APPENDIX 31

Achieving Attainment of the James Chlorophyll Water Quality Standard

James Chlorophyll
Conference Call

June 18, 2010

Jeni Keisman, Lewis Linker,
and the CBP Modeling Team

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Key Points:

- Two new scenarios have been developed to examine the nutrient loads needed in the James to achieve the chlorophyll water quality standard in the James.
- These scenarios both use the 190 TN, 12.7 TP Loading Scenario as the global load reduction and change the loads in the James to either the same level of effort (percent of E3) as in the Virginia Potomac, or to half way between the James basin loads under the 170/11.3 scenario and the Potomac level of effort.
- Both of these scenarios are estimated to have achieved the chlorophyll water quality standard in the James.

How we did the assessment:

- We focused on the areas where the overall assessment system was solid as presented by Jeni Keisman at the WQGIT conference call June 14, 2010.

- The two areas of focus were JMSTL in the spring from '93 to '97 and the JMSMH in the summer from '97 to '00.

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James Chlorophyll *a* Attainment at 190TN, 12.7TP

Cbseg	190 Loading Scenario 190TN, 12.7TP, 6030TSS '91-'93 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '92-'94 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '93-'95 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '94-'96 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '95-'97 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '96-'98 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '97-'99 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '98-'00 CL Spring Seasonal
JMSTFL	0%	0%	2%	2%	2%	0%	0%	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	4%	4%	4%	0%	5%
JMSMH	3%	1%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	0%	0%

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
JMSTFL	0%	0%	0%	0%	~~5%~~	~~15%~~	~~15%~~	~~8%~~
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	4%	3%
JMSPH	0%	0%	0%	0%	0%	0%	~~11%~~	~~11%~~

Case 1 – The Lower James Tidal Fresh

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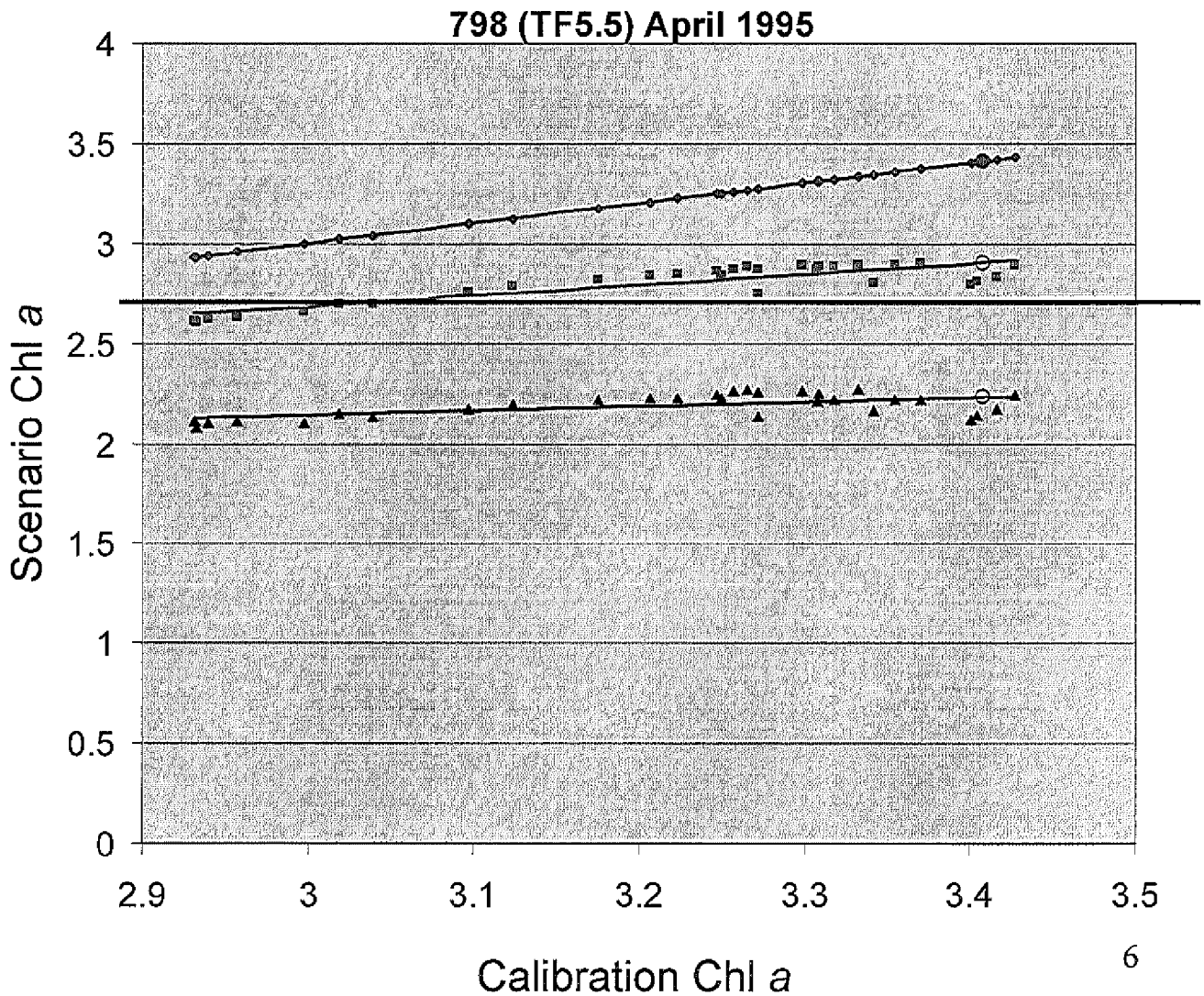
Chlorophyll *a* Problem Segments: JMSTFL Spring

