AN EVALUATION OF THE COST OF POINT SOURCE NITROGEN LIMITS OF TREATMENT IMPLEMENTATION IN THE CHESAPEAKE BAY WATERSHED

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Virginia Tech for the Chesapeake Bay Program

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The purpose of this project was to perform a cost evaluation of implementing nitrogen limits of treatment (LOT) technology at wastewater treatment plants (WWTPs) in the Chesapeake Bay Watershed. LOT technology was defined as technology that would produce a 12 month average effluent total nitrogen (TN) concentration of 3 mg/L from each of the WWTPs. Most of this effort was a follow up to the evaluation of 51 WWTPs performed under a previous project entitled, "Evaluation of Wastewater Treatment Plants for BNR Retrofits using Advances in Technology". This project was performed by Virginia Tech at the request of the Point Source Workgroup of the Nutrient Removal Subcommittee of the Implementation Committee of the Chesapeake Bay Program from 1996-1999, and it was funded by Bay Program Funds administered through the USEPA Region III Office. All 51 of those WWTPs were evaluated for this report, plus, a few additional WWTPs were included, notably the Blue Plains WWTP located at Washington, D.C., the largest WWTP in the Watershed. Altogether, 60 WWTPs were evaluated for this report.

An Excel spreadsheet model was developed and used for determination of the LOT upgrade costs for each of the 60 WWTPs. The summary page printouts for all 60 of the WWTPs are included in Appendix A of this report.

The WWTPs included in the 1999 report were evaluated for BNR upgrades that would reduce the effluent TN discharges to less than 8 mg/L on a yearly average. Recommendations were made for upgrades that would accomplish this, and a 20 year present worth cost evaluation was performed for each suggested upgrade option, including multiple options for individual WWTPs. When multiple options were provided, a preferred option was suggested for that specific WWTP. Lists of the estimated costs for each of the preferred options are included with this report in Appendix B. During the evaluations of this project and report, the LOT evaluations were performed as if the 51 WWTPs had implemented the preferred BNR upgrade recommended in the 1999 report. However, it was known that many of the plants had not implemented the upgrades. Therefore, the cost of the upgrade for 3 mg/L TN recommended in this report was combined with the cost of the upgrade recommended in the 1999 report to achieve 8 mg/L TN, unless the authors had specific information that the previously recommended upgrade, or an equivalent upgrade, was being or had been made to that specific WWTP. The capital costs and cost per pound additional N removal numbers for each of the plants included in the 1999 report are included in Appendix C of this report.

The separate and combined capital costs and the separate and combined cost per additional pound of nitrogen (N) removed are listed in Table 1 of this report. The

operation and maintenance costs, and the total 20-year present worth costs for each of the WWTPs are listed on the summary pages for each WWTP, included in Appendix A. Table 1 estimates that LOT could be implemented at these 60 WWTPs for an average additional cost beyond 8 mg/L BNR of \$2.58 per additional pound of N removed. Excluding the Blue Plains WWTP, the cost would be \$2.98 per pound.

It was known that upgrades were either underway or completed at several of the WWTPs. These can be identified in Table 1 because the cost and nitrogen removal information is omitted for them under the 8 mg/L heading. Also, cost and nitrogen removal information is not listed for the nine WWTPs included in this evaluation that were not part of the 8 mg/L evaluation and report. These nine plants are:

- Lewisburg, PA
- Lock Haven, PA
- Bowie, MD
- Easton, MD
- Havre de Grace, MD
- Princess Anne (Fairmount), MD
- Western Branch, MD
- Blue Plains, Washington, D.C.
- Tyson Foods, Temperanceville, VA

Table 1 also includes the cost of implementing 8 mg/L TN technology at the 51 plants, and combines it with the cost of implementing LOT technology at the 59 WWTPs of this report, not including the Blue Plains WWTP. Then, the cost per pound additional N removed becomes \$2.40 per pound. This number is not precisely accurate, however, because it includes flows for some of the 8 mg/L upgrades that are different from the flows used for the same WWTPs when determining the costs of the LOT upgrades. However, it is reasonably representative, and does represent the cost of upgrading WWTPs that currently are achieving average effluent TN concentrations greater than 8 mg/L. Note, however, that the cost per pound of N removed will be higher if the LOT upgrade is made after the WWTPs are already achieving annual average TN effluent concentration of <8 mg/L. This information is included in Table 2.

Note that the total capital cost for LOT implementation at the 60 WWTPs is estimated to be \$430 million. This includes the Blue Plains WWTP. The total 20 year present worth cost for LOT upgrading of all 60 WWTPs, assuming that the 51 WWTPs have already been upgraded to 8 mg/L, is estimated to be \$498.21 million (see Table 2).

