Appendixes To
Nutrient Reduction Technology Cost Estimation
For Point Sources
In The Chesapeake Bay Watershed

Chesapeake Bay Program
A Watershed Partnership

November 2002

List of Appendixes

Appendix A:

List of NRT Cost Task Force Members

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NRT Cost Task Force Membership

Allison Wiedeman	EPA Chesapeake Bay Program
Bob Ehrhart	VA Department of Environmental Quality
Bob Steidel	Hopewell Regional Wastewater Treatment Facility
Chris Pomeroy	AQUALAW
Cliff Randall	Virginia Tech
Dave Waltrip	Hampton Roads Sanitation District
Glen Harvey	Alexandria Sanitation Authority
Jerusalem Bekele	DC Department of Health
John Kennedy	VA Department of Environmental Quality
John Murtha	PA Department of Environmental Protection
Lisa Bacon	CH2M HILL
Marya Levelev	MD Department of the Environment
Mike Kyle	Lancaster Area Sewer Authority
Ning Zhou	Virginia Tech
Tanya Spano	Metropolitan Washington Council of Governments
Ta-shon Yu	MD Department of the Environment
Thor Young	Stearns & Wheler
Tom Sadick	CH2M HILL

Appendix B:

Point Source NRT Cost Survey

Part 1: Point Source Survey Letter and Attachment

Part 2: Point Source Survey Responses (Part II is available in hard copy by contacting Ning Zhou at the Chesapeake Bay Program Office at 410-267-5727 or zhou.ning@epa.gov)

Appendix B, Part 1: The Survey Letter and Attachment

Dear Wastewater Treatment Plant Contact:

Attached please find a cost estimate for implementation of nutrient reduction technology at your facility. This information was obtained either from previous correspondence with your facility, grant agreement information, or state reports. **This information reflects only the incremental costs necessary to remove nitrogen.**

The Chesapeake Bay Program is currently performing an analysis of data to estimate costs for all municipal facilities in the Chesapeake Bay watershed to implement Nutrient Removal Technology. Nutrient Removal Technology (NRT) is considered to be any method employed to remove nitrogen from wastewaters including, but not limited to, Biological Nutrient Removal (BNR). Critical information as a part of this work is site specific cost to achieve Biological Nutrient Removal (BNR is defined for this study as: an annual average, non regulatory, final effluent nitrogen concentration of 8 mg/l Total Nitrogen). Information on cost to obtain Limit of Technology (LOT is defined for this study as an annual average, non regulatory, final effluent concentration of 3 mg/l Total Nitrogen) is also desired if available. Estimates for your facility will be a part of this analysis to determine NRT costs Bay-wide; thus, it is important the information be reviewed to ensure its accuracy. Please note, this information will be used in a Bay-wide cost analysis and is not intended to be used for other purposes such as grant applications, etc.

The Bay program is required to provide these cost estimates by May of this year. In order to complete this requirement it is necessary that all cost data that will be used be finalized by March 2002. If data is not available for your facility then your cost will have to be estimated based upon typical values. In addition to the dollar amounts provided in the attachment, there are a number of assumptions that are related to the derivation of costs that need confirmation as well. Please take a look at the attachment and provide a response by **March 1, 2002** to the contact provided on the attachment. Your assistance in this matter would be very much appreciated.

Sincerely,

Attachment
Wastewater Treatment Facility NRT Cost Information

Name of Facility:____
Facility Contact (name and phone #)_____________________________________
Design Flow ________MGD 2000 Annual Ave Flow_______________ What is your current treatment process? (circle one)

BNR Activated Sludge Trickling Filter SBR RBC Other (Please specify)

____

Is this facility currently designed to allow year round nitrification? Yes No

Are there significant site or design constraints that influence the cost to obtain BNR at your facility?
Yes No
If yes provide short explanation (example: HPO plant with no available land for expansion) and an estimate of the additional costs to compensate for this constraint:
____
____

Please confirm, or provide, the following information:
The costs to implement BNR (around annual average 8 mg/l TN) at your facility is :
$ _____________ in **Capital Costs**, (in ___________(year)dollars), and
$______________ per year in **Operation and Maintenance Costs**

The costs to implement LOT (annual average 3 mg/l TN) at your facility would be :

$ _____________ in **Capital Costs**, (in ___________(year)dollars), and
$______________ per year in **Operation and Maintenance Costs**

The items included in the derivation of these cost values include the following (please put a check by all that apply):

Capital Costs

Tanks, Channels and Buildings
Yard Piping
Pumps and Mechanicals
Sitework
Solids Handling
Electrical & Instrumentation
Construction Phase Changes
Engineering Design
Grant Application
Legal Fees
Administration
Methanol Addition Systems
Other? _________________

Operation and Maintenance Costs

Power
Methanol
Other Chemicals
Labor
Solids Handling
Equipment
Other?__________________

Is this a cost value based on voluntary or regulatory implementation? (Circle one)

Please send a response by **March 1, 2002** to: Ning Zhou, Point Source Database Manager, Chesapeake Bay Program, 410 Severn Ave, Annapolis, MD 21403 410-267-5727 (phone) 410-267-5777 (fax), zhou.ning@epa.gov

Appendix C

Correspondences used in developing costs for municipalities

This Appendix is organized by state and available in hard copy only by contacting Ning Zhou at the Chesapeake Bay Program Office at 410-267-5727 or zhou.ning@epa.gov

Appendix D

Description of CSO Tiers for Blue Plains

Appendix D: CBP's Tiered Scenarios for CS0 in DC (as 2/22/02)

CSO Assumptions		Tier 1	Tier 2	Tier 3	Tier 4 (E3)
Note: CSO loadings have been updated to reflect latest estimates from DC-WASA's CSO LTCP study (2001). These recalculated loads are: Total Nitrogen - 123,329 lb/yr; Total Phosphorus - 26,894 lb/yr; and Total Suspended Solids - 4.23 million lb/yr.	**Assumptions (Note: All tiers are assumed to be defined in year 2010.)**	Assumes an approximately 43% reduction in CSOs, and therefore assumes an equal % reduction in TN, TP, & TSS. This scenario is based on: 1) Use of updated CSO loading figures; and 2) implementation of specific projects authorized under DC-WASA's existing CIP budget. These project are expected to be completed in approximately 8 years (i.e., 2010) and have therefore been incorporated as 'phase 1' of the DC-WASA Draft CSO LTCP currently under review by EPA.	Assumes an approximately 43% reduction in CSOs, and therefore assumes an equal % reduction in TN, TP, & TSS. This scenario is based on: 1) Use of updated CSO loading figures; 2) implementation of specific projects authorized under DC-WASA's existing CIP budget (implemented in 8 years); and 3) approval of the DC-WASA CSO LTCP by EPA.	Assumes an approximately 43% reduction in CSOs, and therefore assumes an equal % reduction in TN, TP, & TSS. This scenario is based on: 1) Use of updated CSO loading figures; 2) implementation of specific projects authorized under DC-WASA's existing CIP budget (implemented in 8 years); and 3) approval of the DC-WASA CSO LTCP by EPA.	CBP Assumed Zero Overflows. **Note 1:** This scenario was not supported by COG staff or DC-WASA even for the E3 scenario because: 1) Zero CSO overflows requires complete separation of sewer and stormwater flows that could only be accomplished by tearing up the majority of the District of Columbia over a 30-40 year period - regardless of political will and unlimited funding, and therefore exceeds even the 'extreme' definition of E3; and 2) The impact of the diverted stormwater would result in increased stormwater loads and which water quality modeling has shown to actually result in making water quality worse in the receiving waterbody. **Note 2:** The current draft of the DC-WASA CSO LTCP outlines a 20-year implementation period (i.e., year 2022) due to the physical time required to construct the significant tunnel infrastructure that is proposed and the complexity of such projects. Even the 93% reductions planned under the LTCP would exceed the Tier 4 (E3) definition.
	Calculated Load	Total Nitrogen: 70,298 lb/yr	Total Nitrogen: 70,298 lb/yr	Total Nitrogen: 70,298 lb/yr	Total Nitrogen: 0 lb/yr from CSOs (Stormwater loads increase by an unquantified amount.)
		Total Phosphorus: 15,330 lb/yr	Total Phosphorus: 15,330 lb/yr	Total Phosphorus: 15,330 lb/yr	Total Phosphorus: 0 lb/yr from CSOs (Stormwater loads increase by an unquantified amount.)
		Total Suspended Sediment: 2.41 million lb/yr	Total Suspended Sediment: 2.41 million lb/yr	Total Suspended Sediment: 2.41 million lb/yr	Total Suspended Sediment: 0 million lb/yr from CSOs (Stormwater loads increase by an unquantified amount.)

