8.4 The James River Basin

Figure 1: Railroad Bridge at Sunset by Bill Piper (Courtesy of Scenic Virginia)

Overview

"The James is the largest of Virginia's Chesapeake Bay watersheds, stretching from the West Virginia border east to the mouth in Hampton Roads. This nation was born on the banks of the James River, but it is also a distinctly Virginia river."[24] The James runs about 350 miles through the heart of Virginia, beginning in the Alleghany Mountains and flowing southeasterly to Hampton Roads where it enters the Chesapeake Bay (Figure 2). The James is formed by the confluence of the Jackson and Cowpasture Rivers and flows 242 miles to the fall line at Richmond and another 106 miles to the Bay. Notable tributaries to the tidal James include the Appomattox, Chickahominy, Pagan, Nansemond and Elizabeth Rivers. "It is the nation's longest river to be contained in a single state. The mountain streams, Piedmont creeks and tidal marshes share the watershed with mountain villages, rolling pastures and broad expanses of croplands."[25]

The James River Basin occupies the central portion of Virginia and covers 10,265 square miles or approximately 24% of the Commonwealth's total land area. The 2010 population for the James River basin was approximately 2,892,000, with concentrations in two large metropolitan areas: the Greater Richmond – Petersburg area with over 650,000 and Tidewater, with over one million people. Two smaller population centers are the Lynchburg and Charlottesville areas, each with over 100,000 people.

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[24] Commonwealth of Virginia, (2005). *Chesapeake Bay Nutrient and Sediment Reduction Strategy for the James River, Lynnhaven and Poquoson Coastal Basins*

[25] Commonwealth of Virginia, (2005). *Chesapeake Bay Nutrient and Sediment Reduction Strategy for the James River, Lynnhaven and Poquoson Coastal Basins*

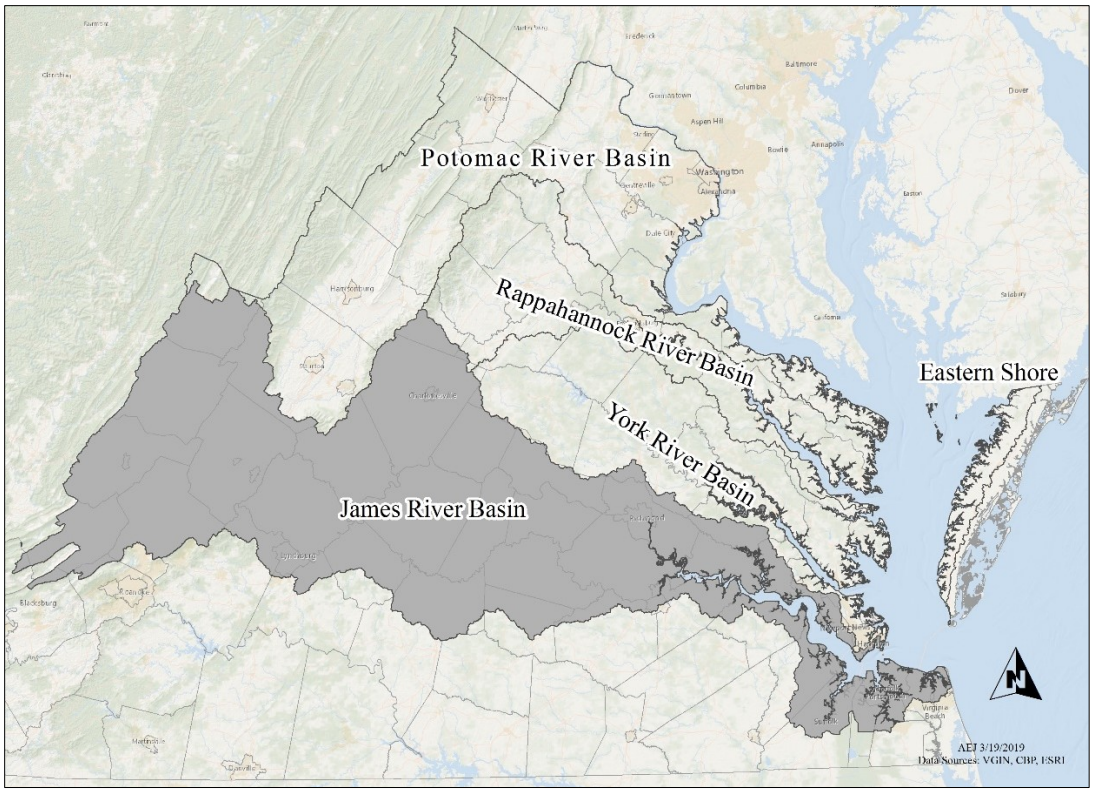

Figure 2: James River Basin Boundary

Based on the draft 2018 IR, the basin includes about 26,100 miles of rivers/ streams, 18,500 acres of lakes and 265 square miles of tidal estuary. Detailed information on the current water quality conditions in the James Basin can be found in the 2018 IR, including the length and area of waterbodies assessed for compliance against Virginia's water quality standards as well as analyses of designated uses supported, significant causes of use impairment and suspected sources of pollution.

As represented in the Chesapeake Bay Watershed Model Version 6, 75.8% of the basin's land area is classified as natural. Agriculture makes up 11.7% of the basin while developed (non-MS4) area accounts for 7.5% and developed (MS4) is 5%. For the Phase III WIP, the land use conditions projected for 2025 were used as the basis for local area planning goals, as discussed in Chapter 5. The 2017 and 2025 modeled land use acres by sector are shown in Figure 3.