The approach to the LOT cost estimations are summarized in the individual sheets for the WWTPs included in Appendix A. The design flow, rather than the current flow was used for all LOT estimates so that the full potential for nitrogen removal as well as the full cost would be included in the evaluation. The Blue Plains WWTP sheet is included as the next page for illustration purposes. If the current average effluent TN was known precisely, it was included with the flow so that an automatic calculation of the additional nitrogen reduction LOT would accomplish would be calculated on a daily basis, and then

summed for a year and for the 20 year amortization period. Note that when the Blue Plains costs were evaluated, it was known that the current WWTP as modified for BNR can average an effluent TN concentration of 5.0 mg/L. Therefore, LOT will reduce the effluent TN by only 2.0 mg/L. The known average effluent TN for the Bowie, MD WWTP is only 4 mg/L, and LOT will reduce it by only 1.0 mg/L. By contrast, the current Scranton, PA WWTP effluent TN averages 9.2 mg/L while the Rocco Farm Foods, Edinburg, VA WWTP will average 12 mg/L TN after the BNR modification currently being implemented is in place. It was assumed that LOT implementation would be sufficient to reduce all of these effluents to an annual average of 3.0 mg/L.

It was further assumed that LOT implementation would not be possible at any WWTP that was not nitrifying ammonia to less than 1 mg/L ammonia-nitrogen. Therefore, if the WWTP was not currently achieving an annual average effluent ammonia-nitrogen concentration of less than 1.0 mg/L, it was assumed that LOT implementation cost would include the cost of upgrading the WWTP to improve nitrification to that level. Fortunately, most of the plants are already capable of achieving this level of nitrification, so the number of plants that needed system or operational modifications was small. For most of those not achieving complete nitrification, it is possible to increase the MCRT (sludge age) and accomplish this change without additional capital costs. That is, for most of the WWTPs in this category, the secondary settling basins were adequate for the increased solids loadings that would result from increasing the MCRT.

Nearly all of the plants required some modification to reduce the nitrate nitrogen to the 1.0 mg/L effluent concentration required necessary to achieve an annual effluent TN concentration of <3 mg/L. The typical plant effluent contains 1-1.5 mg/L non-biodegradable soluble organic nitrogen. This cannot be removed biologically, chemically or by settling. Removal would require either activated carbon adsorption or reverse osmosis type membrane separation, and this would greatly increase the cost over the nutrient removal technologies assumed for this evaluation. Therefore, the nitrate nitrogen cannot significantly exceed 1.0 mg/L, and the ammonia-nitrogen must be less than 1.0 mg/L, and preferably less than 0.5 mg/L, if the LOT concentration of 3.0 mg/L is to be met.

The most common method recommended for upgrading the plants from 8 mg/L TN BNR to LOT was the addition of denitrification filters with methanol addition. Few other technologies are capable of LOT achievement, but it can be accomplished with Bardenpho or modified Bardenpho treatment trains. The latter is being implemented at the Fairmount WWTP, Princess Anne, MD, and the former is in place at the Parkway WWTP operated by the Washington Suburban Sanitary Commission. However, the operators have to want to operate to achieve the 3.0 mg/L TN goal, and the WWTPs possibly will have to have effluent sand filters to achieve the goal.

The modification cost for the Blue Plains WWTP is for modifying the existing deep bed effluent filters to denitrification filters and the installation of a methanol feed system for them. The total capital cost is estimated to be \$31.69 million, and the M&O cost increase is estimated to be \$1.676 million per year. This results in a 20 year present worth cost of

\$56.82 million for LOT implementation at Blue Plains. However, it would reduce the nitrogen discharge by 6,170 pounds per day, or more than 45 million pounds over a 20 year period, for a cost per pound of additional nitrogen removed of \$1.26 per pound.

Additional information that was used to estimate the LOT implementation costs are given in Table 2. This table lists the WWTPs by state, and provides summary data for each state. Please note that this table is only for the calculation of LOT costs, assuming that the 51 WWTPs of the previous report had upgraded to 8 mg/L TN or less using the technology recommended in the previous report. Exceptions to the 8 mg/L TN were the two industrial WWTPs plus Scranton and some of the newly included WWTPs that were not part of the 51 WWTP report.

The last page of Table 2 also includes a summary of the cost of LOT implementation for the WWTPs categorized by size, i.e., design influent flow. Again, the costs here are representative of upgrading WWTPs to LOT after they have already been upgraded to 8 mg/L effluent TN. The summary on the last page estimates that the cost would be \$2.58 per additional pound N removed for the 60 plants included in this report. If Blue Plains is not included, the cost is \$2.98 per pound. Note that the cost per additional pound N removed increases as the design flow of the WWTP decreases. The cost per pound N removed was estimated to be \$1.234 per pound for design flows greater than 50 MGD, \$2.786 per pound N for flows between 15 and 50 MGD, increasing up to \$4.108 per pound N for WWTPS with design flows less than 1.0 MGD.