Appendix E

Capital Cost Data for Tier 1 for Nitrogen Removal

Appendix E: Nitrogen Removal Capital Cost Data for Tier 1 Methodology

STATE	FACILITY	DESIGN FLOW	CC@8($)	Year of Cost Estimate	Source of Estimate *	CC@8 (2000$)
MD	ABERDEEN	4	2,388,974	1998	CC	$2,493,241
MD	ANNAPOLIS	10	13,550,000	1999	CC	$13,875,420
MD	BALLENGER CREEK	6	2,000,000	1995	CC	$2,275,153
MD	BOWIE	3.3	225,532	1991	CC	$290,134
MD	BROADNECK	6	2,163,794	1994	CC	$2,461,481
MD	BROADWATER	2	5,911,212	1998	CC	$6,169,207
MD	CAMBRIDGE	8.1	9,934,376	2002	CC	$9,817,860
MD	CELANESE	1.25	5,791,500	2002	DE	$5,723,574
MD	CHESAPEAKE BEACH	1.18	1,360,000	1992	CC	$1,698,320
MD	COX CREEK	15	$9,476,780	2002	CC	$9,365,631
MD	CRISFIELD	1	4,052,200	2002	DE	$4,004,673
MD	CUMBERLAND	15	10,367,450	2001	CC	$10,265,922
MD	DAMASCUS	1.5	1,661,200	1998	CC	$1,733,703
MD	DELMAR	0.65	1,030,000	2002	DE	$1,017,920
MD	DENTON	0.8	3,611,714	1999	CC	$3,698,454
MD	DORSEY RUN	2	2,500,000	1992	CC	$3,121,912
MD	EASTON	2.35	5,800,000	1993	CC	$6,851,202
MD	ELKTON	2.7	6,360,000	2002	DE	$6,285,406
MD	EMMITSBURG	0.75	7,900,000	1996	CC	$8,728,723
MD	FREDERICK CITY	8	8,816,824	2002	CC	$8,713,415
MD	FREEDOM DISTRICT	3.5	1,000,000	1994	CC	$1,137,576
MD	HAVRE DE GRACE	1.89	6,278,550	2002	CC	$6,204,912
MD	INDIAN HEAD	0.5	656,000	2002	DE	$648,306
MD	JOPPATOWNE	0.95	1,739,998	1996	CC	$1,922,527
MD	KENT ISLAND	2.135	$20,742,570	2002	DE	$20,499,289
MD	LA PLATA	1	4,120,970	2002	CC	$4,072,637
MD	LEONARDTOWN	0.68	1,840,000	2002	CC	$1,818,419
MD	MARYLAND CITY	2.5	823,000	1990	CC	$1,077,941
MD	MARYLAND CORR. INST.	1.23	1,870,000	1995	CC	$2,127,268
MD	MATTAWOMAN	15	7,935,800	2002	DE	$7,842,724
MD	MOUNT AIRY	1.2	4,010,000	1999	CC	$4,106,305
MD	NICODEMUS	1.6	200,000	2002	CC	$197,654
MD	NORTHEAST RIVER	2	1,800,000	2002	DE	$1,778,889
MD	PARKWAY	7.5	15,500,000	1992	CC	$19,355,857
MD	PATUXENT	7.5	1,260,200	1990	CC	$1,650,573
MD	PISCATAWAY	30	19,485,416	2000	CC	$19,485,416
MD	SOD RUN	20	17,300,000	1999	CC	$17,715,480
MD	TANEYTOWN	1.1	3,166,000	2000	CC	$3,166,000
MD	THURMONT	1	2,216,504	1996	CC	$2,449,019
MD	WESTERN BRANCH	30	32,596,340	1991	CC	$41,933,278
MD	WESTMINSTER	5	4,231,847	2001	CC	$4,190,405
PA	ELIZABETHTOWN BOROUGH	3	8,400,000	2002	CC	$8,301,480
PA	HARRISBURG SEW. AUTH.	37.7	25,448,000	1999	DE	$26,059,164
PA	LANCASTER AREA SEW. AUTH.	15	4,249,333	2002	FP	$4,199,494
PA	LANCASTER CITY	29.73	2,500,000	2002	FP	$2,470,679
PA	WYOMING VALLEY	50	763,000	2002	FP	$754,051

Appendix E (continued): Nitrogen Removal Capital Cost Data for Tier 1 Methodology

STATE	FACILITY	DESIGN FLOW	CC@8($)	Year of Cost Estimate	Source of Estimate *	CC@8 (2000$)
VA	ALEXANDRIA	54	40,295,000	1999, 2000	CC**	$40,470,807
VA	AQUIA	6.5	704,000	1990	CC	$922,078
VA	ARLINGTON	40	21,633,946	1999, 2000	CC**	$21,710,798
VA	CULPEPER	4.5	3,147,100	2000	PER/FP	$3,147,100
VA	DALE CITY #1	4	6,929,000	2000	CC	$6,929,000
VA	DALE CITY #8	4	7,122,000	2000	CC	$7,122,000
VA	FMC	5.4	3,800,000	2000	DE	$3,800,000
VA	FWSA OPEQUON	8.4	5,388,236	1998	CC	$5,623,405
VA	H.L. MOONEY	18	18,188,676	1999, 2000	CC/DE**	$18,394,217
VA	HARRISONBURG-ROCKINGHAM REG. SA	16	5,743,094	1995, 1999	CC**	$6,057,948
VA	HENRICO COUNTY	75	17,970,000	1994, 1999	CC**	$19,108,369
VA	LEESBURG	4.85	12,955,468	1998	CC	$13,520,909
VA	LITTLE FALLS RUN	4	3,979,981	1990, 2001	CC**	$5,098,611
VA	MASSAPONAX	8	8,766,902	2000	CC	$8,766,902
VA	MIDDLE RIVER	6.8	2,598,866	1999	CC	$2,661,281
VA	NOMAN M. COLE POLUTN. CONTR. PLNT.	67	20,799,000	1995, 1997	CC**	$22,159,902
VA	PROCTORS CREEK	21.5	1,931,120	1991	CC	$2,484,273
VA	PURCELLVILLE	1	3,030,059	2000	CC	$3,030,059
VA	REMINGTON REGIONAL	2	1,640,276	1995, 2001	CC/DE**	$1,805,477
VA	STUARTS DRAFT	1.4	2,730,249	2000	CC	$2,730,249
VA	TOTOPOTOMOY	5	4,219,540	2000	CC	$4,219,540

* Sources include: Construction cost (CC), Engineering Design Estimate (DE), and Facilities Plan (FP)

Note: Other cost estimates have been eliminated from the data table.

** Project costs were estimated for phases occuring in different years. Each phase cost was converted to 2000$ and the total cost is shown.

Appendix F

Statistical Analyses of Tier 2 Cost Data

Tier 2 Cost Estimate Model

Chesapeake Bay Nutrient Reduction Task Force

The project team developed estimates of Tier 2 costs using a regression model where costs are a function of facility design flow. Three alternative models were evaluated and the diagnostics used in the final model selection are provided. The recommended equation is presented below, along with supplementary analysis that compares the model's predicted results (and uncertainty estimates) with the observed data. A discussion of the model's limitations also is provided.

The recommended equation to estimate capital costs for Tier 2 for facilities in all Chesapeake Bay jurisdictions is:

$$Y = -\,5986.7330X^2 + 704350.8039X + 2023829$$

Sufficient data were available to develop defensible cost equations for Maryland and Virginia, but it was not possible to develop jurisdiction equations for the other states because an insufficient number of data points were available. Therefore, the project team elected to use one equation for all Bay states.

Data Used for Analysis and Model Development

The recommended equation was developed from a data set of 66 records. The original file of capital cost data represented approximately 132 records. In addition to normalizing the full set to present costs in 2000$, the data were also screened to limit data to estimates which were considered "reliable". Consequently, preliminary evaluations on the 2000$- adjusted, more reliable subset of 66 records were conducted to examine the effects of potentially major factors on the relative cost per mgd.

The Chesapeake Bay Program provided the data for this analysis with input and review of the data from representatives of Maryland, Pennsylvania, Virginia, and the District of Columbia. The datum from the Maryland Kent Island facility (2.135 mgd and $20,499,289-adjusted 2000 dollars) was removed because this was based upon an atypical expansion cost, following task force discussion. The final file consists of 66 facility-specific records. State representation is: MD (40 records), PA (5 records), and VA (21 records).

A new variable, coded ***CF***, was calculated as the ratio of adjusted cost by flow, resulting in a cost per mgd per facility. The range of CF over the 66 observations is: $15,081 to $11,638,297 per mgd. The median value is $1,020,901 per mgd, with lower 5^{th} and upper 95^{th} percentiles of $117,544 and $3,401,086 per mgd, respectively. The skew in the ratio is indicative of highly divergent costs which may be attributable to: date of cost (even with adjustment for absolute 2000$), differences in facility size (economies of scale), state differences, as well as other unknown factors. Preliminary evaluations relied upon the CF measure to compare states, year of costs incursion and changes over time in order to inform model development.

Alternative Models Evaluated

Three different models were evaluated to establish a predictive equation for adjusted 2000 cost dollars, based upon facility flow (mgd). The first was a simple linear regression with flow and cost as independent and dependent variables, respectively. The second added a quadratic term ($flow^2$) which improves predictive behavior at the extremes of the range of flows. The third used a transformed (square root) independent variable. Log transformations were not evaluated beyond a preliminary stage given because the diagnostic results showed a lack of fit (i.e., poor predictive capability). Figures 1 through 3 show the fits versus observed adjusted capital cost dollars from the three regression models of the "pooled" data from all jurisdictions.

Among the three models, the quadratic equation displayed the best fit overall. The following bullets summarize results from the model fitting. The equations and diagnostic information for the various models are provided in Table 1.

- Most of the information in Table 1 documents model attributes which are used to compare models. While R^2 - values are often cited in support of goodness of fit (the higher the value, the more useful the fit), conventional regression diagnostics focus an ANOVA which compares the mean square attributable to the regression to the mean square of the residuals. The ratio of those two values is distributed as an F-statistic, which indicates the probability of the linear function in rejecting the null hypothesis of no correlation. High F-values correspond to low probability (for fixed degrees of freedom), meaning that the relationship is "statistically significant."
- While there are increases in the cases of outliers and leverage points, behavior of the estimates suggested an overall improvement with the addition of the quadratic term. (The "leverage" measures test for the effect of individual points on the slope-intercept estimates. This relates to sufficiency and/or completeness of an equation.)
- The final terms in table—SE/FIT and CI/FIT—document the relative percent that the estimated standard error of the model exhibits over the range of predicted values. A confidence interval on a regression line does not parallel the best fit. Rather, the confidence interval exhibits wider divergence from the predicted values at the upper and lower bounds of the range of the independent variable. These terms give the range (percentage) spanned for the ratio of the standard error to the predicted values on the fit line and the range (percentage) spanned by the width of a 95% confidence interval (as a portion of the predicted value) over the range of observed flows. In general, the lower the standard error, the less uncertain the predicted values derived from the regression equation.
- Results of this analysis indicated a modest improvement to the linear model with addition of the quadratic term, and no improvement with the square root term.