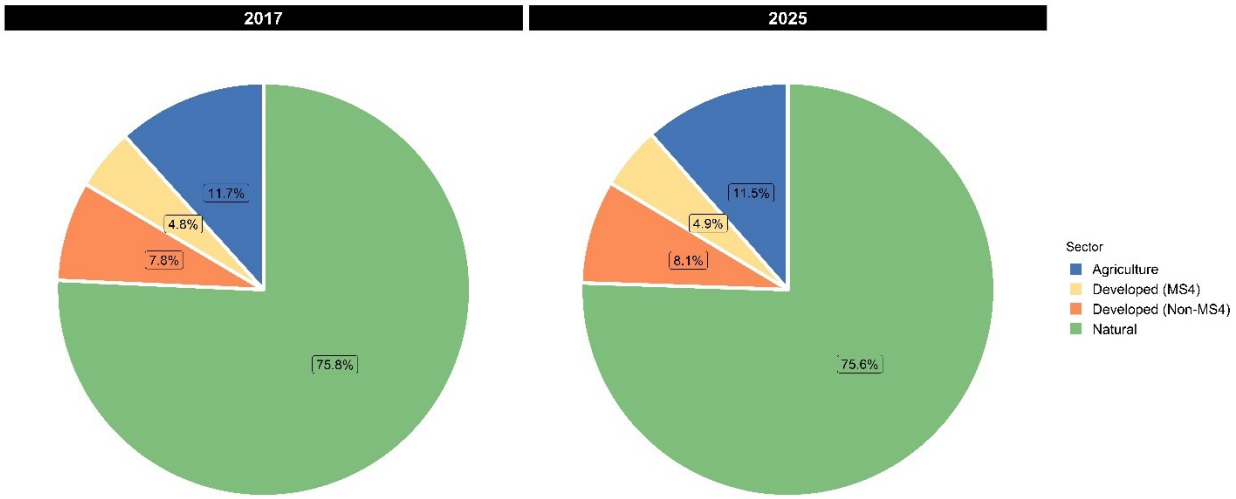

Figure 3: Comparison of 2017 Versus 2025 Modeled Land Use in the James River Basin