DISCUSSION OF RESULTS AND THEIR IMPLEMENTATION

It is recommended that the WWTPs be classified according to their design flows rather than their current flows for LOT implementation purposes. It is unlikely that there will be a significant difference in the capital costs of the upgrades because all of the WWTP owners will insist that the plant capacities not be downgraded. This means that sufficient modifications will have to be made so that LOT can be achieved when the WWTPs reach design flow. Consequently, the actual amount of N removal LOT implementation will achieve will increase with time, but ultimately will approximate the removals calculated using design flows. Thus, this approach would appear to be a more representative approach over the coming 20 years than assuming current flows. If desired, a flow escalation factor could be applied to the current flows, assuming they will reach design flow in 20 years, to get a more accurate estimate of the amount of N that will be removed. In this regards, it should be noted that some of the WWTPs included in this report are already at design flow.

A logical approach would be to first try to classify all of the WWTPs in the Bay Watershed in accordance with whether or not they are capable of BNR to 8 mg/L or less at present. Following this classification, they should be classified in accordance with the likely LOT technology that would have to be applied to achieve an average effluent TN concentration of 3 mg/L. For most of the WWTPs capable of BNR to 8 mg/L or less this, the applicable LOT technology will be the implementation of effluent denitrification filters, or the modification of existing effluent filters to denitrification filters. For

example, of the WWTPs discharging to the James River and located in the Hampton Roads area. several of them are BNR facilities capable of effluent TN concentrations less than 8 mg/L. This includes the two Chesterfield County WWTPs, the Henrico County WWTP, the HRSD-VIP WWTP, the HRSD-Nansemond WWTP and the HRSD-York River WWTP. Others, such as the Richmond, the HRSD-Williamsburg and the HRSD-James River WWTPs could be easily upgraded for BNR. Some of the plants, such as Henrico County, already have effluent filters that could be converted to denite filters, but most of them would have to be retrofitted with effluent denite filters with methanol addition. Along the Potomac River, all of the WWTPs that have to meet an effluent total phosphorus (TP) concentration of 0.18 mg/L already have deep bed effluent filters. All of these filters need to be converted to denite filters, which is somewhat less expensive than the installation of denite filters where none currently exist. The point is that this information is readily available for most of the large plants and they could be quickly classified.

After the WWTPs have been classified in accordance with design flow and probable type of LOT upgrade, the results of this report could be used to determine the typical costs of upgrading for that classification. Then the cost of upgrading all of the WWTPs in that classification could be quickly determined. Using this approach, a reasonably accurate estimate of the costs of upgrading all of the WWTPs in the Bay Watershed could be made.

JAMES RIVER WWTPs

There are several large plants along the James River of Virginia that have not been included in any way in the preceding parts of this report. Seven of the largest James River WWTPs are listed in the following table. I was personally involved with the development of BNR designs for all of them except the Richmond WWTP, and I included it because it is the largest discharging to the River. Because I am aware that five of these WWTPs have already implemented BNR, and the sixth is under construction (Hopewell), I decided to perform an economic evaluation of what it would cost to upgrade all seven of the WWTPs for LOT. All of the BNR upgrades implemented or being implemented are capable of discharging yearly average TN concentrations of 6 mg/L. Therefore, the additional N removal calculations were based on the reduction from 6 to 3 mg/L. To the best of my knowledge, BNR treatment has not been implemented at the Richmond WWTP, but it is possible that plans for modification are underway.

Table 2 Th	o Fetim	nated Cost o	f TN LOT Im	plementation a	t 7 James Rive	r WWTPs
Table 5. Th		Increased	Increased	Incr. 20 -yr	Ad 120 yr.	COSUIO
WWTP	Flow	Cap. Cost	M&O Cost	Pres't Worth	TN Rem.	ad'l TN rem.,\$/lb
	mgd	\$, mill.	\$, thou/year	\$, millions	lbs, millions	1.91
Richmond	50	46.2	1,948.4	75.42 54.52	9.125	5.97
Hopewell	50	42.57	796.7 264	8.02	7.3	1.10
Henrico	40	4.06	739.3	41.48	7.3	5.68
HRSD-VIP	40	50.59	139.3	11.40		

HRSD-Nan	30	23.26	556.9	31.61	5.475	5.77
Proctor's	20	16.16	377.6	21.82	3.65	5.98
Creek					1.005	(5 (
Falling Ck.	10	9.05	195.2	11.98	1.825	6.56
TOTALS	240	171.69	5,049.7	244.85	74.241	3.30

The table shows that upgrading most of the WWTPs that already have BNR upgrades will be relatively expensive as determined by the cost per additional pound of nitrogen that will be removed. That is because all of these WWTPS are capable of producing an annual average effluent concentration of 6 mg/L or less as currently constructed or planned. The exception is the Henrico WWTP because it already has effluent filters, and the cost will be for modifying them rather than constructing them. The cost per additional pound of removal at the Richmond WWTP is low because it was assumed that this WWTP is currently discharging a TN concentration of 16 mg/L. The actual concentration was not known when this estimate was made.

The summary work sheets for the James River WWTPs are included in Appendix A of this report.