Spring JMSTFL Chla criterion:

15 ug/L (ln =~2.71)

station data

TF5.5	obs	n180
Mar-95	5.1	5.53
Apr-95	30.2	18.2
May-95	9.1	7.49



James Chlorophyll *a* Attainment at 190TN, 12.7TP

Cbseg	190 Loading Scenario 190TN, 12.7TP, 6030TSS '91-'93 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '92-'94 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '93-'95 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '94-'96 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '95-'97 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '96-'98 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '97-'99 CL Spring Seasonal	190 Loading Scenario 190TN, 12.7TP, 6030TSS '98-'00 CL Spring Seasonal
JMSTFL	0%	0%	2%	2%	2%	0%	0%	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	4%	4%	4%	0%	5%
JMSMH	3%	1%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	0%	0%

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
JMSTFL	0%	0%	0%	0%	~~5%~~	~~15%~~	~~15%~~	~~8%~~
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	4%	3%
JMSPH	0%	0%	0%	0%	0%	0%	~~11%~~	~~11%~~

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How we did the assessment *(cont.)*:

James Chlorophyll *a* Attainment at 170TN, 11.3TP

Cbseg	170 Loading Scenario 170TN, 11.3TP, 5650TSS '91-'93 CL Spring Seasonal	170 Loading Scenario 170TN, 11.3TP, 5650TSS '92-'94 CL Spring Seasonal	170 Loading Scenario 170TN, 11.3TP, 5650TSS '93-'95 CL Spring Seasonal	170 Loading Scenario 170TN, 11.3TP, 5650TSS '94-'96 CL Spring Seasonal	170 Loading Scenario 170TN, 11.3TP, 5650TSS '95-'97 CL Spring Seasonal	170 Loading Scenario 170TN, 11.3TP, 5650TSS '96-'98 CL Spring Seasonal	170 Loading Scenario 170TN, 11.3TP, 5650TSS '97-'99 CL Spring Seasonal	170 Loading Scenario 170TN, 11.3TP, 5650TSS '98-'00 CL Spring Seasonal
JMSTFL	0%	0%	1%	1%	1%	0%	0%	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	2%	2%	2%	0%	2%
JMSMH	2%	0%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	0%	0%

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
JMSTFL	0%	0%	0%	0%	4%	11%	11%	4%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	2%	2%
JMSPH	0%	0%	0%	0%	0%	0%	9%	9%

From WQGIT Conference Call June 14, 2010, Jeni Keisman presentation.