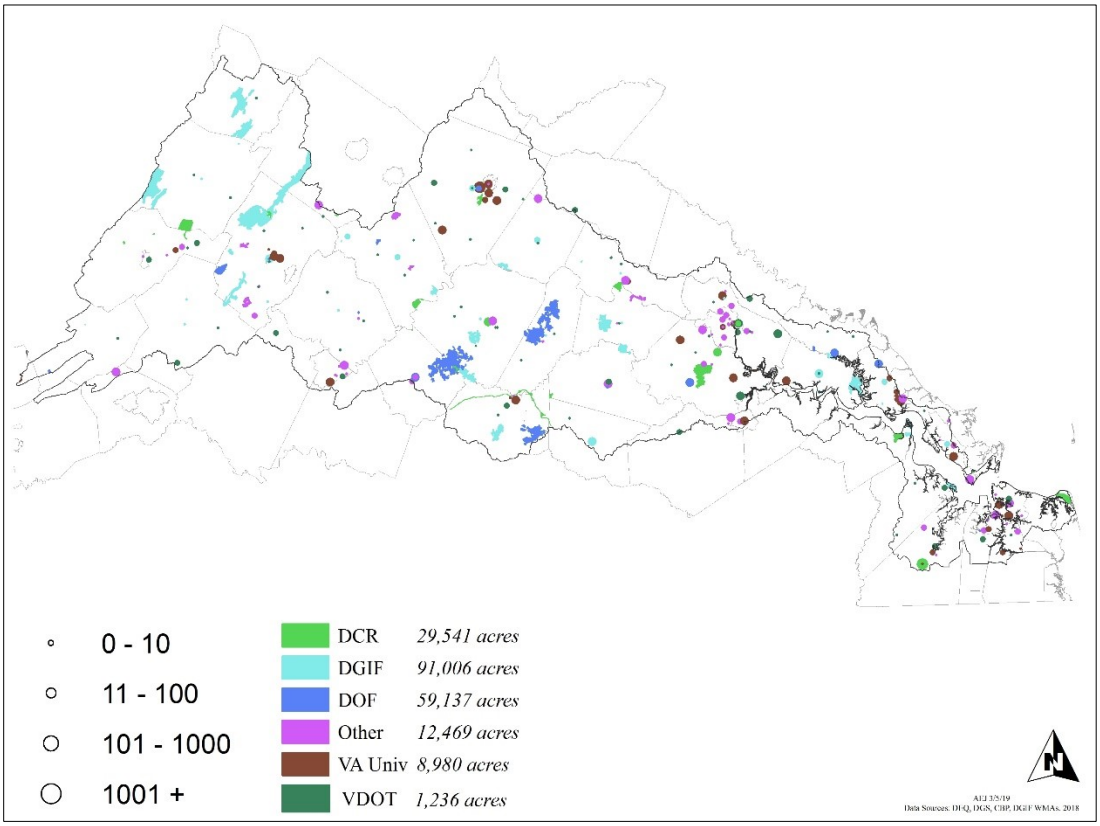

Figure 4: State Owned Lands in the James River Basin

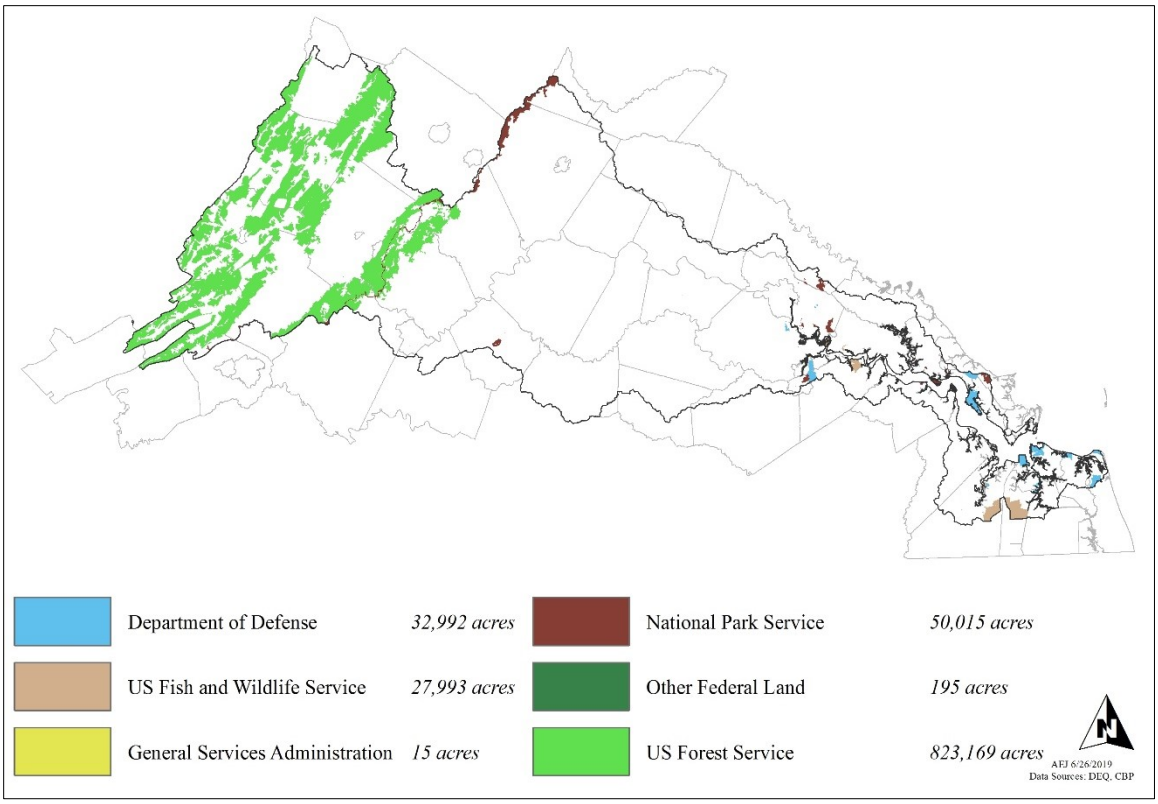

Figure 5: Federal Facilities in the James River Basin

State landholdings total nearly 202,369 acres (Figure 4) plus another approximate 54,000 acres of non-MS4 roads. Federal landholdings are significant, totaling nearly 1,221,064 acres (Figure 5).

All or part of the following 38 counties lie within the basin: Albemarle, Alleghany, Amelia, Amherst, Appomattox, Augusta, Bath, Bedford, Botetourt, Buckingham, Campbell, Charles City, Chesterfield, Craig, Cumberland, Dinwiddie, Fluvanna, Giles, Goochland, Greene, Hanover, Henrico, Highland, Isle of Wight, James City, Louisa, Montgomery, Nelson, New Kent, Nottoway, Orange, Powhatan, Prince Edward, Prince George, Roanoke, Rockbridge, Surry, and York. There are also 17 cities in the watershed: Buena Vista, Charlottesville, Chesapeake, Colonial Heights, Covington, Hampton, Hopewell, Lexington, Lynchburg, Newport News, Norfolk, Petersburg, Portsmouth, Richmond, Suffolk, Williamsburg, and Virginia Beach.

The 10 PDCs (Figure 6) and 20 SWCDs (Figure 7) located wholly or in part within the James River Basin are shown in the following maps. The basin also includes three watershed roundtables: the Upper James Watershed Roundtable, the Middle James Watershed Roundtable and the Lower James Watershed Roundtable. Watershed roundtables are designed to bring together diverse local stakeholders with a vested interest in their communities and concern for local water quality. Common roundtable activities include collecting and analyzing water quality data, planning and implementing watershed-wide water quality goals, coordinating workshops/forums and developing outreach and education resources. DEQ provides funding opportunities for watershed roundtable activities in Virginia to help achieve water quality improvement goals.