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TABLE 1. THI	TABLE 1. THE COST OF IMPLEMENTING LIMIT	PLEMENTIN	~ .	S OF TREATMENT NI		GEN REMO	VAL IN THE	E CHESAPE/	TROGEN REMOVAL IN THE CHESAPEAKE BAY WATERSHED	TERSHED
relilisylvallia	Design Flow	n		Tillion\$	\$ per lb N	Removed	1000s lb N	000s lb N Removed	Tot. Nrem	Total \$ per
SHIMAM	mgd	8 mg/L	3 mg/L	Total	8 mg/L	3 mg/L	8 mg/L	3 mg/L	1000 lbs	lb N Rem
Altoona East	ວ າ	1.23	8.33	9.56	0.51	4.15	3185	2740	5925	2 19
Altoona West	13.5	1.233	11.53	12,763	0.42	4.82	3880	3288	7168	2 44
Chambersburg	8.9	6.347	0	6.347	2.69	0.48	2841	. 414	3255	2.41
Greater Hazleton	တ ထ	7.84	16.25	24.09	3.24	8.19	3860	2701	6561	- r. r.
Hanover	4 5	90.0	5.13	5.19	0.08	8.19	3046	803	3849	177
	30	25.448	0	25,448	2	0.47	27635	1826	29461	σ.
Lancaster City	29.7	1.077	23.08	24.157	0.19	3.65	9230	9052	18282	, o
Lebanon	∞	4.039	7.62	11.659	1.19	4.35	4652	2435	7087	2 6
Lewisburg	2.4	1	3.63	3.63	t	1.31	ı	490.4	490.4	13.1
Lock Haven	3.75	ı	4.59	4.59	t	2.42	ſ	390	390	2.42
Scranton	10	2.815	13.32	16,135	92.0	3.2	4464	6028	10523	2 16
UAJA, St. College	ဖ	0.78	0.52	1,3	0.33	0.78	3330	1825	5155	0.49
Susq-Lanc. Area	12	1.619	10.46	12.079	1.12	4.01	2288	3650	5938	5 6 2
Inroop	/	3.32	6.92	10,24	1.68	4.46	1982	2117	4099	3.12
wm port Central	7.2	6.339	9.61	15.949	1.36	1.86	0099	6716	13316	161
Wm port West	4.5	5.246	9.76	15,006	2,58	9.01	3200	1387	4587	4 52
Wyoming Valley	32	0.763	24.69	25,453	0.18	3.65	5575	6026	15284	2 2 2
York City	26	1.78	11.08	12 86	0.42	2.29	5806	7884	13690	ر د د
TOTALS	227.25	69.94	166.52	236.46	0.97	3.41	91574	634864	155050 4	2 6
						:	0	1.00	133000.4	7.28
Maryland	Design Flow	BNR Capital	Costs,	Million\$	\$ per lb N Removed	Removed	1000s lb Ad'l	d'I N Rem.	Tot Nrem	Total & nor
WWIPs	mgd	8 mg/L	3 mg/L	Total	8 mg/L	3 mg/L	8 ma/L	3 ma/l	1000 lbs	Ib N Dom
Bowie	2.2	,	0.52	0.52	ا ر	8.08		73	73	
Brunswick	0.7	0.39	2.65	3.04	0.5	14.2	530	219	749	0.0 0.4 0.4
Chestertown	6.0	1.35	0.1	1,45	5.92	0.38	247	292	539	
Cristield	7.7	1.949	2.78	4.729	4.95	9.26	379	365	744	2:32 7:06
Easton	5	ı	2.7	5.7	1	9.81		730	730	0 8 0
EIKTON	2.7	1.97	0	1.97	1.87	0.47	1452	803	2255	1.37
rederaispurg	0.75	0.75	2.65	3.4	3.34	5.16	507	657	1164	4 37
Georges Creek	0.63	9 0	2.65	3 25	3.55	10.82	457	292	749	. c
Havre de Grace	J. 0	•	3.3	3.3	ul.	7.16	1	584	584	7.16
Indian Head	0.5	0.49	0.52	101	2.9	3.11	219	219	438	3.01
Mattawornan	15	1	0	0	1	0	t	0	C	000
Princess Anne	1.26	ı	2.81	2.81	1	2.68	1	383,25	383.25	0 0 0
Western Branch	16.63	1	0	0	1	0.48	ı	5037	5037	0.48
vvinebrenner	90	9.0	0	9.0	3.77	0.45	411	511	922	1 93
IOIALS	46.97	œ L .	23.68	31.78	1.31	2.91	4202	10165.25	14367.25	1.92