Case 2 – The James Mesohaline

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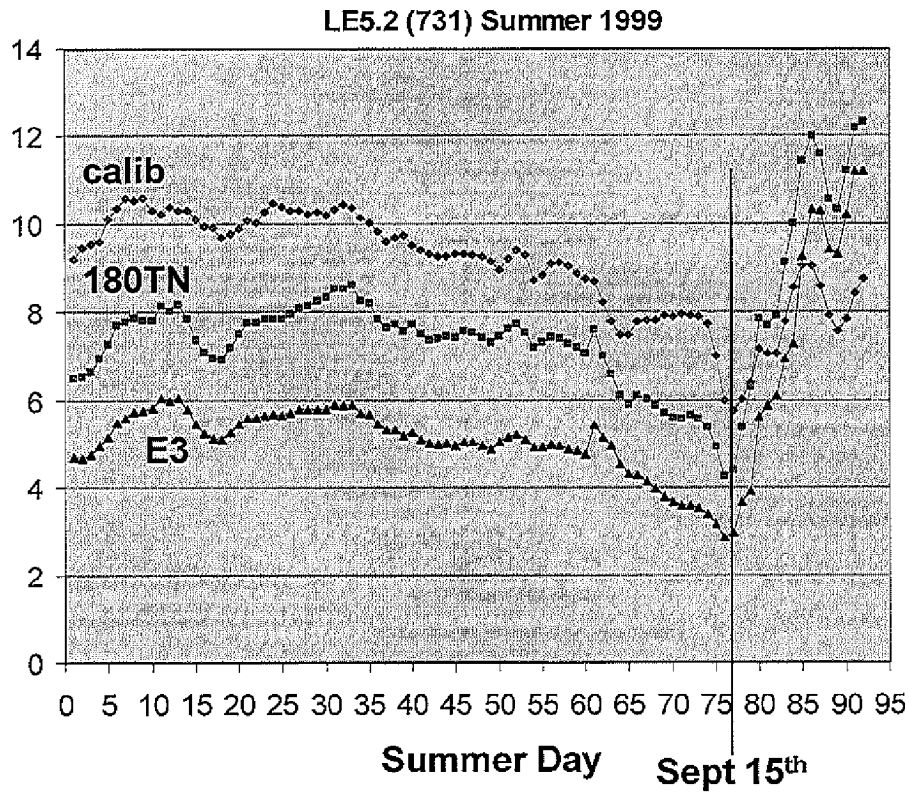
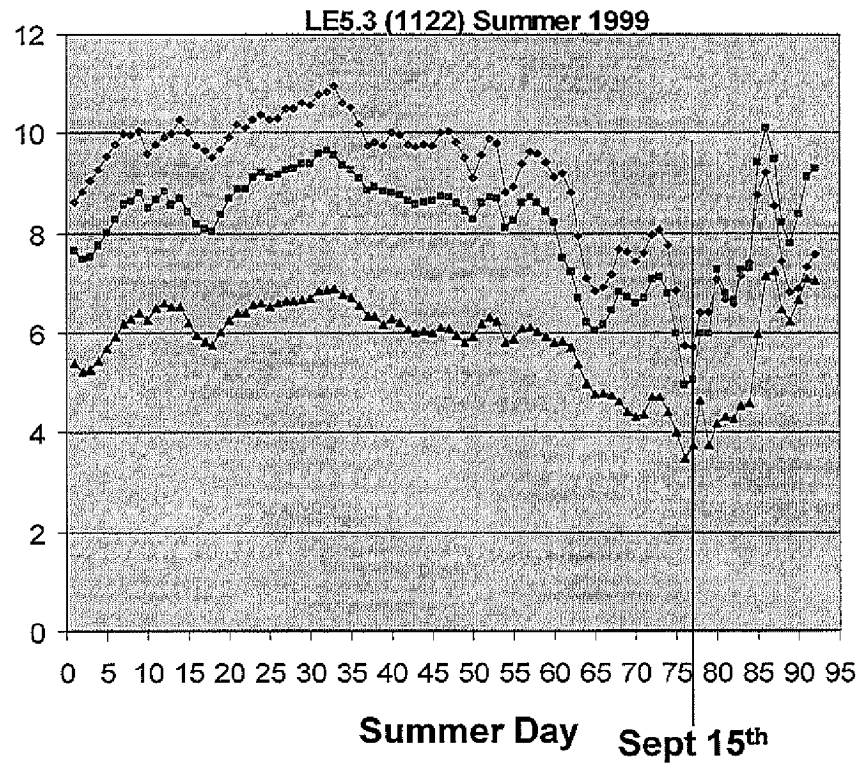
Case 1: The James Mesohaline