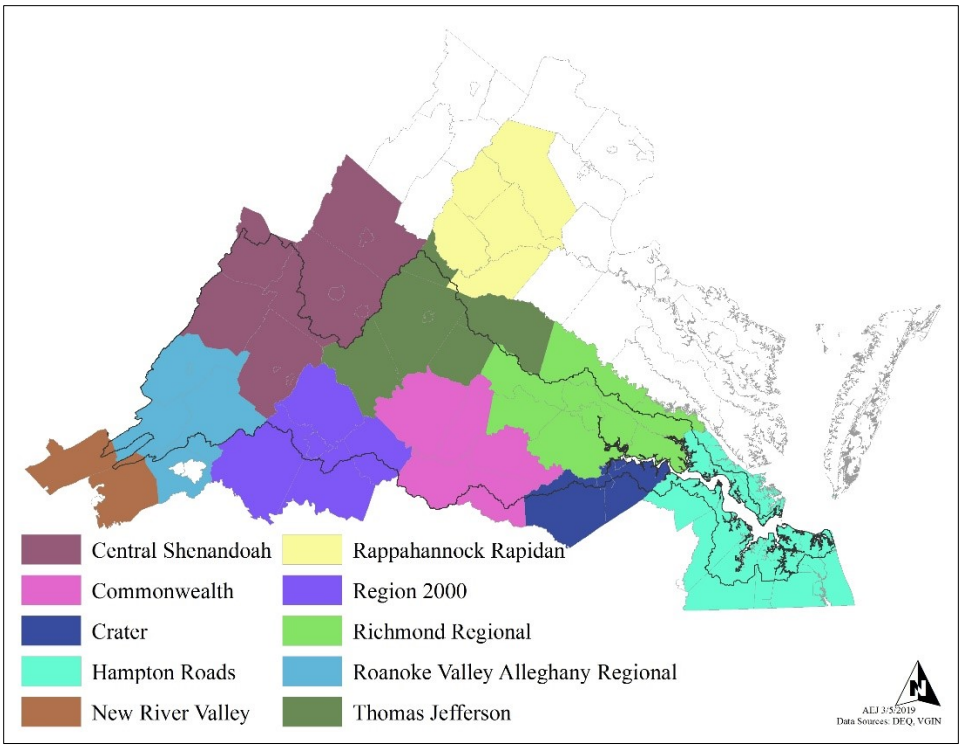

Figure 6: PDCs in the James River Basin

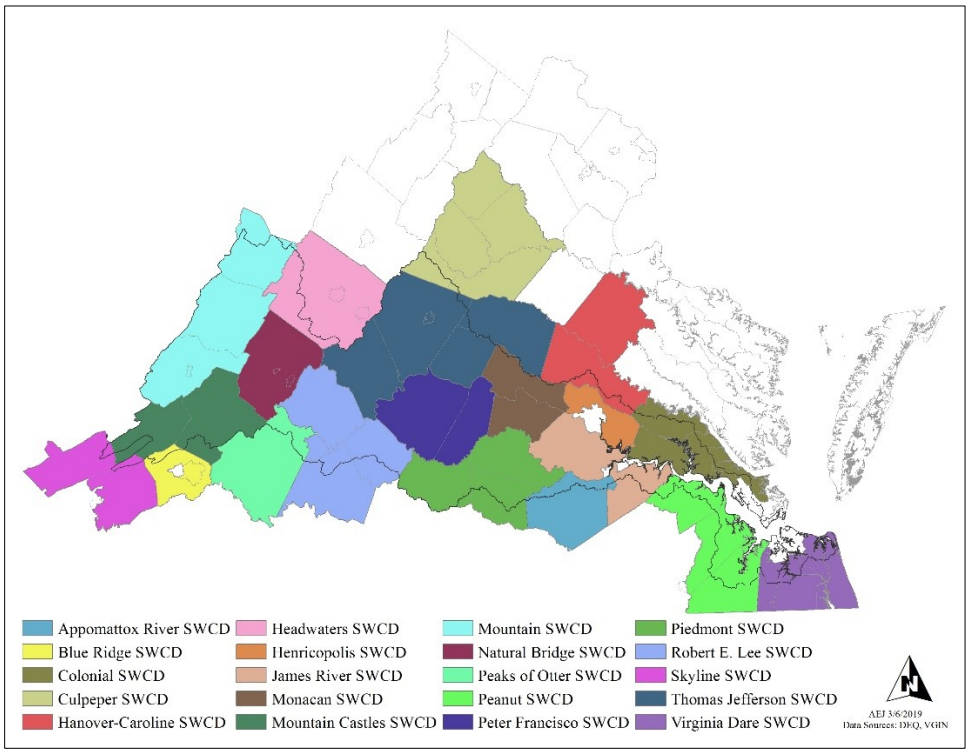

Figure 7: SWCDs in the James River Basin

Final Phase III WIP Development

In 1985, the nitrogen and phosphorus loads from the James River Basin were 39.4 million pounds and 8.4 million pounds respectively. When the Chesapeake Bay TMDL was released in 2010, the James loads were 32 million pounds of nitrogen and 2.8 million pounds of phosphorus. According to the 2017 progress update loads contributed from this basin were 24.4 million pounds of nitrogen and 2.5 million pounds of phosphorus. The major contributing sources of nitrogen and phosphorus in the James River Basin as of 2017 are the wastewater sector followed by the natural and agriculture sectors.

The Final Phase III WIP 2025 target loads allocated to this basin are 25.9 million pounds of nitrogen and 2.7 million pounds of phosphorus. The Chesapeake Bay Program's estimate of loads that must be reduced to account for climate change in the basin are an additional 480,000 pounds of nitrogen and 59,000 pounds of phosphorus. These climate change loads are represented as an additional load on the WIP III Final bars shown in Figure 8.

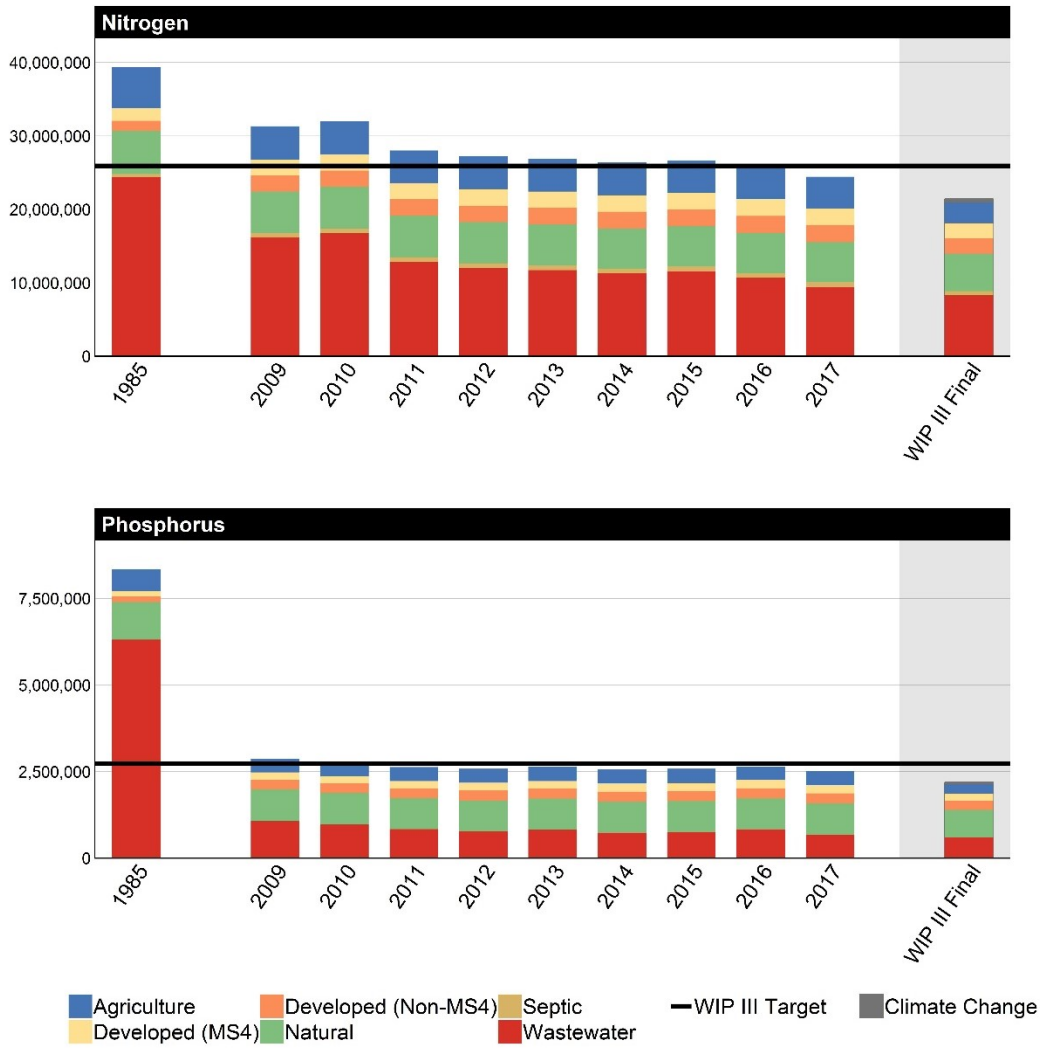

Figure 8: Nutrient Load Reductions for the James River Basin

The BMP inputs received from the PDCs and SWCDs in the James River Basin were combined with the regulated wastewater facilities and MS4s at their permit limits and federal facilities, then run through the Chesapeake Bay Watershed Model Version 6. Further adjustments were made based on additional state initiatives. Final modifications were made after the public review period and these results are shown in Figure 8 as WIP III Final. Exchanges as discussed in Chapter 7 are available from the James River Basin to meet the WIP III target for other river basins, ensuring an equitable level of effort from all stakeholders and local water quality improvements throughout Virginia's Chesapeake Bay watershed, and are presented in Table 3 at the end of this section.