Total \$ per 1b N Rem. 3.7 2.13 3.32	Total \$ per 1b N Rem. 1.21 4.06 1.94 2.45 2.45 2.45 2.82 6.13 0.47 1.25 4.95 1.17 8.22 6.54 1.32 9.96 3.06 4.75 6.54 1.07 2.86 2.46 1.07 2.5 5.41 2.51
Tot. Nrem To 1000 lbs 7610 5727 13337	Tot. Nrem To 1000 lbs 9125.0 942.0 291.0 584.0 584.0 584.0 771.0 2264.0 2920.0 2920.0 2920.0 2920.0 20367.0 511.0 1004.0 7226.0 321.9 219.0 3650.0 8797.0 4512.0 630.0 1533.0 4789.0 292.0 584.0 85977.9
1000s lb Ad'l N Rem. 8 mg/L 3 mg/L - 7610 3292 2435 3292 10045	8 mg/L 3 mg/L 3 mg/L 3 mg/L 3 mg/L 511.0 218 73.0 584.0 584.0 511.0 1023 1241.0 584.0 5328 1898.0 512.0 5328 1898.0 512.0 5328 1898.0 513.0 5328 1898.0 514.0 5328 1898.0 5200 121.9 5200 121.0 5328 1898.0 5200 5328 1898.0 5200 5328 1898.0 5200 5328 1898.0 5200 5328 1898.0 5200 5328 1446.0 557.0 584.0 657.0 584.0 657.0 584.0 657.0 584.0 657.0 584.0 657.0 584.0 657.0 520.0
1000s lb A 8 mg/L - 3292 3292	8 mg/L 8 mg/L 431 218 218 260 1023 - 420 5328 200 - 4366 484 - 8140 4366 484 - 292 292 27894 1000s lb , 8 mg/L 126962
\$ per lb N Removed 8 mg/L 3 mg/L: 3.35 0.47 3.35 2.92	\$ mg/L 3 mg/L 3 mg/L - 1.21 - 0.065 8.22 - 0.12 8.08 - 2.45 - 2.45 - 2.45 - 2.45 - 0.11 0.91 - 8.22 0.02 5.12 - 6.13 0 0.02 5.12 - 6.13 0 0.16 4.59 - 0.79 27.6 - 0.79 27.6 - 0.14 21.58 2.36 - 0.14 21.58 2.36 - 0.14 21.58 2.36 - 0.14 21.58 2.36 - 0.14 21.58 2.36 - 0.14 21.58 2.36 - 0.14 21.58 2.36 - 0.14 21.58 2.36 4.52 - 2.46 1.27 0.48 - 2.5 - 0.22 11.03 0.48 2.49 \$ per lb N Removed 8 mg/L 3 mg/L 3 mg/L 0.94 2.98
\$ per lb N 8 mg/L - 3.35 3.35	07
Million\$ Total 19.72 6.656	Million\$ Total 6.01 3.45 0.55 1.06 0.55 1.06 0.54 3.36 4.84 13.32 0 3.8 5.39 12.76 3.36 5.28 6.96 3.457 0.52 12.59 2.72 0.52 12.59 2.72 12.59 2.72 12.59 2.72 12.38 3.5 0.52 12.38 3.5 0.52 12.38 3.5 0.52 12.38 3.5 0.52 12.38 3.5 0.52 12.38
BNR Capital Costs, Million\$ 8 mg/L 3 mg/L Tot - 19.72 19.7 6.656 0 6.68 6.656 19.72 26.3	BNR Capital Costs, Million\$ 8 mg/L 3 mg/L Tota - 6.01 6.01 0.09 3.36 3.45 0.03 0.52 0.55 - 1.06 1.06 - 1.06 1.06 0 0.54 0.54 - 3.36 3.36 0 0.54 0.54 - 13.32 13.33 0 0 0 - 12.76 12.77 - 12.76 12.77 0 0.15 5.13 5.28 0.057 6.39 6.96 0.057 6.39 6.96 0.057 6.39 6.96 0.12 2.65 2.77 - 2.65 2.65 - 2.65 2.77 - 2.65 2.65 - 2.65 2.77 BNR Capital Costs, Million\$ 8 mg/L 3 mg/L Tott 8 mg/L 3 mg/L 1388.3
✓ BNR Cap8 mg/L6.6566.656	_
Design Flow mgd 25 8 33	mgd 30 2 2 0.325 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
NEW YORK WWTPs Binghampton Endicott Village TOTALS	WWTPs Arlington Colonial Beach Dahlgren Dale Services #8 Duport W'boro Fishersville Front Royal Harrisonburg Merck, Elkton H.L. Mooney Leesburg Lower Potomac Luray Middle River/Ver. Opequon Parkins Mill Purcellville Rivanna River Rocco, Edinburg Strasburg Strasburg Strasburg Waynesboro Wilderness Woodstock TOTALS