TABLE 1. MODEL DIAGNOSTICS FOR POOLED DATA (ALL STATES, 66 DATA POINTS)

Equation Type	Linear	Quadratic	Square Root
Equation	Y = 351071.9793X + 3648055	Y = –5986.7330X^2 + 704350.8039X + 2023829	Y = 3028405.129 SQRT(X) - 679550
R^2	0.43	0.48	0.46
R^2_{ADJ}	0.42	0.47	0.45
F_{DF}	$48.1_{1,64}$	$52.2_{2,63}$	$48.1_{1,64}$
p[F]	<0.001	<0.001	<0.001
Outlier	CASES 5 & 66	Cases 5, 33, & 66	CASES 5, 33 & 66
Leverage	CASES 14 & 19	Cases 14 & 19	NA
SE/FIT	8.7 => 25.1	10 => 45	8 => 77
CI/FIT	45 => 100	31 => 182	40 => 309

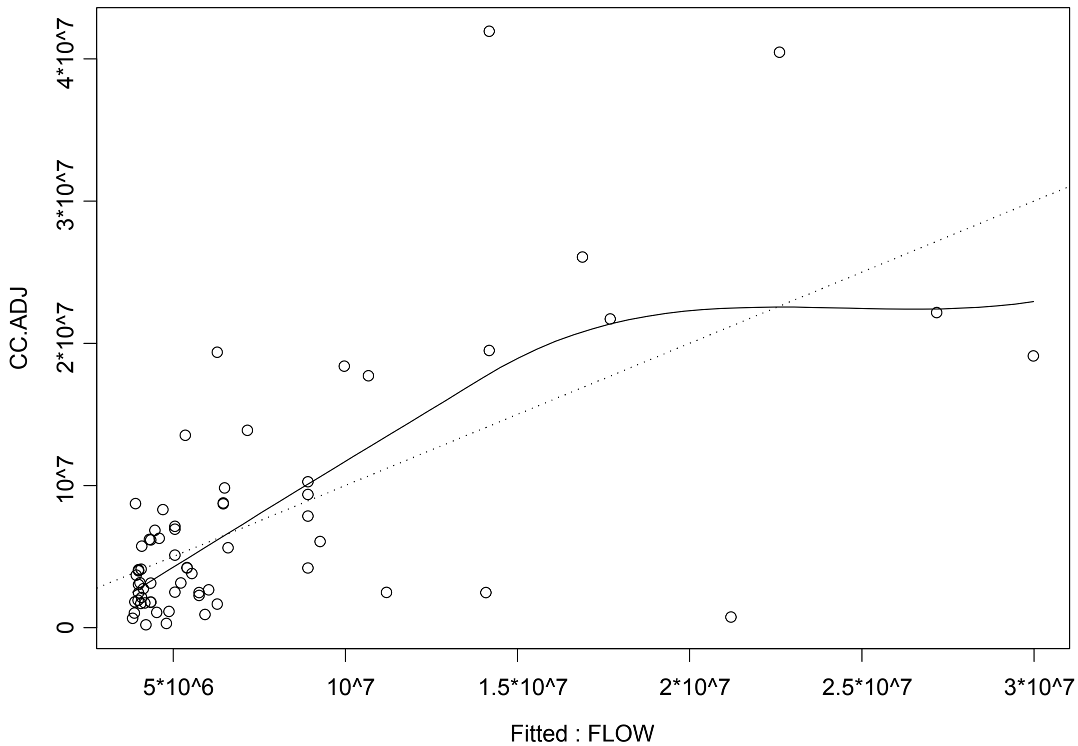

FIGURE 1: UNTRANSFORMED LINEAR FIT

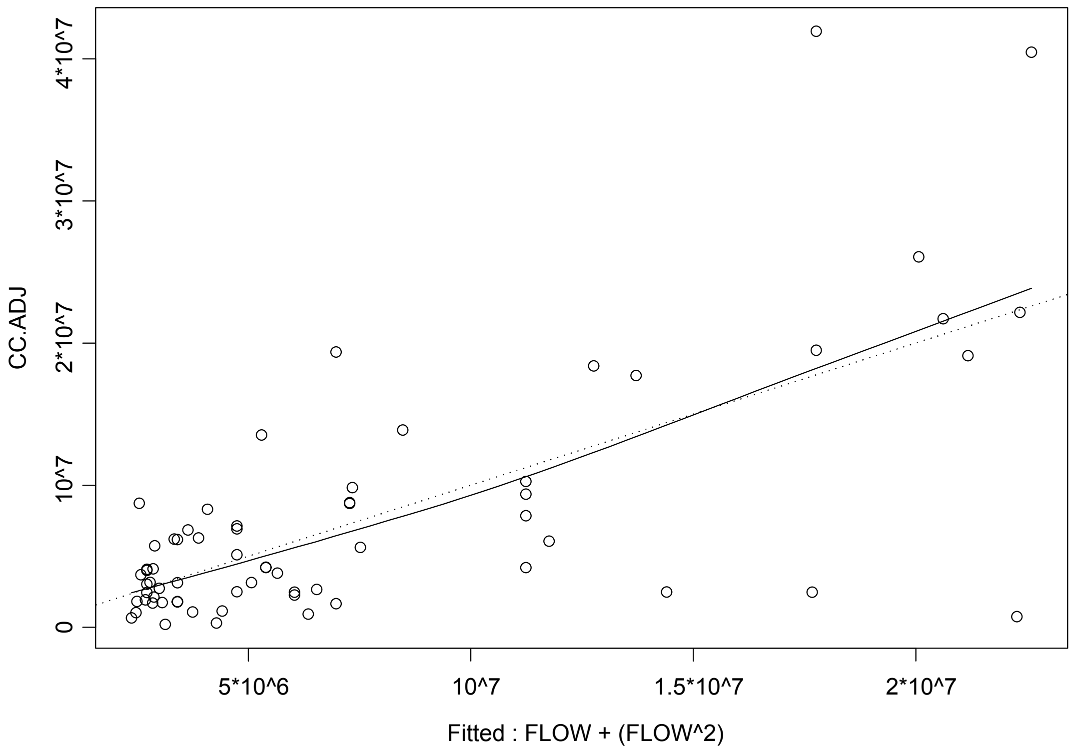

FIGURE 2: UNTRANSFORMED QUADRATIC FIT

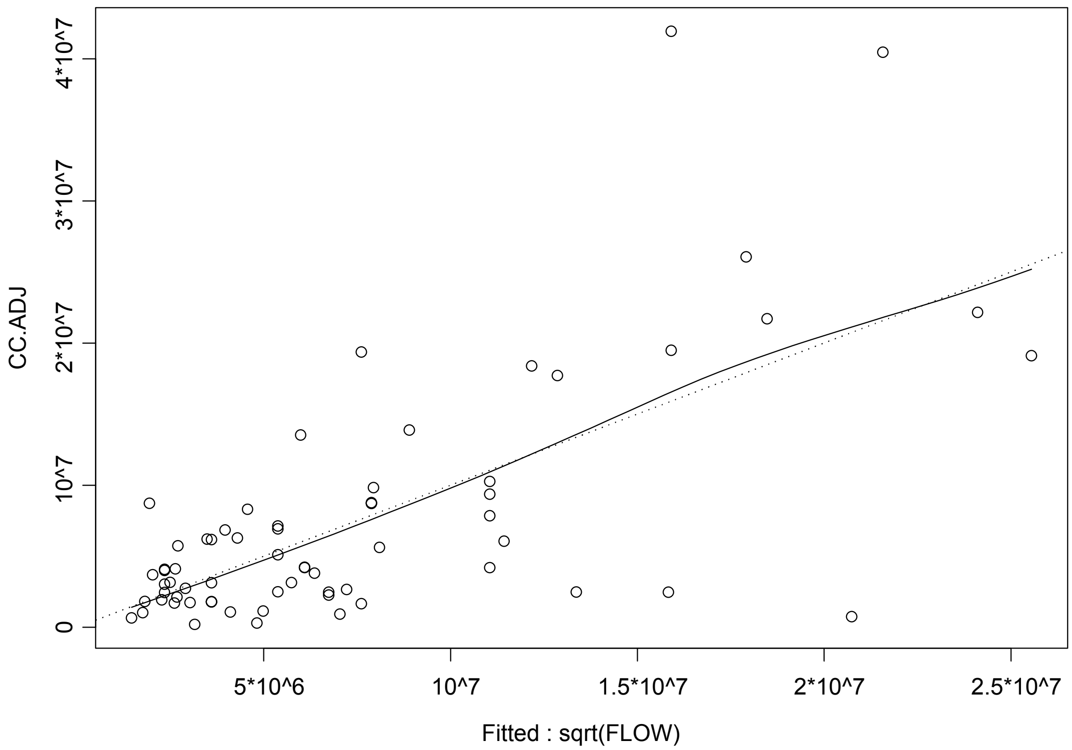

FIGURE 3: SQUARE ROOT EQUATION

Selection of Preferred Model

Overall, the quadratic equation provides a best fit for the available data. None of the models is ideally representative over the range of values. The recommended model was selected on the basis of a comparison of the predictive capabilities of the three alternative models in addition to the modest improvement of equation fit described above.

Table 2 provides comparison of predicted values from the three models (with estimates of uncertainty) to observed values for a subset of flows which span the range observed in available data: 0.5, 1, 5, 15, 30, 50/54 and 75 mgd. The table lists counts of observations, the range of reported adjusted costs, the best estimate (and standard error as a percent of the estimate at that flow), and the 95 percent confidence interval for each flow for the three models.

Figure 4 graphically compares the estimates produced by the three equations over the flow range, 0 to 30 mgd, for which the equation will be used. The quadratic equation provides the most conservative estimates over the broadest range of values for which the equation will be used. The project team used this feature, in conjunction with the statistical analysis discussed above, to help determine that this was the best equation to use for this study.

TABLE 2: MODEL PREDICTION COMPARISONS

	OBSERVATIONS		LINEAR	QUADRATIC	SQUARE ROOT
Example Flow (MGD)	Number of Data Points at the MGD	RANGE ($Mil)	BEST Est. [% SE], 95% Confidence Interval ($ Mil)	BEST Est. [% SE], 95% Confidence Interval ($ Mil)	BEST Est. [% SE], 95% Confidence Interval ($ Mil)
0.5	1	0.6	3.8 [25%]	2.4 [46%]	1.5 [77%]
			1.9 – 5.7	2.1 - 4.5	2.6 - 4.4
1	4	2.4 - 4.1	4.0 [23%]	2.7 [38%]	2.3 [44%]
			2.1 - 5.9	0.6 - 4.8	0.3 - 4.4
5	2	4.20 – 4.22	5.4 [16%]	5.4 [15%]	6.1 [13%]
			3.7 - 7.1	3.8 - 7.0	4.5 - 7.7
15	4	4.2 – 10.4	8.9 [9%]	11.2 [11%]	11.0 [8%]
			7.3 - 10.6	8.8 - 13.7	9.2 - 12.9
30	2	19.5 – 32.6	14.2 [8%]	17.8 [10%]	15.9 [9%]
			11.7 - 16.7	14.1 - 21.5	13.1 - 18.7
*50**	*1*	*0.8*	*21.2 [10%]*	*22.3 [9%]*	*20.7 [9%]*
			16.9 - 25.5	*18.1 - 26.5*	*16.8 - 24.6*
*54**	*1*	*40.3*	*22.6 [10%]*	*22.6 [10%]*	*21.6 [10%]*
			18.0 - 27.3	*18.1 - 27.1*	*17.5 - 25.7*
75	1	18	30.1 [11%]	21.2 [22%]	25.5 [10%]
			23.2 - 36.7	K	20.4 - 30.7

* The lines representing the single observations for 50 and 54 mgd have been italicized to point out the extremes in values which occur throughout the range of flows. The single value at 50 mgd is the datum from the Wyoming PA facility and represents the minimum CF ratio in the dataset. The less extreme value at 54 mgd represents the Alexandria VA facility with a CF of $759,459 per mgd.