James Chlorophyll *a* Attainment at 190TN, 12.7TP

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
JMSTFL	0%	0%	0%	0%	~~5%~~	~~15%~~	~~15%~~	~~8%~~
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	~~0%~~	~~0%~~
JMSMH	0%	0%	0%	0%	0%	0%	15%	14%
JMSPH	0%	0%	0%	0%	0%	0%	~~11%~~	~~11%~~

JMSMH Chlorophyll *a*, Estuarine Model Summer 1999





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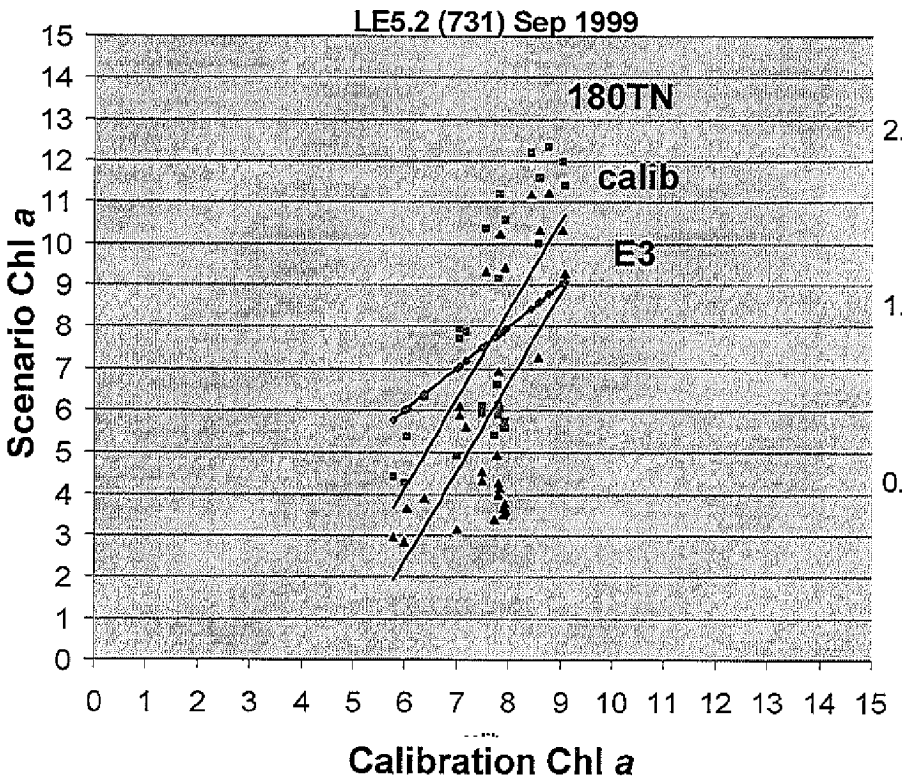
JMSMH Chlorophyll *a*, Refined Regression, Sept. 1999