Figure BNR Reco- SRT Design Effluent MLSS Nitrate MGD MCD Mod. Days Temp NH, N 78% VS Recycle MGD MCD MGD			ADLE 4.	WUKKSH	TABLE 2. WORKSHEET FOR DETERMINATION	DETERN	INATION	OF COST	OF LOT L	OF LOT UPGRADES	S FOR CH	ESAPEAK	E BAY W	ATERSHE	FOR CHESAPEAKE BAY WATERSHED WWTPS	
Mac	New County Helper New New	PLAN	Design	BNR	Reco-	SRT	Design	Effluent	MLSS	Nitrate	BNR	Add'I N	Capital	Ann.	20 yr.	S per
Main	Main		MGD	Coung.	mend. Mod.	Days	lemp C	NH, -N	75% VS	Recycle	Eff.	Rem.	Cost	O&M	Amort.	Add.lb
Part	Mail							PE	NNSYLVA	A.Z.	N-for	D/S(I')	SIMIL	4	& Wil	N rem.
na 13.5 MLE Filters 14 12 0.9 3524 (1.50) 5.5 ber 6.8 TF- Add¹ - 10 <1.0 - 1.50 5.5 rer 8.9 BaF- Add¹ - 10 <1.0 3500 - 6.5 rer 8.9 BaF- Add¹ - 10 <1.0 3500 - 6.5 rer 4.5 OD Denite 20 10 <1.0 3600 3Q 4.5 ster 2.9 MLE Denite 15 10 <1.0 3600 3Q 6.5 rer 3.0 Unox Add¹ - 10 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0	Name	Altoona	0.6	MLE	Denite	15	11	1	2550	30	6.5	375.3	8,33	212.4	11.52	4.15
ber 6.8 TF- Desired Meth. 14 12 0.9 3524 3Q 5.5 ter 6.8 TF- Add'l Add'l Add'l 10 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0	Main	Altoons	13.6	AAI F	riffers	:				(1.50)						
ber 6.8 TF- Add'l - 10 <1.0 - C.D. Remove cr 8.9 BAFF Add - 10 <1.0 3500 - Remove cr 4.5 OD Denite 20 10 <1.0 3500 - 6.5 ser 30 Unox Add'l - 10 <1.0 3500 30 Remove ster 29.7 MLE Denite 20 10 <1.0 <1.0 3600 3Q Remove ster 29.7 MLE Denite 15 10 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0	br 6.8 TF- brile Add'll Meth. - 10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10	West	C.C.	MLE	Denite Filters	4	21	6.0	3:524	30	5.5	450,4	11,53	286.9	15.83	4.82
cr 8.9 BAF- Add -	Math	Chamber	8.9	TF-	l,ppV		10	<1.0			Remove	567	C	1	100	0 4 0
er 8,9 BAF- Add Add - 10 <1.0 3500 - 6.5 rer 4.5 OD Denite 20 10 <1.0 5000 >50Q 4.5 rer 4.5 OD Denite 20 10 <1.0 5000 >50Q 4.5 rer 3.0 Unox Add! - 10 <1.0 <1.0 3600 3Q Remove rer 2.9.7 MLE Denite 15 10 <1.0 <1.0 4000 2Q 6.5 rer 2.4 A2/0 w Denite 15 10 <1.0 <1.0 4750 2Q 6.5 r 2.4 A2/0 w Denite 15 12 <1.0 <1.0 4750 2Q 6.5 r MLE Denite 15 12 <1.0 4750 2Q 6.5 ge Filters Meth. 15 12	cr 8.9 BAF. Add **.10 <1.0 <1.0 350 **.5 370 16.25 390.4 22.11 cr 4.5 OD Denite 20 1.0 <1.0	spurg		DeniteF	Meth.						l mg/L		>	<u>†</u>	0.21	0.48
Second Form Bake	State A	Greater	6.8	BAF-	Add		01	<1.0	3500	ů.	6.5	370	16.25	390.4	22.11	8.19
Street 4.5 OD Denite 20 10 <1.0 5000 >500 4.5	Secondary Seco	Hazleton		Denit F	BAF											2
str 30 Unox Add'I - 10 <1.0 3600 3Q Remove ster 29.7 MLE Denite 15. 10 <1.0 N/a 2Q 6.5 ton 8.0 TF-AS Denite 15. 10 <1.0 4000 2Q 6.5 r 2.4 AZ/0 w Denite 25 12 <1.0 4750 2Q 6.5 r 3.75 AZ/0 w Denite 25 12 <1.0 4750 2Q 6.5 r 3.75 AZ/0 w Denite 25 12 <1.0 4750 2Q 6.5 ton 16 MLE Denite 15 10 <1.0 4500 3Q 1.5 sec Filters Meth. 15 12 2.1 4000 2.5Q 6.5 sarca 30h. 12.5 10 <1.0 4500 3Q 6.5	State 30 Unox Add'1 10 <1.0 3600 3Q Remove 250.2 0 56.4 0.85 35.05	Hanover	4.5	QO	Denite Filters	20	01	<1.0	2000	>500	4.5	110	5.13	96.5	6.58	8.19