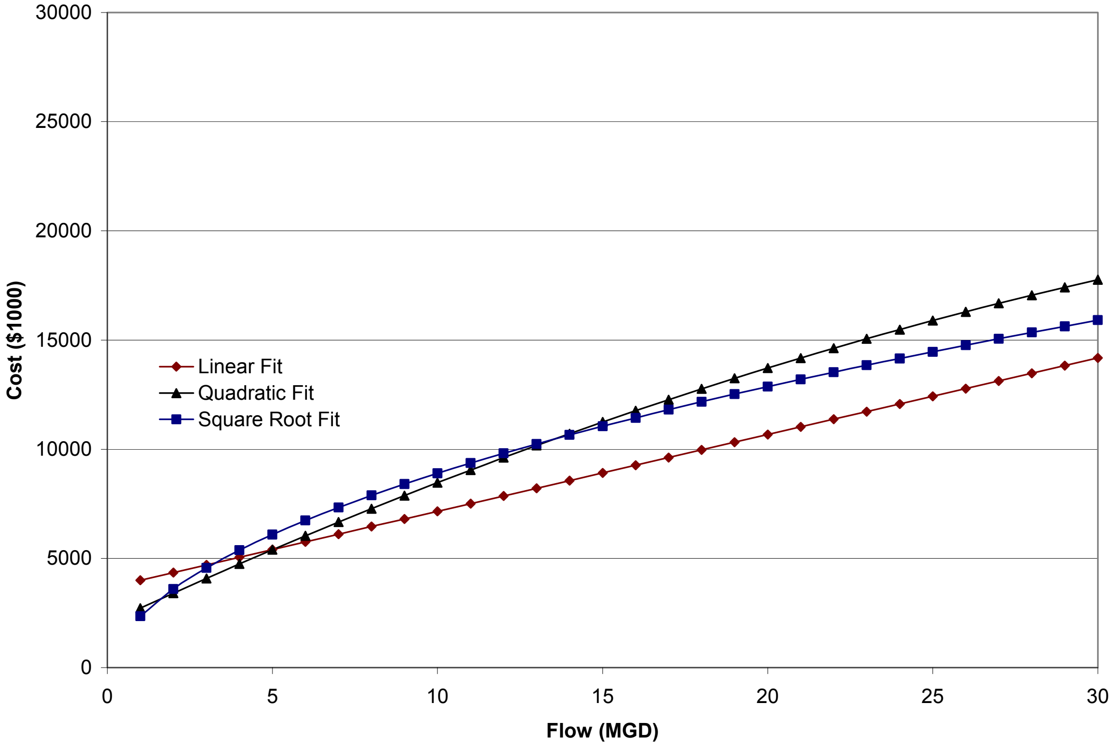

FIGURE 4: COMPARISON OF EQUATION ESTIMATES OVER THE 0 TO 30 MGD FLOW RANGE

Appendix G

Details of Cost Assumptions Used in the Tier 3&4 Methodology

Summary of Costs for TN=5 Capital and Operating for Plant Sizes 0.1 to 30 MGD

Facility/component	Plant annual average flow 0.1mgd	1.0 mgd	10 mgd	30 mgd	Comments/assumptions
Secondary anoxic reactor	11	105	1,040	3,125	1 hr HRT using $ 2.50 per gallon installed w/ baffles
Mixing/misc mechanical	10	50	200	500	Allowance
Nitrification improvements allowance	50	250	1,000	3,000	Guesstimate based on flow per gallon - $.50 for 0.1 mgd, $.25 for 1 mgd, and $0.10 for 10 and 30 mgd for improvements to achieve more reliable nitrification for LOT. E.g., Q splits, aeration, tankage
Methanol facility	75	250	500	800	Used in-house estimates and judgement. 55 Gallon drums for 0.1 mgd, bulk storage for others
Clarifier improvements	40	200	1,050	2,100	Assumed clarifiers added for 25% of flow. E.g. for 1 mgd cost use clarifier cost for 250k flow. Used EPA I/A curve for circular clarifier @ 600 gpd/sq ft includes WAS & RAS - ENR 2475
Total Construction	186	855	3,790	9,525	
30 % Program Implementation Cost	56	257	1,137	2,858	
Total Capital Cost	**$241**	**$1,112**	**$4,927**	**$12,383**	$ x 1,000
Annual O&M Costs	**$7,046**	**$29,218**	**$157,469**	**$293,938**	Actual dollars at design flow

update 4/4/02 tes

Capital Costs for TN=5 By Components ($000)

Facility/component	0.1mgd	1.0 mgd	10 mgd	30 mgd	Comments/assumptions
	Plant annual average flow				
Secondary anoxic reactor	11	105	1,040	3,125	1 hr HRT using $ 2.50 per gallon installed w/ baffles
Mixing/misc mechanical	10	50	200	500	Allowance
Nitrification improvements allowance	50	250	1,000	3,000	Guesstimate based on flow per gallon - $.50 for 0.1 mgd, $.25 for 1 mgd, and $0.10 for 10 and 30 mgd for improvements to achieve more reliable nitrification for LOT. E.g., Q splits, aeration, tankage
Methanol facility	75	250	500	800	Used in-house estimates and judgement. 55 Gallon drums for 0.1 mgd, bulk storage for others
Clarifier improvements	40	200	1,050	2,100	Assumed clarifiers added for 25% of flow. E.g. for 1 mgd cost use clarifier cost for 250k flow. Used EPA I/A curve for circular clarifier @ 600 gpd/sq ft includes WAS & RAS - ENR 2475
Total Construction	186	855	3,790	9,525	
30 % Program Implementation Cost	56	257	1,137	2,858	
Total Capital Cost	**$241**	**$1,112**	**$4,927**	**$12,383**	$ x 1,000
$/gallon	$2.41	$1.11	$0.49	$0.41	
N removed lbs/ day	3	25	250	750	8 mg/L TN to 5 mg/L TN
N removed lbs/ year	913	9,125	91,250	273,750	

Note: These are incremental costs to go from 8 to 5 mg/L TN

updated 4/4/02 tes

Annual O&M Costs for TN = 5 mg/L for 0.1 MGD of Flow

Cost Component	Quantity	Units	Cost/unit	Cost /year		
Methanol	1.175	gal/day	$2.00	$858		1/10 of 1 mgd - use $2 /gal for 55 gallon drums
Solids production	0.93	lbs/MG	$0.15	$51		1/10 of 1 mgd
Energy	3	kW/day	$0.05	$1,314		Estimate for mixing and other electrical needs
Labor	0	hrs/day	$30.00	$0		No extra labor
Maintenance				$4,823	$241	Use 2% of the capital cost
Total Annual Cost				**$7,046**		Actual dollars at design flow

Updated 4/4/02

Annual O&M Costs for TN = 5 mg/L for 1 MGD of Flow

Cost Component	Quantity	Units	Cost/unit	Cost /year		
Methanol	11.75	gal/day	1	$4,289		8 mg/L to 5 mg/L , 3 mg/L NO3 removed*3.1 mg/MeOH/mg/NO3*1*8.34 = 77.56 lbs MeOH /day / 6.6 lbs /gal = 11.75 gal/day @ $1.00/gal
Solids production	9.3	lbs/MG	0.15	$509		0.12 lbs /lb MeOH: 77.5 lbs MeOH * 0.12 = 9.3 lbs /MG and use cost of $ 300/dt or $0.15 /dlb
Energy	5	kW	0.05	$2,190		use 50 HP/MG - EPA Nitrogen Control Manual - pg 216, anoxic volume of 41,667/1,000,000 x 50hp/MG = 2.1 HP*.746kW/HP = 1.56 kW say 2 also add 3 kW for clarifier mechanism, metering pumps, lights = 5
Labor	0	hrs/day	30	$0		No extra Labor
Maintenance				$22,230	**$1,112**	Use 2% of the capital cost with capital cost
Total Annual Cost				**$29,218**		Actual dollars at design flow

Updated 4/4/02

Annual O&M Costs for TN = 5 mg/L for 10 MGD of Flow

Cost Component	Quantity	Units	Cost/unit	Cost /year		
Methanol	117.5	gal/day	$1.00	$42,888		10x1mgd
Solids production	93	lbs/MG	$0.15	$5,092		10x 1mgd
Energy	25	kW	$0.05	$10,950		0.4 MG anoxic x 50 HP/MG = 20 HP = 15 KW + 5 for other electrical
Labor	0	hrs/day	$30.00	$0		No extra labor
Maintenance				$98,540	$4,927	Use 2% of the capital cost with capital cost of denite facility
Total Annual Cost				**$157,469**		Actual dollars at design flow

updated 4/4/02

Annual O&M Costs for TN = 5 mg/L for 30 MGD of Flow

Cost Component	Quantity	Units	Cost/unit	Cost /year		
Methanol	352.5	gal/day	$1.00	$353		30x1mgd
Solids production	279	lbs/MG	$0.15	$15,275		30x1mgd
Energy	70	kW	$0.05	$30,660		1.25 MG x 50 = 75 HP*.746= 56 use 70 with other electrical needs
Labor	0	hrs/day	$30.00	$0		no extra labor
Maintenance				$247,650	$12,383	Use 2% of the capital cost with capital cost of denite facility
Total Annual Cost				**$293,938**		Actual dollars at design flow

updated 4/4/02

Summary of Costs for TN=3 Capital and Operating for Plant Sizes 0.1 to 30 MGD

	Plant annual average flow				
Facility/component	**0.1mgd**	**1.0 mgd**	**10 mgd**	**30 mgd**	**Comments/assumptions**
Pumping station	140	350	1,400	3,200	Using approximate average for two sets of EPA cost curves - IA manual and Construction Cost Curves for Muni WW Conveyance Systems - Used 3x ADF for costs e.g., 0.1 = 0.3 peak capacity
Denite filters	100	625	6,000	17,200	Used 2 gpm/sq ft with various redundancy (BW and O/S) based on flow. 50% for 0.1mgd, 20% for 1 mgd, 15% for 10mgd and 10% for 30mgd. Used flat $1500/sq ft
Total Construction Costs	$240	$975	$7,400	$20,400	
30 % Program Implementation Cost	$72	$293	$2,220	$6,120	Includes administration, engineering, CM, bonding,legal
Total capital cost	**$312**	**$1,268**	**$9,620**	**$26,520**	$ x 1,000
Annual O&M costs	**$22,993**	**$69,925**	**$311,634**	**$841,120**	Actual $ at design flow

updated 4/4/02

Capital Costs for TN=3 By Components ($000)

