs along to their customers. Increased car and vehicle prices will similarly be passed along to consumers and not be absorbed by manufacturing, wholesale or retail segments of the automotive industry.

Exhibit 4 converts the cost allocation of those who will directly fund the Phase 1 projects into a list of those who will provide revenues to these direct funders. For federal and state government, the source of revenues is taxpayers, including those who are charged specific fees such as the fee on septic systems in Maryland that supports the Bay Restoration Fund. Local government will also turn to taxes and fees, except that local governments are highly likely to be much more focused in their pursuit of monies and to turn to the housing and construction industry and its customers through the imposition of impact fees and similar levies for new construction. Costs that are likely ultimately to be generated by the housing industry and its customers include both the local government share of big projects and the $237 million cost of septic systems that is assumed to be included in housing prices. There is no assurance that the housing industry and its customers (i.e. home purchasers and property owners) will be able to afford these added costs.

For example, the average cost per septic system is estimated at $13,000. Even if, as assumed in this analysis, that state and local governments pick up half of this cost, it is not clear that an $6,500 can be added to the cost of each housing unit and passed along to buyers or that current owners can afford this. The current woeful state of the housing market only makes this a more dubious presumption. Finally, Maryland consumers are assumed to be paying for power and other companies' costs to comply with air quality regulations as well as the higher prices of vehicles resulting from the implementation of the California vehicle emissions standards in Maryland.

Exhibit 4. Summary of who provides revenue to pay for the Maryland Watershed Implementation Plan, Phase I

Source of payments/costs	*Value (millions)*	*Share of total*
Federal taxpayers	$2,654	23.6%
State taxpayers	$2,921	26.0%
Local taxpayers/housing industry customers	$2,510	22.3%
Farmers/agriculture industry	$152	1.4%
Consumers	$3,001	26.7%
Total	**$11,238**	**100.0%**

The costs summarized in Exhibit 4 constitute a major financial burden on Maryland residents. Based on the estimated 2010 Maryland population and number of households, the total implementation cost of Phase I is the per Marylander equivalent of $1,944 while the equivalent cost per household is $5,121.[11]

Each of these revenue streams can be seen as a reduction in income available to taxpayers, consumers of housing and other goods/services and the agricultural sector. In lieu of creating revenue for Phase I, these revenues could be retained by these groups and spent for other goods and services. The following exhibits provide estimates of the economic impacts of these revenues if they were not diverted to Phase I costs, but were instead used by taxpayers and others for a variety of economic purposes. These impacts represent the economic costs in terms of jobs, income, and business sales to other Maryland businesses of the Phase I Plan. Additional detail regarding analytical methodology is presented in the appendix to this report.

Under the assumptions made for this analysis, federal and Maryland taxpayers will pay $5.6 billion of the total costs of the Phase I project. If these billions were instead available to taxpayers as increased personal income, they would be used for a wide range of consumer goods and services. The impact of this consumer-oriented spending can be estimated by creating a model of the Maryland economy (which the study team has done) and estimating the jobs, income and business sales associated with changes in final demand for goods and services provided by the state's business community. The kind of consumer-oriented spending that taxpayers would be able to afford is defined as induced impacts.[12]

As shown in Exhibit 5, an added $5.6 billion in consumer spending power would support almost 32,000 years of work (e.g., 32,000 jobs for one year or 4,000 jobs per year for 8 years). The income associated with these jobs is more than $1.3 billion. Business sales for establishments in

[11] According to the Maryland Department of Planning, the 2010 population for Maryland was 5,779,380; and the number of households that year was 2,194,400. " Demographic and Socio-Economic Outlook**,**" Maryland Department of Planning, Planning Data Services http://planning.maryland.gov/MSDC/county/statemd.pdf

[12] The model of the Maryland economy was created using software and data provided by IMPLAN, a product of the Minnesota IMPLAN Group, Inc.. See Appendix for discussion of IMPLAN and the methodology of estimating economic impacts.

Maryland would approach $4.3 billion if money were not diverted to finance Phase I. Note: these lost sales would be less than $5.6 billion because some income will be spent out of state or will be saved.

Exhibit 5. Economic costs of federal and state taxes used to fund Phase I

Type of impact	*Direct*	*Indirect*	*Induced*	*Total*
Years of work (full-/part-time jobs)	-	-	31,885	31,885
Income (millions of dollars)	-	-	$1,345	$1,345
Business sales (millions of dollars)	-	-	$4,283	$4,283
Source: IMPLAN, Sage				

The diversion of $2.5 billion in spending from the housing and construction industry to the Phase I projects represents a loss of demand for housing industry goods and services. This loss is based on the assumption that local governments would turn to impact fees and similar impositions on the industry to generate its share of Phase I costs and the assumption that a major share of the septic system costs would go directly into increased housing prices. This diversion would reduce the quantity demanded of housing and related real estate services by $2.5 billion. The consequence of this diversion is over 6,600 direct years of work in the housing and real estate industries. When the full multiplier effect is considered the total economic cost includes over 15,000 jobs with associated income of almost $700 million and sales to Maryland businesses of $3.7 billion as shown in Exhibit 6.