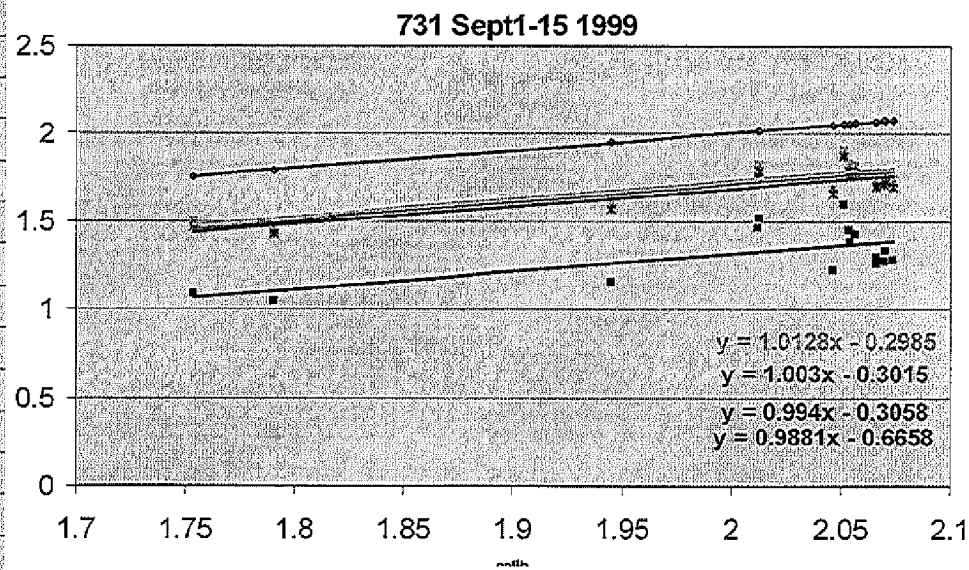
station data

LE5.2	chl a (ug/L)	
month	obs	N190
Jul-99	11.1	8.94
Aug-99	6.19	5.34
Sep-99	14	23.7



station data

LE5.2	chl a (ug/L)	
month	obs	N190
Jul-99	11.1	8.94
Aug-99	6.19	5.34
Sep-99	14	10.8



James Chlorophyll *a* Attainment at 190TN, 12.7TP

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
JMSTFL	0%	0%	0%	0%	5%	15%	15%	8%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	15%	14%
JMSPH	0%	0%	0%	0%	0%	0%	11%	11%

Cbseg	'91-'93 CL Summer Seasonal	'92-'94 CL Summer Seasonal	'93-'95 CL Summer Seasonal	'94-'96 CL Summer Seasonal	'95-'97 CL Summer Seasonal	'96-'98 CL Summer Seasonal	'97-'99 CL Summer Seasonal	'98-'00 CL Summer Seasonal
JMSTFL	0%	0%	0%	0%	5%	15%	15%	8%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	4%	3%
JMSPH	0%	0%	0%	0%	0%	0%	11%	11%

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Global and James Basin Scenario Loads

Total Nitrogen Loads in Millions of Pounds

Scenario→	1985 Scenario 342TN, 24.1TP, 9790TSS	"91 -'00 Base Scenario 309TN, 19.5TP, 8950TSS	2009 Scenario 248TN, 16.6TP, 8110TSS	Target Load Option A 200TN, 15TP, 6390TSS	Tributary Strategy 191TN, 14.4TP, 6462TSS	190/13 Loading Scenario 190TN, 13TP, 6123TSS	190 Loading Scenario 190TN, 12.7TP, 6030TSS	James Between LoE as Potomac and 170 TN 11.3 TP	James At Same LoE As Potomac	179 Loading Scenario 179TN, 12.0TP, 5510TSS	170 Loading Scenario 170TN, 11.3TP, 5650TSS	E3 2010 Scenario 141TN, 8.5TP, 5060TSS	1/3 Between E3 & Forest 113TN 7.1TP 4450TSS	2/3 Between E3 & Forest 85TN 5.7TP 3840TSS	All Forest Scenario 58TN 4.4TP 3240TSS
Total Bay TN Loads	342	309	248	200	191	190	190	187	185	179	170	141	113	85	58
James Basin TN Loads	42.6	36.8	30.4	27.1	27.5	26.6	26.6	23.5	21.5	26.0	25.5	16.1	13.2	10.2	*

Total Phosphorus Loads in Millions of Pounds

Scenario→	1985 Scenario 342TN, 24.1TP, 9790TSS	"91 -'00 Base Scenario 309TN, 19.5TP, 8950TSS	2009 Scenario 248TN, 16.6TP, 8110TSS	Target Load Option A 200TN, 15TP, 6390TSS	Tributary Strategy 191TN, 14.4TP, 6462TSS	190/13 Loading Scenario 190TN, 13TP, 6123TSS	190 Loading Scenario 190TN, 12.7TP, 6030TSS	James Between LoE as Potomac and 170 TN 11.3 TP	James At Same LoE As Potomac	179 Loading Scenario 179TN, 12.0TP, 5510TSS	170 Loading Scenario 170TN, 11.3TP, 5650TSS	E3 2010 Scenario 141TN, 8.5TP, 5060TSS	1/3 Between E3 & Forest 113TN 7.1TP 4450TSS	2/3 Between E3 & Forest 85TN 5.7TP 3840TSS	All Forest Scenario 58TN 4.4TP 3240TSS
Total Bay TP Loads	24.1	19.5	16.6	15.0	14.4	13.0	12.7	12.3	12.2	12.0	11.3	8.5	7.1	5.7	4.4
James Basin TP Loads	6.51	4.34	3.32	3.05	3.29	*	2.68	2.35	2.22	2.58	2.47	1.50	1.30	1.11	*