ster 29.7 MLE Denite 15 10 <1.0 N/a 2Q Ingre 10 8.0 TF-AS Peliters 15 10 <1.0	State 29.7 MLE Denite 15. 10 <1.0 N/a 2Q	Harris- burg	30	Unox	Add'l Meth.		0_	<1.0	3600	3Q	Remove	250.2	0	56.4	0.85	0.47
ton 8.0 TF-AS Filters 15 10 <1.0 4000 2Q 6.5 1	Same Same TF-AS Tiller Lange Lange	Lancaster	29.7	MLE	Denite	15 .	10	<1.0	N/a	2Q	6.5	1240	23.08	663.5	33.03	3.65
ton 8.0 TF-AS Denite 15 10 <1.0 4000 2Q 6.5 1.2 Filters Filters 12.4 AZ/0 w Denite 25 12 <1.0 4750 2Q 1.5 1.1 3.75 AZ/0 Denite 25 12 <1.0 4500 3Q 1.5 1.0 MLE Denite 15 10 1.2 2300 3Q 7.7 1.5 MLE Denite 15 10 1.2 2300 2.5Q 6.5 2.6 Filters Meth. 15 10 <1.0 3600 1.5Q 6.5 2.5 MLE SRT 15 12 2.4 2300 2.Q 6.5 3001 3.0 MLE N-DN 12.5 10 <1.0 4500 3.Q 6.5 301 3.0 3.0 3.0 3.Q 6.5 3.Q 302 3.0 3.0 3.	Name State Filters 15 10 <1.0 4000 2Q 6.5 333.6 7.62 190.3 10.47 2.4 A20.0 Denite 25 12 <1.0 4750 2Q 1.5 490.4 3.63 69.7 4.68 3.75 A20.0 Denite 25 12 <1.0 4750 2Q 1.5 490.4 3.63 69.7 4.68 3.75 A20.0 Denite 25 12 <1.0 4750 3Q 13.5 390 4.59 153.6 6.89 10	CIE			Filter										X	
- 2.4 A2/0 w Denite 25 12 <1.0 4750 2Q 1.5 13.5 ton 1	2.4 A2/0 w Integrated Denite Filters 2.5 1.2 <1.0 4750 2Q 1.5 490.4 3.63 69.7 4.68 1. 3.75 A2/0 benite Filters 2.5 1.2 <1.0 4750 3Q 1.5 30.0 4.59 153.6 6.89 ton 1.6 MLE Palters 1.2 <1.2 230 3Q 1.3 30.0 4.59 153.7 404 19.37 sec Filters Meth. 1.2 1.2 300 2.5Q 6.5 250 0.52 60.6 1.43 sec Filters Meth. 15 1.2 300 2.5Q 6.5 250 0.52 60.6 1.43 area 1.0 1.1 3.0 1.5Q 6.5 250 0.52 6.0 1.454 area 1.0 1.2 2.4 2300 2.5Q 6.5 250 0.51 1.63 1.644	Lebanon	8.0	TF-AS	Denite Filters	15	01	<1.0	4000	2Q	6.5	333.6	7.62	190.3	10.47	4.35
ton 16 MLE Denite 25 12 <1.0 4500 3Q 13.5 ton 16 MLE w SRT, 15 12 3.2 3000 2.5Q 6.5 see Filters Meth. To MLE Politers To MLE N-DN 12.5 10 16.7 4000 2.5Q 6.5 and 7.0 MLE N-DN 12.5 10 16.7 4000 2.5Q 6.5 and 7.2 MLE N-DN 12.5 10 16.7 4000 2.5Q 0* and 32 Schreib- Denite 15 10 0.5 2.60 1.0 6.5 MLE Filters MLE Barden 15 10 0.5 2.60 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.60 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.60 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.60 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.600 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.600 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.600 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.600 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.600 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.600 1.0 6.5 City 26 MLE Barden 15 10 0.5 2.600 1.0 6.5 2.600 1.	to size size size size size size size size	Lewis- burg	4.0	A2/0 w	Denite	25	12	<1.0	4750	2Q	1.5	490.4	3.63	69.7	4.68	1.31
16 MLE Denite 15 10 1.2 2300 3Q 7.7 16 MLE Denite 15 10 1.2 2300 3Q 7.7 17 MLE SRT, 15 12 3.2 3000 2.5Q 6.5 18 7.0 MLE SRT 15 10 <1.0 3600 1.5Q 6.5 19 7.0 MLE SRT 15 10 <1.0 3600 1.5Q 6.5 10 6.5 4500 2.5Q 0* 10 16.7 4000 2.5Q 0* 10 16.7 4000 2.5Q 0* 10 16.7 4000 2.5Q 0* 11 4.5 MLE N-DN 15 10 2.6 4500 3 Q 6.5 12 32 Schreib Denite 12 8 <1.0 2750 1Q 6.5 13 Schreib Barden 15 10 0.5 2.500 1.5 0.5 14 26 MLE Barden 15 10 0.5 2.500 1.5 0.5 15 16 17 17 17 17 17 17 17	16 MLE Denite 