Exhibit 6. Economic costs of local taxes and impacts on housing industry

Type of impact	*Direct*	*Indirect*	*Induced*	*Total*
Years of work (full-/part-time jobs)	6,651	5,464	3,267	15,383
Income (millions of dollars)	$285	$271	$140	$697
Business sales (millions of dollars)	$2,510	$760	$427	$3,697
Source: IMPLAN, Sage				

The need for farmers to absorb the costs of complying with the Phase I plan is the equivalent of a shrinking bottom line for these farmers of an estimated $152 million. This would mean less personal income and less money to reinvest in agricultural production. Assuming this lost income is evenly divided between lost personal income and lost reinvestment in agricultural production, Exhibit 7 summarizes the economic losses related to this diversion of farm income. The estimated loss includes 424 direct agricultural production years of work. With the multiplier effect the total impact is estimated at almost 1,300 years of work with associated income of $45 million and business sales of $185.

Exhibit 7. Economic costs on farmers and agricultural companies

Type of impact	*Direct*	*Indirect*	*Induced*	*Total*
Years of work (full-/part-time jobs)	424	287	560	1,271
Income (millions of dollars)	$11	$10	$24	$45
Business sales (millions of dollars)	$76	$34	$75	$185
Source: IMPLAN, Sage				

Finally, the higher costs for electricity and vehicles that will result from compliance with air quality regulations will reduce the monies that consumers have for other goods and services. This loss of income translates into over 17,000 years of work, income of $724 million and business sales of more than $2.3 billion. See Exhibit 8 for relevant statistical detail.

Exhibit 8. Economic costs on consumers

Type of impact	*Direct*	*Indirect*	*Induced*	*Total*
Years of work (full-/part-time jobs)	-	-	17,164	17,164
Income (millions of dollars)	-	-	$724	$724
Business sales (millions of dollars)	-	-	$2,305	$2,305
Source: IMPLAN, Sage				

These economic segment-specific costs are summarized in Exhibit 9. The diversion of $11 billion to the costs of Phase I implementation translates into an economic loss of almost 66,000 years of work (e.g., 11,000 fewer jobs supported by the Maryland economy for six years) with associated lost income of $2.8 billion. The loss of business sales is estimated at $10.5 billion. In other words, the economic segments impacted by Phase I implementation would lose well over $10 billion in economic activity over the course of implementation.

Exhibit 9. Summary of economic costs of Phase I projects

Source of payments/costs	*Years of work (full-/part-time jobs)*	*Income (millions of dollars)*	*Business sales (millions of dollars)*
Federal taxpayers	15,179	$640	$2,039
State taxpayers	16,706	$705	$2,244
Local taxpayers/housing industry customers	15,383	$697	$3,697
Farmers/agriculture industry	1,672	$53	$253
Consumers	17,164	$724	$2,305
Total	65,702	$2,811	$10,470
Source: IMPLAN, Sage			

Conclusion

While there is a broadly shared desire to continue to build upon the progress made heretofore in terms of improving the condition of the Chesapeake Bay, the cost associated with this progress is substantial. Using publicly available industry data and IMPLAN modeling software, the study team calculates that industries impacted by the need for roughly $11 billion in Phase I Watershed Implementation Plan funding would be significantly affected. Specifically, these industries would collectively shrink by $10.5 billion over the course of implementation. Maryland's economy would also support almost 66,000 fewer jobs (measured in job-years) over the course of implementation. These jobs would be associated with $2.8 billion in lost wage/salary income. The average job lost would pay nearly $43,000/year.

These estimates come with some caveats. First, the cost of implementation may be well above the $11 billion figure used to drive this analysis. Second, the study team has had to make certain assumptions regarding financing sources given a general lack of available specificity. That said, funding must come from somewhere. The only way that the study team's estimates of impact are potentially overstated is if the federal government contributes more toward Bay restoration than is assumed in the study. The study does not also consider the potential positive effects of implementation. Presumably, implementation would involve demand for research services, consultants, equipment and other services/products. To the extent that these goods and services were produced in Maryland, there would be a partially offsetting benefit to the costs described throughout this report. That said, there is no evidence to suggest that a significant share of the capabilities to be used in the implementation process will be primarily sourced from Maryland businesses.