Chlorophyll Assessment of 190 TN, 12.7 TP Global Loads with James at the Same LoE As the Potomac

Cbseg	tsaa_jlp_1 CL '91-'93 CL Spring Seasonal	tsaa_jlp_1 CL '92-'94 CL Spring Seasonal	tsaa_jlp_1 CL '93-'95 CL Spring Seasonal	tsaa_jlp_1 CL '94-'96 CL Spring Seasonal	tsaa_jlp_1 CL '95-'97 CL Spring Seasonal	tsaa_jlp_1 CL '96-'98 CL Spring Seasonal	tsaa_jlp_1 CL '97-'99 CL Spring Seasonal	tsaa_jlp_1 CL '98-'00 CL Spring Seasonal
JMSTFL	0%	0%	0%	0%	0%	0%	0%	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	0%	0%

Cbseg	tsaa_jlp_1 CL '91-'93 CL Summer Seasonal	tsaa_jlp_1 CL '92-'94 CL Summer Seasonal	tsaa_jlp_1 CL '93-'95 CL Summer Seasonal	tsaa_jlp_1 CL '94-'96 CL Summer Seasonal	tsaa_jlp_1 CL '95-'97 CL Summer Seasonal	tsaa_jlp_1 CL '96-'98 CL Summer Seasonal	tsaa_jlp_1 CL '97-'99 CL Summer Seasonal	tsaa_jlp_1 CL '98-'00 CL Summer Seasonal
JMSTFL	0%	0%	0%	0%	0%	~~2%~~	~~2%~~	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	~~8%~~	~~8%~~

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Chlorophyll Assessment of 190 TN, 12.7 TP Global Loads with James Between LoE As Potomac and 170 TN, 11.3 TP

Cbseg	jlp_2CL '91-'93 CL Spring Seasonal	jlp_2CL '92-'94 CL Spring Seasonal	jlp_2CL '93-'95 CL Spring Seasonal	jlp_2CL '94-'96 CL Spring Seasonal	jlp_2CL '95-'97 CL Spring Seasonal	jlp_2CL '96-'98 CL Spring Seasonal	jlp_2CL '97-'99 CL Spring Seasonal	jlp_2CL '98-'00 CL Spring Seasonal
JMSTFL	0%	0%	0%	0%	0%	0%	0%	0%
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	1%	0%	0%	0%	0%	0%	0%	0%
JMSPH	0%	0%	0%	0%	0%	0%	0%	0%

Cbseg	jlp_2CL '91-'93 CL Summer Seasonal	jlp_2CL '92-'94 CL Summer Seasonal	jlp_2CL '93-'95 CL Summer Seasonal	jlp_2CL '94-'96 CL Summer Seasonal	jlp_2CL '95-'97 CL Summer Seasonal	jlp_2CL '96-'98 CL Summer Seasonal	jlp_2CL '97-'99 CL Summer Seasonal	jlp_2CL '98-'00 CL Summer Seasonal
JMSTFL	0%	0%	0%	0%	~~2%~~	~~6%~~	~~6%~~	~~2%~~
JMSTFU	0%	0%	0%	0%	0%	0%	0%	0%
JMSOH	0%	0%	0%	0%	0%	0%	0%	0%
JMSMH	0%	0%	0%	0%	0%	0%	1%	1%
JMSPH	0%	0%	0%	0%	0%	0%	~~9%~~	~~9%~~

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Conclusions:

- Achieving the James chlorophyll standard requires going beyond the current James Tributary Strategy loads of 27.5 TN and 3.29 TP.

- The scenario loads half way between Virginia Potomac level of effort and the James basin loads under the 170/11.3 scenario are estimated to achieve all James chlorophyll standards with James loads of 23.5 TN and 2.35 TP.

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