Facility/component	Plant annual average flow 0.1mgd	1.0 mgd	10 mgd	30 mgd	Comments/assumptions
Pumping station	140	350	1,400	3,200	Using approximate average for two sets of EPA cost curves - IA manual and Construction Cost Curves for Muni WW Conveyance Systems - Used 3x ADF for costs
Denite filters	100	625	6,000	17,200	Used 2 gpm/sq ft with various redundancy (BW and O/S) based on flow. 50% for 0.1mgd, 20% for 1 mgd, 15% for 10mgd and 10% for 30mgd. Used flat $1500/sq ft
Total Construction Costs	$240	$975	$7,400	$20,400	
30 % Program Implementation Cost	$72	$293	$2,220	$6,120	Includes administration, engineering, CM, bonding,legal
Total capital cost	**$312**	**$1,268**	**$9,620**	**$26,520**	
$/gallon	$3.12	$1.27	$0.96	$0.88	
N removed lbs/ day	2	17	167	500	5 to 3 mg/L TN
N removed lbs/ year	621	6,096	60,955	182,500	

Note: these are incremental costs to get from 5mg/L to 3 mg/L TN

Annual O&M costs

Annual O&M Costs for TN = 3 mg/L for 0.1 MGD of Flow

Cost Component	Quantity	Units	Cost/unit	Cost /year		
Methanol	1.175	gal/day	$2.00	$858		1/10 of 1 mgd
Solids production	0.93	lbs/day	$0.15	$51		1/10 of 1 mgd
Energy	13.4	kW	$0.05	$245		1/10 of 1 mgd
Labor	2	hrs/day	$30.00	$15,600		5 days/week
Maintenance				$6,240	$312	Use 2% of the capital cost with capital cost of denite facility
Total Annual Cost				**$22,993**		Actual dollars at design flow

Annual O&M Costs for LOT TN=3 mg/L for 1 MGD of Flow

Cost Component	Quantity	Units	Cost/unit	Cost /year		
Methanol	11.75	gal/day	1	$4,289		(5 to 3 mg/L TN) - assume operating at 2 therefore use 3 mg/L NO3 - 3x3.1*8.43*1mgd = 77.5 /6.6 lbs per gal=11.75 gpd
Solids production	9.3	lbs/day	0.15	$509		Yield 0.12 lbs /lb MeOH: 77.5 lbs MeOH * 0.12 = 9.3 lbs /MG and use cost of $ 300/dt or $0.15 /dlb
Energy	134	kW	0.05	$8,578		30 ft TDH for PS & misc elec - 1140 * 30 ft* 1 mgd/.7 eff = 48857 kW/yr or 134 kW/Day - use $ 0.05/kW hr
Labor	4	hrs/day	30	$31,200		5 days per week
Maintenance				$25,350	**$1,268**	Use 2% of the capital cost with capital cost
Total Annual Cost				**$69,925**		Actual dollars at design flow

Updated 4/4/02 tes

Annual O&M Costs for TN = 3 mg/L for 10 MGD of Flow

Cost Component	Quantity	Units	Cost/unit	Cost /year		
Methanol	117.5	gal/day	$1.00	$42,888		10 x 1 mgd
Solids production	93	lbs/day	$0.15	$5,092		10 x 1 mgd
Energy	1340	kW	$0.05	$24,455		10 x 1 mgd
Labor	6	hrs/day	$30.00	$46,800		5 days/week
Maintenance				$192,400	$9,620	Use 2% of the capital cost with capital cost of denite facility
Total Annual Cost				**$311,634**		Actual dollars at design flow

updated 4/4/02

Annual O&M Costs for TN = 3 mg/L for 30 MGD of Flow

Cost Component	Quantity	Units	Cost/unit	Cost /year		
Methanol	352	gal/day	$1.00	$128,480		30X1 mgd
Solids production	279	lbs/day	$0.15	$15,275		30X1 mgd
Energy	4020	kW	$0.05	$73,365		30X1 mgd
Labor	12	hrs/day	$30.00	$93,600		5 days/week
Maintenance				$530,400	**$26,520**	Use 2% of the capital cost with capital cost of denite facility
Total Annual Cost				**$841,120**		Actual dollars at design flow

updated 4/4/02

Appendix H

References and Data Contacts for Industrial Costs:

This appendix is organized by facility and available in hard copy by contacting Ning Zhou at the Bay Program Office, 410-295-6892 or zhou.ning@epa.gov

Appendix I

Communications, Decisions, and References for Cost and Load Data Compiling

Part 1: Communications and Decisions for Cost Methodology Applications

Part 2: Communications and Decisions for Load Calculations by Tier

Part 3: References for Section X Summary Cost Tables

Part 1: Communications and Decisions for Cost Methodology Applications

Attachment 1: Messages concerning the workgroup decision to use survey data for facilities >30MGD.

Marya Levelev <mlevelev@mde.state.md.us>

04/05/02 02:28 PM

To: gbharvey@alexsan.com, lbacon@ch2m.com, tsadick@ch2m.com, kcollini@chesapeakebay.net, jbekele@dchealth.com, jmkennedy@deq.state.va.us, rwehrhart@deq.state.va.us, Allison Wiedeman/CBP/USEPA/US@EPA, Ning Zhou/CBP/USEPA/US@EPA, DWaltrip@hrsd.dst.va.us, bsteidel@hrwtf.org, mkyle@lasa-wpcf.org, cpomeroy@mcguirewoods.com, Ta-Shon Yu <tyu@mde.state.md.us>, tspano@mwcog.org, jmurtha@state.pa.us, tayoung@stearnswheler.com, cliff@vt.edu

cc:

Subject: Re: facilities with design flow>30

Allison, for MD we would like to use cost curves for Back River and Patapsco. Western Branch already can achieve 3 mg/l.

>>> <Wiedeman.Allison@epamail.epa.gov> 04/05/02 12:21PM >>>
hey folks - as we have agreed to in previous meetings, we will try to calculate costs for nrt for the larger facilities (= or greater than 30 MGD) individually based on site specific information where available, instead of using cost curves. Ning has assimilated a table below which lists all of the facilities in the watershed that are greater than 30, and has provided what data we have on them, whether it be the recent survey data, randall data, grant data, or info from MDE, or directly from the facility. Note that we could use info for some of them. in particular:

Tashon - why did you not include a cost for western branch to go to 3 on your original cost spread sheets??

Bob E. or Tanya - can you see if you can get capital costs to go to 3 for the following facilities - we did not receive surveys from them, or they did not provide this information

arlington
richmond
henrico county
hrsd-vip
hrsd nansemond
hopewell - i believe that bob stiedel said that it is not feasible to even consider going to 3 for hopewell at this time.

Allison Wiedeman
410-267-5733
wiedeman.allison@epa.gov
410-267-5777 (f)
Chesapeake Bay Program Office

Attachment 2: Message concerning applying actual TN@3 cost data to Tier 3 and Tier 4

Allison Wiedeman/CBP/USEPA/US@EPA

05/03/02 11:55 AM

To: gbharvey@alexsan.com, bsteidel@hrwtf.org, DWaltrip@hrsd.dst.va.us, cpomeroy@mcguirewoods.com, jmkennedy@deq.state.va.us, tspano@mwcog.org, jmurtha@state.pa.us, jbekele@dchealth.com, mlevelev@mde.state.md.us, kcollini@chesapeakebay.net, rwehrhart@deq.state.va.us, mkyle@lasa-wpcf.org, cliff@vt.edu, lbacon@ch2m.com, tsadick@ch2m.com, tyu@mde.state.md.us, Ning Zhou/CBP/USEPA/US@EPA, tayoung@stearnswheler.com

costing between 8 and 3

OK folks - based on your comments which i very much appreciated, i think this is the best way to go, based on two reasons:

1) Applying the KISS principle

2) I want to be able to keep the actual numbers provided by the sources in tact to the extent we can so that they will appear as provided in our database. Halfing them or whatever will then not allow the actual numbers to be reflected in the database and i fear that the database will loose credibility even though there were some very thoughtful ideas behind it.

We will use option 1 which is, wherever we got costs for 8 and 3 only for TN, we apply the costs to go to 3 in Tier 3 (for 5 mg/l TN). This will in the long run be close enough. We will put zero cc for Tier 4. This only applies for TN and not for TP. We will use the calculated approach for TP.

I liked your idea Glenn and almost used it but i felt that based upon reason 2 above, i wanted to find a way to put the actual numbers in the database.

unless anyone violently objects, Ning is proceeding this way. He will put the final numbers together and have them ready for our next meeting on the 8th.

Allison Wiedeman
410-267-5733
wiedeman.allison@epa.gov
410-267-5777 (f)
Chesapeake Bay Program Office
410 Severn Ave
Annapolis, MD 21403

Attachment 3: Message from MDE concerning the TN Cost Estimates for Tier 3 and 4.

Ta-Shon Yu
<tyu@mde.state.md.us>

05/15/02 08:33 AM

To: Ning Zhou/CBP/USEPA/US@EPA
cc: Allison Wiedeman/CBP/USEPA/US@EPA, George Keller <gkeller@mde.state.md.us>, Marya Levelev <mlevelev@mde.state.md.us>,
Subject: Re: Cost Estimates for Tier 3 - N and Tier 4 - N

Ning:

This will confirm that your understanding on the Maryland's position with respect to the subject matter is correct.

It is reasonably to assume that future allocations of federal grants among jurisdictional states and Washington D.C., in the matter of reducing nutrient loadings to the Chesapeake Bay and its tributaries, would be pro-rated on the basis of the ultimate discharge limits on Total Nitrogen and Total Phosphorus. The State of Maryland has exemplified itself with great effort and success in the past, and has continued to pursue the ultimate goal of discharge limit @ TN = 3 mg/l within the Chesapeake Bay and its tributary basin.

Thank you.