Finally, the report does not consider potentially broader impacts upon the state's economy. For example, if home prices rise in the state, more residents are likely to choose to live in Virginia, Pennsylvania, the District, Delaware or West Virginia. This could cause retailers and certain employers to relocate to these states. If local energy prices rise, other businesses, including manufacturers, could choose to relocate elsewhere. As of the time of this writing, Maryland continues to hemorrhage manufacturing employment despite industry job growth in the balance of the nation. All of this would further impact Maryland's attractiveness to business and its business climate rankings, which already fall far short of Virginia's and other highly competitive states.

The economic impact of these effects could be massive over time and have not been included in this analysis. From a public policy implication, this suggests that Maryland's implementation program should strive to retain at least the current level of economic development competitiveness vis-à-vis Virginia and other Mid-Atlantic states. In other words, Maryland's contributions to Bay restoration should be commensurate with the contributions of other states, thereby allowing Maryland's industries to continue to effectively compete. Of course, even this may not represent sufficient consideration to local business interests given the ongoing emergence of competition on a global scale.

Appendix

Maryland's Phase I Watershed Implementation Plan for the Chesapeake Bay Total Maximum Daily Load identifies scores of individual projects under eight broad strategies. These projects and their estimated costs are listed in Exhibit A-1.

Exhibit A-1. Strategies & projects for Maryland Watershed Implementation Plan (millions of $)

Strategy	*Project*	*Estimated cost*
Point Sources	Major WWTPs (not including Blue Plains)	$1,186
	Blue Plains Waste Water Treatment Plant Upgrades	$402
	Major Industrial	N.A.
	Minor Industrial	N.A.
	Federal facilities – major	N.A.
	Upgrade Large Minor Municipal WWTPs (0.1-0.5 MGD)	$58
	Eliminate Sewer Overflows, combined systems	$463
	Eliminate Sewer Overflows, separate systems	$1,374
Urban Stormwater	MS4 Phase I Permitted Counties	$2,614
	SHA MS4 Phase I and II	$1,000
	MS4 Phase II (CE and WA Counties, larger municipalities, and federal facilities)	$365
	• Regenerative Stormwater Conveyance (part of MS4)	
	• Rural Residential Tree Planting (same as MS4)	
	• Urban Tree Canopy (same as MS4)	
	Existing Urban Nutrient Management Law	$4
	Enhanced Urban Nutrient Management	
Septic Systems	Continue Upgrade, new/failing Septic Systems in Critical Area	$81
	Septic hookups to ENR plants	$36
	Require upgrade all systems in Critical Area	$358
Agriculture	Cover Crops	$107
	Soil Conservation & Water Quality Plans	$12
	Conservation Tillage	
	Continuous No-Till Conservation	$3
	Water Control Structures	$1
	Stream Protection with Fencing	$0
	Stream Protection without Fencing	$0
	Streamside Grass Buffers	$1
	Streamside Forest Buffers	$5
	Wetland Restoration	$3
	Retire Highly Erodible Land	$3
	Cropland Irrigation Management	$1
	Vegetative Environmental Buffers	$1
	Vegetated Open Channels	$2
	Stream Restoration Non-Coastal Plain	$1
	Technical Assistance for Soul Conservation Districts	$68
	Verification and Inspection of Cost Shared Practice	$1

Strategy	*Project*	*Estimated cost*
Animal Waste, Biosolids, Phosphorus	P Site Index for nutrient management	
	Manure Transport	$7
	Dairy Manure Incorporation Technology	$1
	Poultry Litter Incorporation Technology	$0
	Poultry Waste Structures	$0
	Livestock Waste Structures	$6
	Runoff Control Systems	$0
	Phytase	
	P-sorbing Materials	$1
	Poultry Litter Treatment	$3
	Mortality Composters	$1
Fertilizer and Manure Applications	Nutrient Management Compliance	$29
	Decision / Precision Agriculture	$14
	100-ft CAFO setbacks	(1)
	10-ft riparian setbacks for application of crop nutrients	(1)
Natural Filters on Public Land	Tree Planting - Forest Brigade (beyond 2017)	(2)
	Wetland Restoration	$9
	Streamside Forest Buffers	$2
	Tree Planting - Other	$5
	Streamside Grass Buffers (beyond 2017)	(2)
	Grassland (beyond 2017)	(2)
	Natural filters on Other Public Lands	$9
Air	Maryland Healthy Air Act	$1,800
	Expand Diesel Engine Retrofit Program	$1
	Low Emission Vehicle Requirement (for 2012-2017 period)	$1,200
Total		**$11,238**

Notes. (1) No cost assigned, however, this would place several thousand acres in permanent vegetated buffers.
(2) Costs will be incurred during a later phase of the overall plan.
Source. Maryland's Phase I Watershed Implementation Plan for the Chesapeake Bay Total Maximum Daily Load

IMPLAN

IMPLAN is an economic impact assessment software system. The system was originally developed and is now maintained by the Minnesota IMPLAN Group (MIG). It combines a set of extensive databases of economic factors, multipliers and demographic statistics with a highly refined and detailed system of modeling software. IMPLAN allows the user to develop local-level input-output models that can estimate the economic impact of new firms moving into an area as well as the impacts of professional sports teams, tourism, and residential development. The model accomplishes this by identifying direct impacts by sector, then developing a set of indirect and induced impacts by sector through the use of industry-specific multipliers, local purchase coefficients, income-to-output ratios, and other factors and relationships.