Wastewater

Wastewater treatment plant upgrades and operational improvements in the wastewater sector in the James River Basin focused mostly on the 36 significant point source dischargers (Figure 9) put in place to achieve significant reductions since 1985. As of 2017, these loads are well below the WLA limits, at 9.4 million pounds nitrogen and 677,000 pounds phosphorus. The expectation through 2025 is that these loads will decline by approximately 30% in response to Initiative #38, but will slowly increase beyond 2025 as population increases continue in the James River Basin.

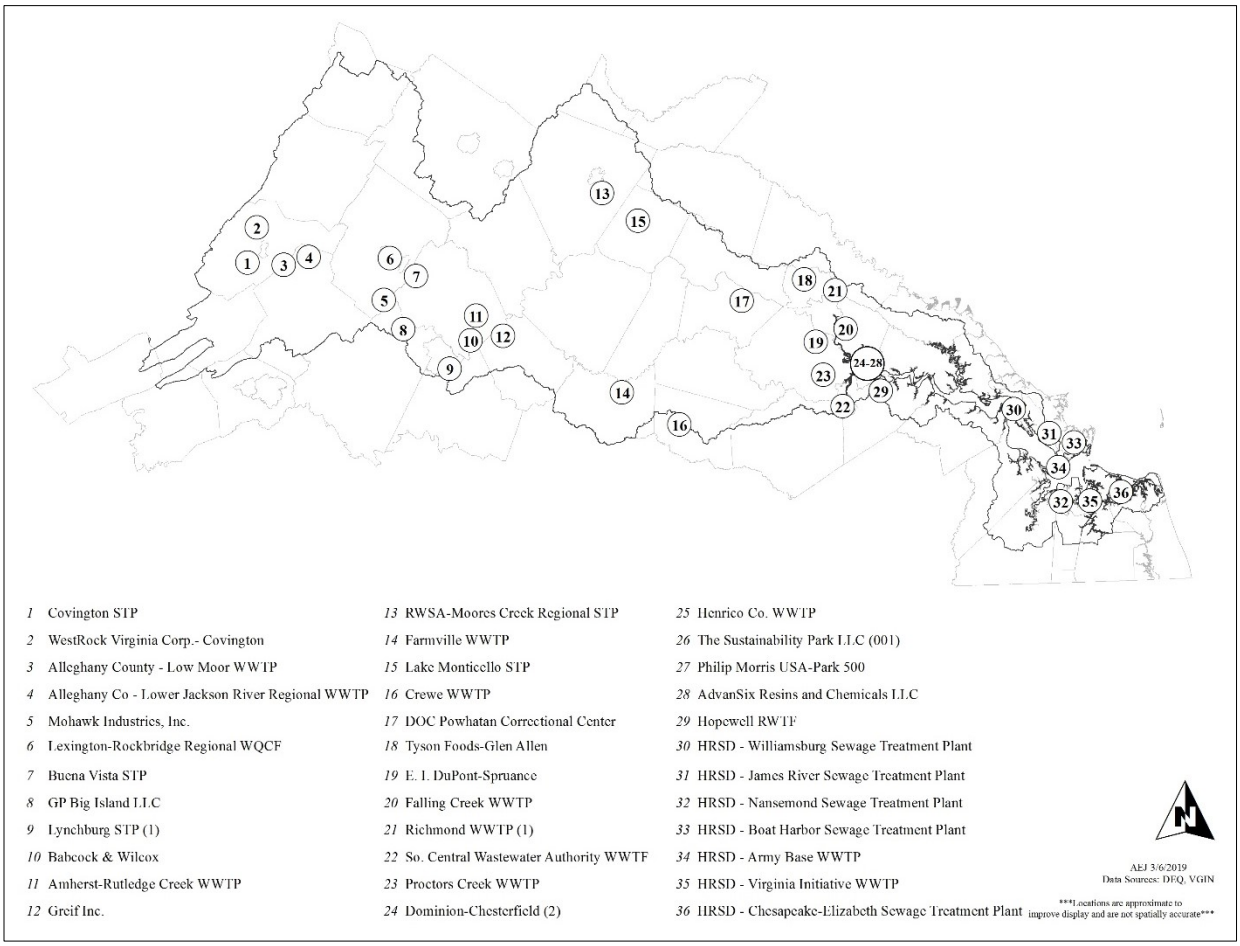

Figure 9: Significant Dischargers in the James River Basin

Regulations have been issued to ensure that these loads are maintained at or below the WLA limits set by the TMDL for dissolved oxygen criteria compliance. A discussion of the James River chlorophyll study and associated regulatory actions can be found at the end of this chapter.[26]

Municipal Separate Storm Sewer Systems (MS4s)

The 50 MS4 permittees in the James River Basin (Figure 10) are implementing nutrient and sediment reductions through TMDL Action Plans that are required by permit or regulation. The Phase II WIP established a schedule for achieving these reductions; 5% in the first five-year permit cycle, 35% in the second cycle and 60% in the third permit cycle. This plan proposes to maintain the previously established MS4 requirements over three permit cycles. The MS4s will not complete their third permit cycle prior to 2025; however; they will be in their third phase of TMDL Action Plan implementation. Virginia will honor its commitment to these regulated entities allowing them three full permit cycles to meet their reductions requirements. Any gap in this sector meeting its permit requirements by 2025 due to timing will be offset by the excess capacity achieved in the wastewater sector.