Ta-Shon Yu

>>> <Zhou.Ning@epamail.epa.gov> 05/14/02 05:29PM >>>

Dr Yu,

Thank you for the information. So, MDE decided to use the calculated Tier 3 and Tier 4 TN cost numbers for ALL MD municipal facilities, not only for Back River and Patapsco, and not to use any existing cost@3 estimates from your BNR cost report. Please confirm that.

Thanks, Ning

From: Ta-Shon Yu <tyu@mde.state.md.us>
To: Allison Wiedeman/CBP/USEPA/US@EPA, Ning Zhou/CBP/USEPA/US@EPA
cc:George Keller<gkeller@mde.state.md.us>,Marya Levelev, 05/14/02 04:52 PM
Subject: Cost Estimates for Tier 3 - N and Tier 4 - N

Allison / Ning:

This is to inform you that the State of Maryland agrees to the application of the adopted equations or formulas, known as Tom's Method, to estimate costs for Tier 3 -N and Tier 4 -N.

The decision is made on the grounds of seeking equity and consistency in the cost comparison with other States.

Marya and I, as Maryland representatives, certainly enjoyed working with you and representatives from other States. We were benefitted a great deal from you all through the process of discussions and deliberations of issues of paramount importance.

Thank you

Appendix I. Part 2: Communications and Decisions for Load Calculations by Tier

Attachment 1: Message concerning the TN concentrations for Hopewell

Bob Steidel <bsteidel@hrwtf.org>

03/11/02 02:27 PM
Please respond to Bob Steidel

To: "Ehrhart,Bob" <rwehrhart@deq.state.va.us>, Allison Wiedeman/CBP/USEPA/US@EPA
cc: Erika Bailey <ebailey@pirnie.com>, Bill M'Coy <wmcoy@pirnie.com>, "Kennedy,John" <jmkennedy@deq.state.va.us>, Mark Haley <mhaley@hrwtf.org>
Subject: Re: loads for tier 1

Allison: we will support our DEQ colleagues on this issue: 21.0 mg/ L TN performance for Tier 1 and 8.0 mg/L TN performance for Tier 2. And as Bob stated, we will provide very clear information to break out the cost for further evaluation. Bob

Robert C. Steidel
Environmental Manager
Hopewell Regional Wastewater Treatment Facility, Virginia
231 Hummel Ross Road, P.O. Box 969
Hopewell, Virginia 23860
804-541-2210
804-541-2441 (fax)
bsteidel@hrwtf.org

----- Original Message -----
From: "Ehrhart,Bob" <rwehrhart@deq.state.va.us>
To: <Wiedeman.Allison@epamail.epa.gov>
Cc: <bsteidel@hrwtf.org>; "Kennedy,John" <jmkennedy@deq.state.va.us>
Sent: Monday, March 11, 2002 1:43 PM
Subject: loads for tier 1

Alison,

I spoke w/ both John & Bob Steidel.

In speaking w/ Bob Steidel, he stated that in 2004 the HRWWTF will include a written commitment to achieve 8.0 mg/l TN by 2010 either thru a voluntary or permit based action; this would seem to further align itself w/ the tier 2 definition. He also indicated cost to go from 21.0 mg/l to 8.0 mg/l could be easily broken out for which ever tier they are assigned.

Given the fact the current grant and "level of effort" both reflect 21.0 mg/l, we suggest that tier one be based on 21.0 mg/l TN and that tier 2 be based on 8.0 mg/l TN, which reflects the tier 2 definition - "mix of regulatory and voluntary programs" and "motivated by incentives". Thus, assigning 21.0 mg/l for tier 1 and the current level of effort/cost, followed by the escalating cost to "reach and maintain" 8.0 mg/l for TN of tier 2 seems to be the most appropriate scenario.

However, as long as it is recorded that the Bay office and the owner (HRWWTF) are comfortable/agreeable w/ 8.0 mg/l TN for tier 1, we do not object to 8.0 mg/l being assigned to tier 1.

Bob Ehrhart
DEQ-Chesapeake Bay Program
804-698-4466
rwehrhart@deq.state.va.us
http://www.deq.state.va.us/bay/wqif.html

-----Original Message-----
From: Wiedeman.Allison@epamail.epa.gov
[SMTP:Wiedeman.Allison@epamail.epa.gov]
Sent: Monday, March 11, 2002 10:44 AM
To: Ehrhart,Bob
Cc: bsteidel@hrwtf.org; Kennedy,John
Subject: Re: loads for tier 1

Bob - there can be an argument for both, however, i feel compelled to go with what the facility operators say,. Can you live with 8 mg/l for tier 1??

Allison Wiedeman
410-267-5733
wiedeman.allison@epa.gov
410-267-5777 (f)
Chesapeake Bay Program Office
410 Severn Ave
Annapolis, MD 21403

"Ehrhart,Bob" <rwehrhart@deq.state.va.us>
To: Allison Wiedeman/CBP/USEPA/US@EPA,
Bob Steidel <bsteidel@hrwtf.org>,"Kennedy,John"
<jmkennedy@deq.state.va.us>
03/11/02 08:46 AM cc:
Subject: loads for tier 1

Allison/Bob,

Would it not be better and/or more reflective of the current situation to show Hopewell as 21.0 mg/l TN for tier 1 & 8.0 mg/l for tier 2? The 21.0 mg/l is consistent w/ the existing grant agreement and commitment level; the 8.0 mg/l for tier 2 is consistent and shown for other localities (such as Petersburg, Falling Creek, etc.).

Thus, I suggest tier 1 be 21.0 mg/l and tier 2 be 8.0 mg/l for Hopewell.

Bob Ehrhart
DEQ-Chesapeake Bay Program
804-698-4466
rwehrhart@deq.state.va.us
http://www.deq.state.va.us/bay/wqif.html

Attachment 2: Message for 2010 Flow of Hopewell:

Allison Wiedeman

09/25/02 12:57 PM
Subject:Re: Hopewell Flows

To:"Ehrhart,Bob" <rwehrhart@deq.state.va.us>
cc: Bob Steidel <bsteidel@hrwtf.org>, "Kennedy,John" <jmkennedy@deq.state.va.us>, "HaleyMark (E-mail)" <mhaley@ci.hopewell.va.us>, Ning Zhou/CBP/USEPA/US@EPA

Bob, Mark Haley and I discussed the flow issue. We determined that it is most appropriate to use a 2010 flow projection of 35.12 MGD. This flow comes from the average flow used in their 1995 - 2000 permit. Even though the current 2000 - 2005 permit uses an average flow of about 29 MGD, Mark believed it is more realistic to use a flow from the previous permit to estimate 2010 flows. WE need to note in the cost report, however, that this flow could go beyond 35.12 due to regional cooperation and economic development in the area. Remember that this flow will only be used for load estimation purposes, and the 50 MGD will be used for costing purposes.

Allison Wiedeman
410-267-5733
wiedeman.allison@epa.gov
410-267-5777 (f)
Chesapeake Bay Program Office
410 Severn Ave
Annapolis, MD 21403

"Ehrhart,Bob" <rwehrhart@deq.state.va.us>

08/26/02 08:10 AM
Subject: Hopewell Flows

To:Bob Steidel <bsteidel@hrwtf.org>, Allison Wiedeman/CBP/USEPA/US@EPA, Ning Zhou/CBP/USEPA/US@EPA
cc: "HaleyMark (E-mail)" <mhaley@ci.hopewell.va.us>, "Kennedy,John" <jmkennedy@deq.state.va.us>

Well, I hope this email will bring clarity and resolution to the aspects of flow w/ respect to the NRT cost analysis. As I see it, there are two distinct issues summarized as follows.

1) Design flow - This POTW has a design flow of 50 MGD; the current upgrade for NRT to 21.0 mg/l for TN is based on the design flow. Any future installation of NRT to meet an annual average of 8.0 mg/l would probably also be based on the current design flow (use of the design flow is consistent with other WQIF projects, such as ASA, Mooney, Noman-Cole, Henrico).
2) 2010 flow- For the purpose of determining loads, this flow is independent of the design flow and is based on flows projected to be discharging (and/or equivalent to the current industrial flow) in the year 2010 . In all municipal facilities (such as the facilities listed in item #1, UOSA, etc.), the 2010 flow used for estimating the load is considerably less than the design flow (for facilities listed in item #1, the 2010 flow ranged from 63 to 87% of the design flow w/ the larger increases generally in NoVA).

In summary, I am not opposed to developing costs based upon the facility design flow of 50 MGD; however, the flow projected to be discharging in 2010 should be revised (i.e. 30 MGD).

Bob Ehrhart
DEQ-Chesapeake Bay Program
804-698-4466
rwehrhart@deq.state.va.us
http://www.deq.state.va.us/bay/wqif.html

Attachment 3: 2010 Flows: Broad Run Water Reclamation Facility

cpomeroy@mcguirewoods.com

03/07/02 01:41 PM

To:Allison Wiedeman/CBP/USEPA/US@EPA
cc: jmkennedy@deq.state.va.us, tom.broderick@lcsa.org, tim.coughlin@lcsa.org
Subject:2010 Flows: Broad Run Water Reclamation Facility

Allison:

As we just discussed, the name of the facility to be added to "Table 2: New Facilities by 2010" of the report entitled "Data Compiling Description for Revised 2005 and 2010 Scenarios" (February 1, 2001) is the Broad Run Water Reclamation Facility in Loudoun County, Va. 2010 flow is currently projected at 2.4 mgd.

Christopher D. Pomeroy
McGuireWoods LLP
One James Center
901 East Cary Street
Richmond, Virginia 23219
804.775.1028 (Direct Line)
804.698.2246 (Direct FAX)
cpomeroy@mcguirewoods.com

Attachment 4: 2010 flow projections for Ashland, Doswell

cpomeroy@mcguirewoods.com

03/11/02 01:59 PM

To:Allison Wiedeman/CBP/USEPA/US@EPA
cc:Ning Zhou/CBP/USEPA/US@EPA, DWaltrip@hrsd.dst.va.us
Subject:RE: 2010 Flows: Broad Run Water Reclamation Facility

Allison:

For the Hanover County, VA plants:

1. Totopotomoy shows no flow for 2005. The flow should be 2.5 mgd.

2. Ashland should be 1.4 mgd in 2005 and 1.55 in 2010.

3. Doswell is a special case. It is a combined discharged point for the Doswell WWTP effluent and the Bear Island paper mill effluent. The paper mill has a right to 5.75 mgd. You may need to take this into account with planning industry controls. The flows should be 6.75 mgd for both 2005 and 2010, unless for some reason Bear Island won't be using that capacity.