There are two major components to IMPLAN: data files and software. An impact analysis using IMPLAN starts by identifying expenditures in terms of the sectoring scheme for the model. Each spending category becomes a "group" of "events" in IMPLAN, where each event specifies the portion of activity allocated to a specific IMPLAN sector. Groups of events can then be used to run impact analysis individually or can be combined into a project consisting of several groups. Once the direct economic impacts have been identified, IMPLAN can calculate the indirect and induced impacts based on a set of multipliers and additional factors.

Economic benefits principally take the form of new employment opportunities, associated compensation and benefits, and augmented business revenues. These economic benefits include both direct benefits, which are closely associated with the activities that would potentially take place, and secondary benefits that are associated with foreseeable and calculable multiplier effects.

Secondary benefits can be segmented into two types of impacts, indirect and induced. Indirect benefits are related to the business-to-business transactions that take place due to increased demand for goods and services that accompanies augmented investment and business operations. Impacted businesses sell everything from office furniture and copiers to computer and graphic design services. Induced benefits are created when workers directly or indirectly supported by increased economic activity spend their earnings in the local economy. Indirect and induced benefits together comprise total multiplier effects.

The hallmark of IMPLAN is the specificity of its economic datasets. The database includes information for over 400 different industries (generally at the three or four digit Standard Industrial Classification level), and twenty-one different economic variables. Along with these data files, national input-output structural matrices detail the interrelationships between and among these sectors. The database also contains a full schedule of Social Accounting Matrix (SAM) data. All of this data is available at the national, state, and county level.

Another strength of the IMPLAN system is its flexibility. It allows the user to augment any of the data or algorithmic relationships within each model in order to more precisely account for regional relationships. This includes inputting different output-to-income/compensation ratios for a given industry, different wage rates, and different multipliers where appropriate. IMPLAN also provides the user with a choice of trade-flow assumptions, including the modification of regional purchase coefficients, which determine the mix of goods and services purchased locally with each dollar in each sector. Moreover, the system also allows the user to create custom impact analyses by entering changes in final demand. This flexibility is a critically important feature in terms of the Sage proposed approach. Sage is uniquely qualified to develop data and factors tailored to this project, and, where appropriate, overwrite the default data contained in the IMPLAN database.

A final advantage of IMPLAN is its credibility and acceptance within the profession. There are over five hundred active users of IMPLAN databases and software within the federal and state governments, universities, and among private sector consultants. The following list provides a sampling of IMPLAN users.

Sample of IMPLAN Users:

Academic Institutions

Alabama A&M University
Albany State University
Auburn University
Cornell University
Duke University
Iowa State University
Michigan Tech University
Ohio State
Penn State University
Portland State University
Purdue University
Stanford University
Texas A&M University
University of California – Berkeley
University of Wisconsin
University of Minnesota
Virginia Tech
West Virginia University
Marshall University/College of Business

Federal Government Agencies

Argonne National Lab
Fed. Emergency Man. Agency (FEMA)
US Dep't of Agriculture, Forest Service
US Dep't of Ag., Econ Research Service
US Dep't of Int., Bureau of Land Mgmt.
US Dep't of Int., Fish and Wildlife Serv.

State Government Agencies

MD Dep't of Natural Resources
Missouri Department of Economic Development
California Energy Commission
Florida Division of Forestry
Illinois Dep't of Natural Resources
New Mexico Department of Tourism
South Carolina Employment Security
Utah Department of Natural Resources
Wisconsin Department of Transportation

Private Consulting Firms

Coopers & Lybrand
Batelle Pacific NW Laboratories
Boise Cascade Corporation
Charles River Associates
CIC Research
BTG/Delta Research Division
Crestar Bank
Deloitte & Touche
Ernst & Young
Jack Faucett Associates
KPMG Peat Marwick
Price Waterhouse LLP
SMS Research
Economic Research Associates
American Economics Group, Inc.
L.E. Peabody Associates, Inc.

US Dep't of Int., National Parks Service
US Army Corps of Engineers
The Kalorama Consulting Group
West Virginia Research League