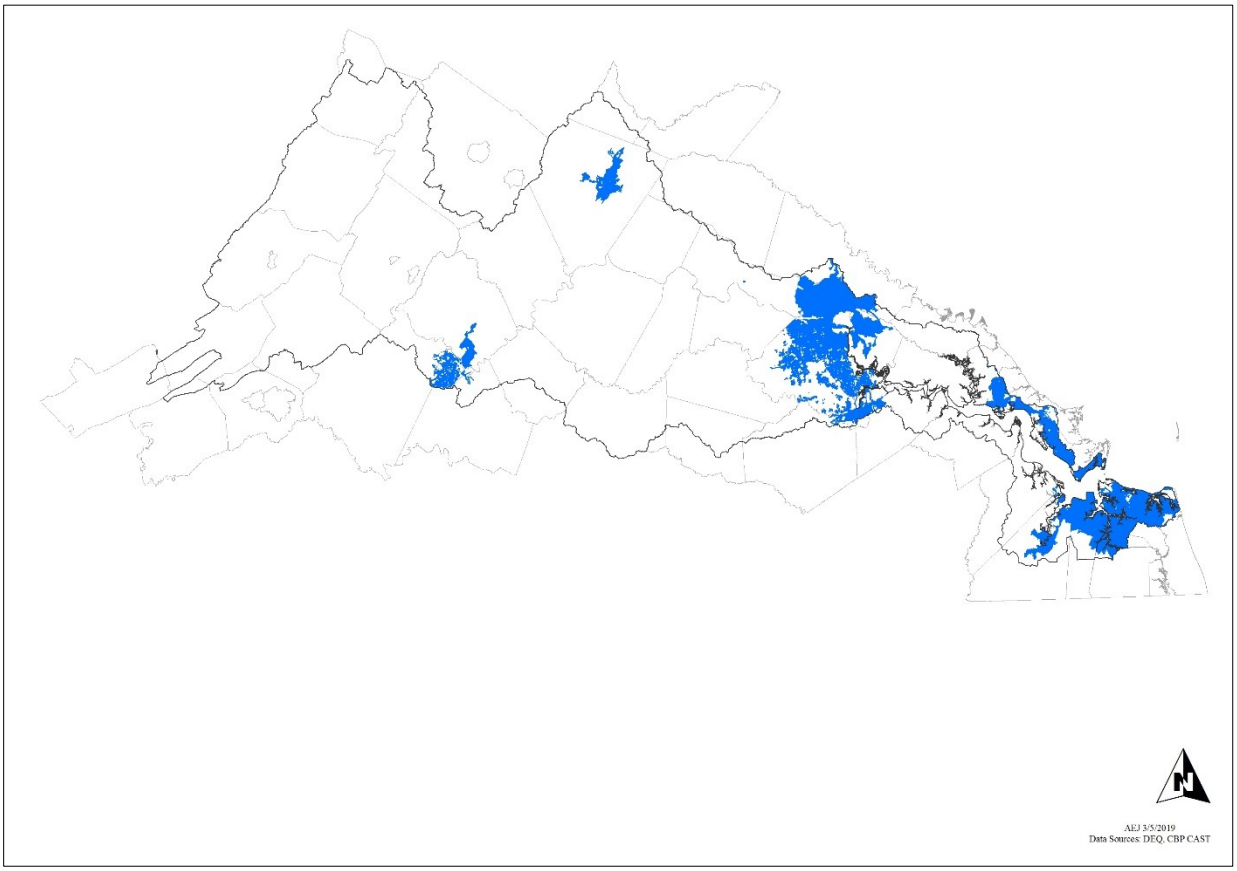

Figure 10: MS4 Permittees in the James River Basin

[26] 9VAC25-40-70 Strategy for Chesapeake Bay Watershed, 9VAC25-820 General Virginia Pollutant Discharge Elimination System (VPDES) Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Bay Watershed in Virginia

Agricultural, Natural and Non-MS4 Developed Lands

Initial BMPs and programmatic actions for agricultural, natural and non-MS4 developed lands were explored through the local and regional engagement described in Chapter 5 of this report. The final BMPs identified for implementation through 2025 based on the draft WIP and public review, assuming sufficient resources are made available, result in reductions of 3.51 million pounds of nitrogen and 376,800 pounds of phosphorus compared to 2017 levels and are shown in Figure 11 as WIP III Final. The WIP III Final BMP implementation levels and resulting nutrient reductions provide a solid foundation to meet the Commonwealth's reduction targets for 2025. The cumulative BMP implementation levels for the WIP III can be seen in Table 3 and the resulting loads in Table 2. Input decks and programmatic actions submitted by the SWCDs and PDCs are available on the DEQ Chesapeake Bay TMDL Phase III WIP Data website. The BMP implementation scenario for the WIP III Final is available on CAST.