Chris

Attachment 5: Message for 2010 flow of H. L. Mooney

Steve Bennett
<Bennett@pwcsa.org>

03/12/02 05:36 PM

To: Allison Wiedeman/CBP/USEPA/US@EPA,
Ning Zhou/CBP/USEPA/US@EPA
cc:
Subject: FW: Flow Projection

Allison and Ning,

Dave Waltrip and I have not connected. I need you help. Did you get flow projections for the H. L. Mooney WWTP in Prince William County? WashCOG should have forwarded them as well as Waltrip. If you don't have them, they are:

Year	Flow
2005	12.130 MGD
2010	14.630 MGD

Please let me know if you did not get them, ok? Thanks.

STEVE BENNETT

Attachment 6: Message for Henrico 2010 Flow

rwehrhart@deq.state.va.us (Robert W. Ehrhart)

02/06/02 04:18 PM
Please respond to rwehrhart

To: Ning Zhou/CBP/USEPA/US@EPA, Allison Wiedeman/CBP/USEPA/US@EPA
cc:jmkennedy@deq.state.va.us (John M. Kennedy)
Subject: Henrico Flows (Final)

Ning,

To summarize our conversation, the facility master plan completed in 1997 projected the WWTF to be operating at about 65 MGD in 2010 (per Keith Cramer). However, the economy - including housing starts and the semiconductor industry driving the rapid growth in Eastern Henrico - have slowed drastically. Pump station flows which would have driven the high daily flows are also not materializing and they could be delayed until 2012-15.

I also spoke with one of the design engineers working for the County & he does not believe the flow level of 65 MGD will occur by 2010.

So in summary for the 2010 run, we suggest that a flow of 50 MGD be used as a compromise between the population projection method and the 1997 Facility Plan. With that revision in mind, I also suggest flow allocations of 89% for Henrico Co., 10% for Hanover Co., and 1% for Goochland Co. in 2010.

Flow allocations of 86% for Henrico, 13% for Hanover, and 1% for Goochland were previously suggested for the 2000 run.

Bob Ehrhart
DEQ-Chesapeake Bay Program
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http://www.deq.state.va.us/bay

Attachment 7: Message for 2010 flow of majors plants around DC area

Tanya Spano <tspano@mwcog.org>

03/13/02 12:01 PM

To:Ning Zhou/CBP/USEPA/US@EPA
cc:Timothy Murphy <tmurphy@mwcog.org>, Mukhtar Ibrahim <mibrahim@mwcog.org>
Subject:Updated Flow Projections for COG Region's Major WWTPs

Ning,

Attached is an Excell table with updated flow projections for our major plants.
Thanks for working with us on this. Call if you have any questions.

Tanya

<<CBPvsCOGflow projections.final.031302.xls>>

FACILITY	NPDES	CBP 2000 Flow MGD	COG 2000 Flow MGD	CBP 2005 Flow MGD	Jursidiction 2005 Flow MGD	CBP 2010 Flow MGD	Jurisdiction 2010 Flow MGD
BOWIE	MD0021628	1.903	1.903	2.002		2.086	
PARKWAY	MD0021725	5.962	5.966	6.271	6.200	6.536	6.200
WESTERN BRANCH	MD0021741	18.293	18.301	19.241	21.000	20.054	23.000
ALEXANDRIA	VA0025160	36.824	36.842	37.384	37.384	37.943	37.943
AQUIA	VA0060968	3.326	3.327	3.542		3.758	
ARLINGTON	VA0025143	27.464	27.467	27.699	33.570	27.934	35.290
BALLENGER CREEK	MD0021822	3.437	3.440	3.785		4.120	
BELTSVILLE USDA EAST	MD0020842	0.215	0.215	0.226		0.236	
BELTSVILLE USDA WEST	MD0020851	0.113	0.113	0.119		0.124	
BLUE PLAINS	DC0021199	317.899	317.948	333.619	330.920	348.486	341.710
DALE CITY #1	VA0024724	2.561	2.546	2.811		3.061	
DALE CITY #8	VA0024678	2.382	2.383	2.615		2.847	
DAMASCUS	MD0020982	0.881	0.892	0.927	0.840	0.974	0.860
FORT DETRICK	MD0020877	0.924	0.969	1.018		1.108	
H.L. MOONEY	VA0025101	9.632	9.633	10.572	12.130	11.513	14.630
LEESBURG	MD0066184	2.677	2.678	2.817		2.958	
MATTAWOMAN	MD0021865	7.058	7.052	7.612		8.172	
NOMAN M. COLE JR.	VA0025364	42.889	42.893	44.859	46.670	46.828	53.000
PISCATAWAY	MD0021539	21.052	21.062	22.144	24.200	23.080	25.300
POOLESVILLE	MD0023001	0.601	0.593	0.632		0.664	
PURCELLVILLE	VA0022802	0.352	0.353	0.388		0.424	
QUANTICO-MAINSIDE	VA0028363	1.159	1.159	1.272		1.385	
SENECA CREEK	MD0021491	6.494	6.492	6.835	17.100	7.177	18.800
UPPER OCCOQUAN	VA0024988	24.391	24.398	25.511	29.500	26.631	34.000
TOTAL		**512.330**	**512.455**	**536.388**	**532.314**	**559.423**	**561.533**

NOTE: Yellow colored raws indicate projected flow was not verified

Use jurisdictions flow for all WWTPs except for Alexandria. ASA agreed to use of CBP projected flows.

Some wastewater flows in the Blue Plains service area are now off-loaded to the Seneca Creek wwtp. The quantity of diverted flow will increase significantly in the future as the Seneca wwtp expands. Both Blue Plains wwtp and Seneca Creek wwtp projected flows have been adjusted to reflect those changes.

Chesapeake Bay Program

Flow Projections for HRSD Facilities

The attached table provides flow projections currently being used for treatment plants in Virginia. These projections are based upon the local planning associated with each of these facilities and provide more accurately projected 2010 flows than the existing EPA data as they take into account know industrial and residential development as well as planned service area expansion. I am most familiar with the HRSD projections and offer the following information to explain these projections.

HRSD has provided flow projection data from our 1990 development plan. All of these projections are expected to change within the next two months with the completion of our 2002 development plan. Furthermore it should be noted that our multiple treatment facilities are tied together allowing flow to be diverted between treatment plants. As a result no single plant flow projection will ever be accurate although the total flow for HRSD should be a reasonably accurate estimate as discussed below.

HRSD currently serves seventeen localities in southeastern Virginia with thirteen regional wastewater treatment plants. Being a regional utility, none of our facilities are necessarily intended to treat the wastewater flows from any one locality. They are all regional facilities and handle flows from several localities. In fact, one of the strengths of our system is that we can actually divert flows from one facility to another. This can even mean diverting wastewater flows from one river basin to another.

On the previous page, we laid out the projected 2005 – 2010 flows from our 1990 Development Plan. Some of these flows are higher than those projected in the Chesapeake Bay Program figures and some are actually lower. This is due mainly to the fact discussed above, where flows can be diverted between facilities to best utilize the assets that we have available, thus delaying the need for treatment plant expansions. We are currently in the process of updating our development plan and anticipate having new flow projections within the next couple of months. When those projections are done, we will forward a copy of the most up to date projections for all of our facilities. Also note that the four treatment plants on the Middle Peninsula are currently planned to be piped into our York River Plant in the future.

Because of these diversion capabilities within HRSD's system, we would like to suggest that a "bubble" be created grouping the plants together that are within the different major watersheds going into the bay. We would suggest that all of our plants fall within either the James River or York River basins. The York River Basin would include our King Williams Plant, Matthews Plant, Urbana Plant, West Point Plant and York River Plant. The James River Basin would include our Army Base Plant, Boat Harbor Plant, Chesapeake-Elizabeth Plant, James River Plant, Nansemond Plant Williamsburg Plant and VIP Plant. Using our 1990 Development Plan flows and recent estimates for Middle Peninsula Plants, we would suggest that the total flows for the York River system would be 13.185 MGD, and total flows for the James River system would be 158.75 MGD. In our 1990 Development Plan, we had envisioned diverting flows away from our York River Plant to the James River Plant to avoid expanding the York River Treatment Plant until a later date. We are reevaluating that as part of our current development plan work and may request that those flows be reallocated back towards the York River Wastewater Treatment Plant.

We appreciate the effort that it takes to make all the flow projections necessary for the Chesapeake Bay Program efforts. Again, because of the strengths and the flexibility of being able to divert flows between wastewater treatment plants, it is recommended that the Chesapeake Bay Program adopt a "bubble" methodology that would allow HRSD to group our plants into these two river basins as discussed above. We recognize that the Chesapeake bay program is operating with a deadline that does not allow waiting until data updates can be completed. We would however request that EPA note that the numbers provided are based upon a 12 year old analysis and that new more accurate numbers will be available by the end of May. Both the newer numbers and the bubble approach should be used any HRSD load allocation that ultimately is developed as a result of this process.