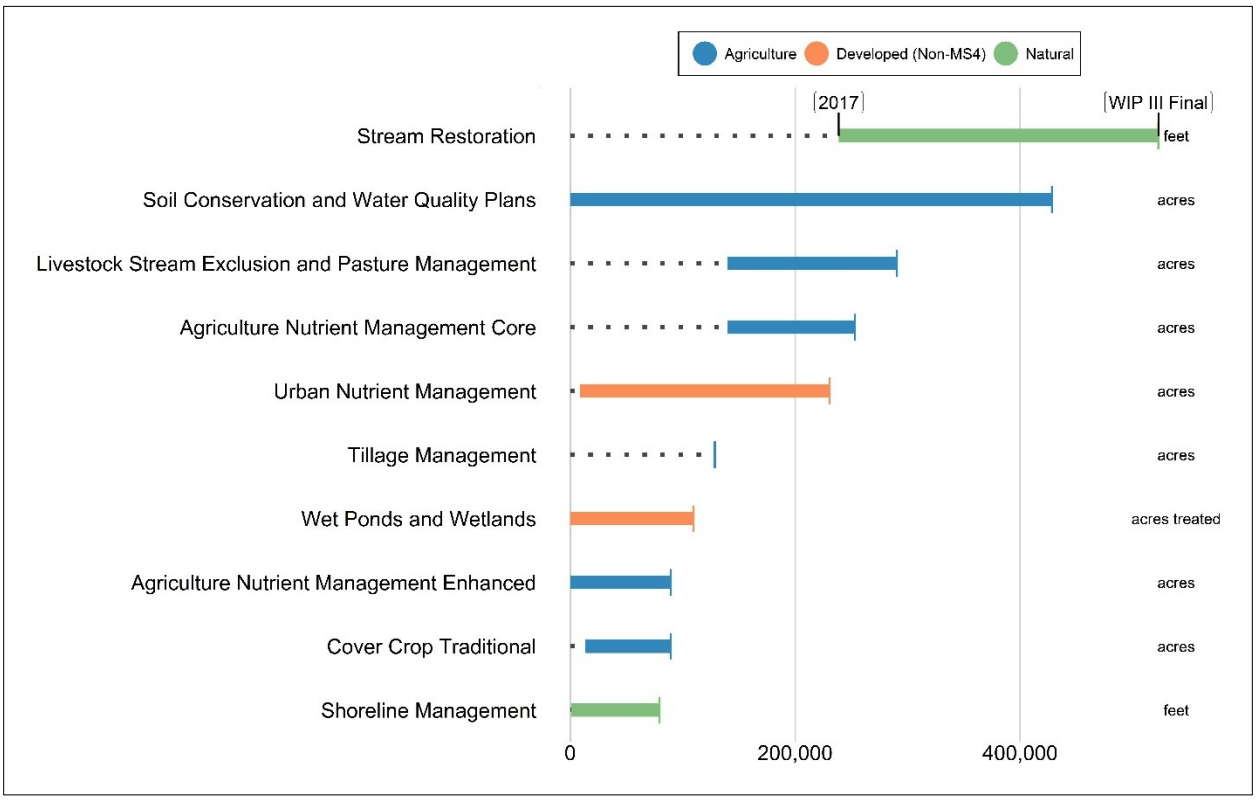

Figure 11: Summary of top BMPs by spatial extent in the James River Basin

Federal Facilities

Federal facilities were expected to provide BMP inputs and programmatic actions to support the Final Phase III WIP (see federal section of Chapters 3 and 5). Inputs from the DoD, USFWS, USFS, NASA LaRC, and NPS were received. The narratives describing federal agency approaches to meeting their planning goal are included in Appendix E. For the purpose of the Phase III WIP, federal agencies are assumed to be treating all lands they own at levels sufficient to meet their local planning goals and current permit requirements. The BMPs used in this plan for federal facilities that did not provide input are derived from the Phase II WIP. For those that did provide BMP inputs, their inputs have been included in the official WIP III Final CAST scenario.

Final Phase III WIP Summary

Table 1 below shows the 2017 progress loads, 2025 basin target loads, reductions from 2017 needed to meet the planning target, additional reductions needed to address climate change, and the reductions identified in the WIP III Final for the James River Basin for nitrogen and phosphorus. Table 2 shows the 2017 progress and WIP III Final loads for nitrogen and phosphorus, as well as the reductions from 2017 levels identified in the WIP III Final by pollution source sector for the James River Basin. Table 3 shows a summary of the WIP III Final BMPs for the James River Basin compared to the levels of implementation reported for 2009 and 2017 progress. The detailed input deck is available in CAST and a summary of Virginia's Bay wide BMPs is provided in Appendix D.

The reductions identified in the WIP III Final for the James River Basin, with the exchanges described in Chapter 7, Initiative 9 and shown in Section 8.6 below, are sufficient to meet the 2025 Basin Targets, and account for forecasted growth and climate change through 2025. The goals set for the James River Basin are ambitious and will require significant sustained funding and technical capacity in all sectors. However, the exchanges to the basin and N:P exchanges within the basin identified in Section 8.6, Table 4 provide a significant buffer and additional assurance that the targets can be met.

Table 1. James River Basin WIP III Final Loads, Targets and Reductions (in pounds)

James River Basin	**2017 Progress Load**	**2025 Basin Target Load**	**Reductions Needed to Meet Target**	**Additional Reductions Needed to Address Climate Change**	**Reductions Identified in WIP III Final**
Nitrogen (pounds)	24,423,000	25,920,000	-1,497,000	480,000	3,506,000
Phosphorus (pounds)	2,503,000	2,731,000	-228,000	59,000	376,800

Table 2 James River Basin Sector Loads and Reductions (in pounds)

Nitrogen (pounds)	**2017 Progress Load**	**WIP III Final Load**	**Reductions Identified in WIP III Final**
Wastewater	9,391,000	8,280,000	1,111,000
Agriculture	4,307,000	2,791,000	1,516,000
MS4 Developed	2,209,000	2,023,000	186,000
Non-MS4 Developed	2,890,000	2,571,000	319,000
Natural	4,736,000	4,406,000	330,000
Federal	890,000	847,000	43,000
Total	**24,423,000**	**20,917,000**	**3,506,000**
Phosphorus (pounds)	**2017 Progress Load**	**WIP III Final Load**	**Reductions Identified in WIP III Final**
Wastewater	677,400	599,800	77,600
Agriculture	401,600	261,200	140,400
MS4 Developed	228,500	210,000	18,500
Non-MS4 Developed	287,600	252,800	34,800
Natural	782,100	687,200	94,900
Federal	126,000	115,500	10,500
Total	**2,503,200**	**2,126,400**	**376,800**

Table 3: James River Basin WIP III Final BMPs

Sector	**BMP**	**Unit**	**2009**	**2017**	**WIP III Final**
Agriculture	Agricultural Stormwater Management	acres	-	-	241
Agriculture	Agriculture Nutrient Management	acres	98,402	140,100	253,142
Agriculture	Agriculture Nutrient Management Enhanced	acres	-	-	89,384
Agriculture	Alternative Crops	acres	108	-	1
Agriculture	Animal Waste Management System	Animal Units	185,709	123,341	402,331
Agriculture	Barnyard Runoff Control	acres	7	331	650
Agriculture	Cover Crop Commodity	acres	5,542	4,981	8,121
Agriculture	Cover Crop Traditional	acres	19,572	34,925	79,341
Agriculture	Cover Crop Traditional with Fall Nutrients	acres	-	-	9,993
Agriculture	Dairy Precision Feeding and/or Forage Management	Animal Units	-	-	6,407
Agriculture	Forest Buffer	acres	4,184	2,129	7,957
Agriculture	Forest Buffer-Streamside with Exclusion Fencing	acres	-	-	17,116