CBP_BASIN	FACILITY	NPDES	98Flow	99Flow	00Flow	05Flow	10Flow
JAMES RIVER	HRSD-ARMY BASE	VA0081230	12.519	13.000	12.749	17.250	17.450
JAMES RIVER	HRSD-BOAT HARBOR	VA0081256	14.825	14.885	14.318	22.500	23.050
JAMES RIVER	HRSD-CHESAPEAKE/ELIZABETH	VA0081264	20.112	20.265	19.056	25.530	26.300
JAMES RIVER	HRSD-JAMES RIVER	VA0081272	15.475	14.436	14.467	21.280	20.00
JAMES RIVER	HRSD-NANSEMOND	VA0081299	17.098	19.400	18.948	18.980	20.150
JAMES RIVER	HRSD-PINNERS POINT (PORTSMOUTH)	VA0025003					
JAMES RIVER	HRSD-VIP	VA0081281	33.716	33.182	31.535	35.700	35.900
JAMES RIVER	HRSD-WILLIAMSBURG	VA0081302	12.261	13.077	15.344	12.700	15.900
JAMES RIVER	HENRICO COUNTY	VA0063690	38.659	34.045	37.096	57.000	65.000
JAMES RIVER	LYNCHBURG	VA0024970	13.609	13.012	13.216	17.400	17.400
JAMES RIVER	PETERSBURG	VA0025437	12.563	12.111	12.035	11.950	12.930
RAPPAHANNOCK RIVER	LITTLE FALLS RUN	VA0076392	2.475	2.271	2.618	3.300	4.160
RAPPAHANNOCK RIVER	URBANNA	VA0026263	0.044	0.047	0.056	0.081	0.113
YORK RIVER	HRSD-YORK	VA0081311	10.663	10.868	11.329	11.980	12.700
YORK RIVER	MATHEWS COURTHOUSE	VA0028819	0.051	0.044	0.047	0.060	0.080
YORK RIVER	WEST POINT	VA0075434	0.605	0.543	0.623	0.644	0.600
YORK RIVER	KING WILLIAM	VA0088102				0.042	0.050
POTOMAC RIVER	AQUIA	VA0060968	3.731	3.202	3.326	4.210	5.290
POTOMAC RIVER	FISHERSVILLE	VA0025291	1.294	0.717	0.798	1.520	1.710
POTOMAC RIVER	HARRISONBURG-ROCKINGHAM (NORTH RIVER REGIONAL)	VA0060640	10.671	8.973	8.571	10.630	11.650
POTOMAC RIVER	MIDDLE RIVER	VA0064793	5.393	3.599	3.597	5.100	5.650
POTOMAC RIVER	NOMAN M. COLE JR. POLLUTION CONTROL PLANT	VA0025364	45.257	41.616	42.889	47.000	53.000
POTOMAC RIVER	STUARTS DRAFT	VA0066877	1.187	0.767	0.836	1.150	1.500
POTOMAC RIVER	UPPER OCCOQUAN SEWAGE AUTHORITY	VA0024988	24.114	23.684	24.391	29.500	34.000
POTOMAC RIVER	WEYERS CAVE STP	VA0022349			0.116	0.360	0.400

Attachment 9: Message concerning 2010 flow for Moores Creek.

"Waltrip, David"
<DWaltrip@hrsd.dst.va.us>
03/11/02 04:55 PM

To:Ning Zhou/CBP/USEPA/US@EPA
cc:
Subject:FW: Moores Ck WWTP flows

I just returned to my office and received the following e-mail. These are minor changes but I though I would give you the chance to incorporate these values if you have not yet started the run. If you already have started the run well change is so small it likely will not change anything.

G. David Waltrip

-----Original Message-----
From: Potter, Eugene
Sent: Monday, March 11, 2002 9:35 AM
To: Waltrip, David
Subject: Moores Ck WWTP flows

Dave. I have reviewed subject flows and w/o knowing how DEQ made their projections, would offer the following projections for Moores Ck based on 20 years of data and least squares averaging:

2005	11.433 MGD
2010	11.888 MGD

Not too different from the DEQ numbers, but probably better numbers.

Attachment 10: Message concerning 2010 flow for Patapsco

Marya Levelev
<mlevelev@mde.state.md.us>

03/13/02 04:32 PM

To: Ning Zhou/CBP/USEPA/US@EPA
cc: George Keller <gkeller@mde.state.md.us>, Jeff Rein <jrein@mde.state.md.us>
Subject: Re: McKenny BNR By 2010?

Ning, Sorry. We should use 73 mgd for Patapsco.

>>> <Zhou.Ning@epamail.epa.gov> 03/13/02 03:04PM >>>

Marya,

Thank you!   We will use the design flow of 63 for patapsco for 2010.

Ning

Marya Levelev <mlevelev@mde.state.md.us>

To: Ning Zhou/CBP/USEPA/US@EPA
cc: Jeff Rein <jrein@mde.state.md.us>
Subject: Re: McKenny BNR By 2010?
03/13/02 02:44 PM

There are currently no plans for Mckenny. We should not consider it. For Patapsco we could use as high as 70 mgd or at least 63 -design capacity. Even though Baltimore City may not show growth, Patapco serves more than one jurisdiction: Howard County, Baltimore County. Arundel County. Flow may increase as a result of growth there. Let me know if you need additional information. Thanks

>>> <Zhou.Ning@epamail.epa.gov> 03/12/02 05:27PM >>>
Marya,

We do not have BNR status for McKenny.   Should we put it as BNR by 2010 for it?

Thanks,

Ning

Attachment 11: Blue Plain Flow Allocation Rate from MWCOG

Chesapeake Bay Program Bay-wide Use Attainability Analysis

Cost Allocation Methodology for the Blue Plains Wastewater Treatment Plant
COG staff document (Approved by BPTC, 4/14/02)

Capital Costs

Allocate the estimated capital costs for each Tier based on the IMA's 370 MGD wastewater flow allocations because that is how capital costs are allocated to the jurisdictions. However, for the non-signatory jurisdictions (i.e., Potomac Interceptor Users), their share of the capital costs would be attributed to the District rather than the individual states as DC-WASA pays those capital costs and works out payment with those non-signatory parties according to individual service agreements.

O&M Costs

Allocate the estimated O&M costs for each Tier based on the projected flows from each of the jurisdictions using the latest BPSA flow projections. For the non-signatory jurisdictions (i.e., Potomac Interceptor Users), use the BPSA 2010 flow projections and attribute their O&M costs to the respective state – using the same protocol used to allocate Blue Plains' nutrient loads for the CBP and states. These wastewater flows are based on the projections from COG's Cooperative Forecast Round 6.2 (6/25/01 run), updated to reflect known flow management impacts through 2025 (4/9/02 update).

ALLOCATIONS	CAPITAL COSTS (IMA-based Flows)		O&M COSTS (2010 BPSA Adj. Flows)	
JURISDICTION	**Flows (MGD)**	**% Costs**	**Flows (MGD)**	**% Costs**
Maryland				
WSSC	169.60	0.4584	129.43	
Naval Ship R&D & NPS*			0.040	
MD subtotal	169.60	**0.4584**	129.47	**0.3819**
Virginia				
Fairfax Co. (& Arlington Co.)	31.00	0.0838	31.00	
LCSA*			13.80	
Vienna*			1.15	
Dulles Airport*			1.05	
VA subtotal	31.00	**0.0838**	47.00	**0.1386**
District				
District & PI Users (*) subtotal	169.4	**0.4578**		
District subtotal			162.54	**0.4795**
TOTAL	**370.00**	100.00	**339.01**	100.00

Appendix I: Part 3: References for Section IX Summary Cost Tables

The following references for the cost tables are available in hard copy by contacting Ning Zhou at the Chesapeake Bay Program Office, 410-295-6892 or zhou.ning@epa.gov

1 = Calculated from the methodologies provided from Thor Young, Stearn & Wheler, LLC and Tom Sadick, CH2M Hill.

2 = NRT eligible cost report from MDE,4/23/02, where cost=0, MDE has indicated funds already appropriated

2a = NRT Cost report, from MDE 3/6/2002

3 = Randall 51 Facility Report, 1999 for BNR @8 and additional 3/2001 report with 60 facilities.

4 = Paid for by Corp of Engineers

5 = From VA 2000 Annual Report and VA 2002 annual Report - Assumes that the cost share information equals 1/2 of total BNR cost to get 8, and that funds are already made available for these facilities to go to 8, except for FMC and Henrico where no funds have been spent as of 2002.

6 = Email from Bob Ehrhart to Allison Wiedeman, 3/7/02

7 = BNR funded under federal funds.

8 = No cost is applied, because TN or TP =current level for Tier 1for this facility

8a = The 2010 TP concentration of 1.5 mg/l shown for these facilities reflects the specific effluent concentration targeted by Virginia either under WQIF Grant program and/or the Tributary Strategy Plan for the Lower River Tributaries.

9 = Cost survey from Seaford WWTP, 3/22/02

10 = From 4/2/01 letters from Eastern Snyder County Regional Authority to Senator Specter. Also, costs not calculated to 8 because they are currently designing only to 3 (4/26/01 Telephone conversation between CBPO and Gannett Hemming)

11 = Message from WVDEP, cost=0 due to irrigation.

12 = Email message from Paul Janiga, DE DNREC, 3/28/02.

13 = Cost survey from Mike Kyle, LASA, 3/6/02

14 = C CSO & Blue Plains Cost Estimates- UAA cost analysis, from Tanya spano, WMCOG, 4/10/02

15 = Telephone conversation with Sunberry WWTP, 6/21/01

16 = Cost Summary: City of Hopewell, from Bob Steidel, Hopewell Regional Wastewater Treatment Facility. 8/7/2002.

17 = Message from Tanya Spano concerning Broad Run, 3/13/02

18 = Message from Marya Levelev, 4/5/02, Western Branch already can achieve 3 mg/l.

19 = Message from Marya Levelev, 8/12/02, to add $10 million TN cc in Tier 2 for Back River

20 = Message from Bob Steidel, 9/17/02, to remove the Tier 1 cost for Hopewell.

21 = Message from Bob Ehrhart, 9/4/02, to remove Tier 1 costs for FMC and Hopewell.

22 = Message from Bob Ehrhart, 9/19/02, to add SIL which replaced Broadway Lagoons, Timberville, Rocco Quality Foods and Wampler Foods-Timberville.

23 = Message from Bob Ehrhart, 11/14/02, No Tier 2 TP cost due to chemical feed facilities have been funded.

A = The capital costs at TN =3 from sources other than calculation are applied to Tier 3 for TN. And, in these cases, the Tier 4 TN capital costs are set to zero. Message from Allison Wiedeman, 5/3/02.

B = The value is set to zero, because this plant's TN or TP level have been lower than the defined level in this Tier for more than five years.

C14 = Message from W. Hunley, HRSD, 10/3/02

C15 = Cost shown represent an order of magnitude planning level estimate as transmitted by HRSD on October 3, 2002. A less costly alternative, which provides for only seasonal nitrification and/or an annual average TN concentration greater than 8.0 mg/l, does potentially exist as discussed in the September 1989 Technical Memoranda C.22 and C. 25 prepared by CH2M Hill. Message from Bob Ehrhart, 11/4/02

C6 = Letter from City of Lynchburg to Allison Wiedeman, 7/14/2001

C9 = Bos, Robert E, PE, Public Utility Administrator with County of Stafford, letter to Allison Wiedeman, EPA, re: Nitrogen Removal Costs, 7/31/01

M = For facilities with existing capital costs and no O&M costs available, the O&M costs are calculated from exiting capital costs adjusted by the cost ratio between calculated O&M and capital cost from the methodologies provided from Thor Young, Stearn & Wheler, LLC and Tom Sadick, CH2M Hill.

N = NRT facilities that currently have or will install NRT by 2010, It is assumed that no additional cost is needed.

S = From NRT cost survey results.