Sector	BMP	Unit	2009	2017	WIP III Final
Agriculture	Grass Buffer	acres	648	818	6,891
Agriculture	Grass Buffer - Narrow	acres	-	1,133	5,173
Agriculture	Grass Buffer-Narrow with Exclusion Fencing	acres	-	133	8,220
Agriculture	Grass Buffer-Streamside with Exclusion Fencing	acres	2,148	3,409	21,134
Agriculture	Horse Pasture Management	acres	25	47	7,314
Agriculture	Land Retirement to Ag Open Space	acres	6,755	6,861	16,577
Agriculture	Land Retirement to Pasture	acres	-	-	7,386
Agriculture	Loafing Lot Management	acres	-	-	70
Agriculture	Manure Compost Static Pile Windrow	dry tons	-	-	6,530
Agriculture	Manure Incorporation	acres	-	-	1,649
Agriculture	Manure Injection	acres	-	-	1,896
Agriculture	Manure Transport	dry tons	11,115	1,687	-
Agriculture	Manure Treatment Slow Pyrolysis	dry tons	-	-	2,600
Agriculture	Mortality Composters	Animal Units	31,873	32,154	311,226
Agriculture	Off Stream Watering Without Fencing	acres	27,142	50,125	76,859
Agriculture	Poultry Litter Amendments (alum, for example)	Animal Units	-	435	15,714
Agriculture	Precision Intensive Rotational/Prescribed Grazing	acres	38,686	88,263	169,671
Agriculture	Soil Conservation and Water Quality Plans	acres	-	-	428,267
Agriculture	Sorbing Materials in Ag Ditches	acres	-	-	43
Agriculture	Tillage Management	acres	138,391	136,780	128,450
Agriculture	Tree Planting	acres	1,562	5,470	17,115
Agriculture	Water Control Structures	acres	580	500	571
Agriculture	Wetland Restoration - Floodplain	acres	71	114	312
Agriculture	Wetland Restoration - Headwater	acres	-	-	307
Developed	Bioretention/raingardens	acres	874	1,643	11,387
Developed	Bioswale	acres	394	391	2,472
Developed	Conservation Landscaping Practices	acres	-	-	8,321
Developed	Dry Detention Ponds and Hydrodynamic Structures	acres	6,713	7,119	40,755

Sector	BMP	Unit	2009	2017	WIP III Final
Developed	Dry Extended Detention Ponds	acres	8,439	8,658	62,141
Developed	Erosion and Sediment Control	acres	10,354	15,771	9,661
Developed	Filter Strip Runoff Reduction	acres	1	1	72
Developed	Filter Strip Stormwater Treatment	acres	-	-	1
Developed	Filtering Practices	acres	362	550	27,630
Developed	Floating Treatment Wetland	acres	-	-	11
Developed	Forest Buffer	acres	34	25	3,200
Developed	Forest Planting	acres	-	5	1,435
Developed	Impervious Surface Reduction	acres	10	39	18,169
Developed	Infiltration Practices	acres	1,176	1,206	33,689
Developed	Permeable Pavement	acres	59	91	74
Developed	Storm Drain Cleaning	pounds of sediment	-	-	70,295
Developed	Stormwater Performance Standard-Runoff Reduction	acres	95	437	205
Developed	Stormwater Performance Standard-Stormwater Treatment	acres	375	1,525	358
Developed	Tree Planting - Canopy	acres	-	-	10,135
Developed	Urban Nutrient Management	acres	4,750	8,950	230,681
Developed	Vegetated Open Channels	acres	218	2,120	1,703
Developed	Wet Ponds and Wetlands	acres	69,106	62,909	109,733
Natural	Denitrifying Bioreactors	pounds of nitrogen	-	-	60,000
Natural	Forest Harvesting Practices	acres	45,270	30,554	50,882
Natural	Oyster Aquaculture	oysters harvested	-	-	50,400,000
Natural	Oyster Reef Restoration	acres	-	-	817
Natural	Shoreline Management	feet	-	1,053	79,446
Natural	Stream Restoration	feet	232,390	238,705	522,922
Natural	Wetland Rehabilitation	acres	-	-	403
Septic	Septic Connection	systems	8	364	16,139
Septic	Septic Denitrification - Conventional	systems	427	607	18,551

Sector	BMP	Unit	2009	2017	WIP III Final
Septic	Septic Denitrification - Enhanced	systems	14	101	608
Septic	Septic Effluent - Enhanced	systems	2	-	1
Septic	Septic Pumping	systems	1,470	575	27,060
Septic	Septic Secondary Treatment - Conventional	systems	1,083	1,114	1,350
Septic	Septic Secondary Treatment - Enhanced	systems	25	60	79

Chlorophyll Study and Regulatory Actions

On September 20, 2018, the State Water Control Board gave approval for DEQ to go to public hearing and comment on amendments to the Water Quality Standards Regulation (9 VAC25-260-310 (bb)), addressing the numeric chlorophyll-*a* criteria applicable to the tidal James River. The proposed amendments were the outcome of a seven-year-long effort to update the regulation with best available science, evaluating the protectiveness of the current criteria and determining if revisions were appropriate, as well as modifying the methods used to assess criteria attainment. The new criteria and assessment method take into consideration the recommendations of a scientific advisory panel (SAP) and a regulatory advisory panel (RAP). The final chlorophyll criteria amendments were presented to the State Water Control Board for adoption at their June 27, 2019, meeting with additional text included, in response to comments received, to describe additional lines of evidence that would be examined to render an appropriate assessment determination for the aquatic life use if "back-to-back" seasonal mean exceedances were to occur. Additional background information on the revised criteria can be found on the DEQ Nutrient Criteria Development website.

In addition, during the James River chlorophyll study an enhanced water quality model was developed to simulate chlorophyll concentrations in response to varying levels of point source nutrient reduction. Modeling scenarios have been run and indicate that water quality conditions protective of the revised chlorophyll criteria can be attained with the point source loads at the DO-based WLAs currently required by the Chesapeake Bay Watershed General Permit and nonpoint source loads controlled at the WIP II level of effort.

Appendix X of the TMDL identified two phases of additional TN and TP reductions necessary in the James Basin to meet the DO criteria. These reductions have been implemented in the last two phases of the Watershed General Permit and are currently incorporated in 9VAC25-820-80. The only remaining WLA reduction yet to be implemented in the Watershed General Permit is an additional one million pounds of TN from the aggregate HRSD James River WLA. In accordance with Part I.C. of the Watershed General Permit, this reduction in WLA is effective January 1, 2022. It should be noted that the Virginia point sources have met the DO-based WLAs in aggregate since 2012.

Following Executive Review by the Office of the Secretary of Natural Resources and the Governor's Office, the revised chlorophyll criteria will be submitted to EPA for their review and approval. Upon EPA approval, DEQ will consider Appendix X to the TMDL to be no longer applicable provided that the final modeling confirms that the DO-based wasteload allocations are protective of the revised chlorophyll criteria. No later than 2020, Virginia will initiate modifications to the Water Quality Management Planning (WQMP) Regulation (9 VAC 25-720) to include wasteload allocations that are protective of

both DO and chlorophyll. Additional nutrient load reductions provided by the point source sector in accordance with Initiative 52 in Chapter 7 will enable the Commonwealth to meet the overall goals of the Phase III WIP and provide a significant margin of safety to ensure chlorophyll criteria are met in the James River.