15 10 1.2 2300 3Q 7.7 830 13.32 404 19.37 15.0 MLE Denite 15 10 1.2 2300 3Q 7.7 830 13.32 404 19.37 15.0 MLE Denite 15 10 <1.0 3600 1.5Q 6.5 500 10.46 279 14.64 15.0 MLE Denite 15 10 <1.0 3600 1.5Q 6.5 500 10.46 279 14.64 15.0 MLE SRT 15 12 2.4 2300 2.Q 6.5 290 6.92 168.2 9.44 15.0 MLE N-DN 12.5 10 16.7 4000 2.5Q 0* 0.50 0.61 193.5 12.51 15.0 MLE BAF 12 8 <1.0 2.6 4500 3 Q 6.5 190 9.76 182.4 12.50 15.0 MLE Barden 15 10 0.5 3600 1 Q 6.5 1080 11.08 465.4 18.06 15.0 Strick Barden 15 10 0.5 3600 1 Q 6.5 1080 11.08 465.4 18.06 15.0 Strick	Lock	3.75	A2/0	Denite	25	1.2	0 >	4500	30	13.5	200	150	7 63 8	000	
16 MLE Denite 15 10 1.2 2300 3Q 7.7 t. 6.0 MLE w >SRT, meth. 15 12 3.2 3000 2.5Q 6.5 n. 12.0 MLE weth. 15 10 <1.0 3600 1.5Q 6.5 n. 12.0 MLE siters 15 10 <1.0 3600 1.5Q 6.5 n. MLE siters SRT 15 12 2.4 2300 2.Q 6.5 t. 7.2 MLE siters 15.5 10 16.7 4000 2.SQ 0.* t. 4.5 MLE siters 15 10 2.6 4500 3.Q 6.5 g 32 Schreib- Denite 12 8 <1.0 2750 1Q 6.5 r. MLE siters Barden 15 10 6.5 3600 1Q 6.5	t 6.0 MLE Denite 15 10 1.2 2300 3Q 7.7 830 13.32 404 19.37 t 6.0 MLE Filters Meth. 12 3.2 3000 2.5Q 6.5 250 0.52 60.6 1.43 n 12.0 MLE Filters 15 12 2.4 2300 2.Q 6.5 500 10.46 279 14.64 n 12.0 MLE SRT 15 12 2.4 2300 2.Q 6.5 500 10.46 279 14.64 n MLE SRT 15 12 2.4 2300 2.Q 6.5 500 10.46 279 14.64 n A.5 MLE N-DN 12.5 10 16.7 4000 2.5Q 6.5 9.61 193.5 12.51 g 3.2 Schreib- Bark 1.0 2.6 4500 3.Q	Haven			Filters				o T	y	J.	0.60	4.09	0.501	6.89	2.42
t. 6.0 MLE w Filters >SRT, neth. 15 12 3.2 3000 2.5Q 6.5 n	t. 6.0 MLE w SRT, ls wheth. 15 12 3.2 3000 2.5Q 6.5 250 0.52 60.6 1.43 12.0 MLE pliers Meth. 15 10 <1.0 3600 1.5Q 6.5 500 10.46 279 14.64 13.0 MLE pliers NLE pliers 12 2.4 2300 2.Q 6.5 290 6.92 14.64 14.64 14 A.1 MLE pliers 12 2.4 2300 2.Q 6.5 290 6.92 14.64 14.64 15 1.2 2.4 2300 2.Q 6.5 290 6.92 14.64 14.64 1 7.0 MLE pliers 1.2.5 10 16.7 4000 2.5Q 0* 9.61 193.5 12.51 g 3.2 Schreib- Denite 1.2 8 <1.0 2.5Q 130 9.41.6 71.69 71.69 35.44 3 26 <td>Scranton</td> <td>91</td> <td>MLE</td> <td>Denite Filters</td> <td>15</td> <td>01</td> <td>1.2</td> <td>2300</td> <td>3Q</td> <td>7.7</td> <td>830</td> <td>13,32</td> <td>404</td> <td>19.37</td> <td>3.20</td>	Scranton	91	MLE	Denite Filters	15	01	1.2	2300	3Q	7.7	830	13,32	404	19.37	3.20
Filters Meth. Filters Meth. 12.0 MLE Denite 15 10 <1.0 3600 1.5Q 6.5 A	Filters Meth. Filters Meth. Sequential Sequen	UAJA, St.	0.9	MLE w	>SRT,	15	12	3.2	3000	2.50	6.5	250	0.50	909	1.42	0
nun 12.0 MLE Denite 15 10 <1.0 3600 1.5Q 6.5 p. 7.0 MLE >SRT 15 12 2.4 2300 2 Q 6.5 nort 7.2 MLE- N-DN 12.5 10 16.7 4000 2.5Q 0,5 nort 4.5 MLE N-DN 15 10 2.6 4500 3 Q 6.5 ning 32 Schreib- Denite 12 8 <1.0 2750 1Q 6.5 City 26 MLE Filters 15 10 0.5 3600 1Q 6.5	nn 12.0 MLE Denite Filters 15 10 <1.0 3600 1.5Q 6.5 500 10.46 279 14.64 p. Area 7.0 MLE SRT 15 12 2.4 2300 2 Q 6.5 500 6.92 16.8.2 9.44 area 7.0 MLE N-DN 12.5 10 16.7 4000 2.5Q 0* 6.5 9.61 193.5 12.51 all Conv. BAF 15 10 16.7 4000 2.5Q 0* 9.01 193.5 12.51 nort 4.5 MLE N-DN 15 10 2.6 4500 3.Q 6.5 190 9.76 182.4 12.50 ining 32 Schreib- Barden 15 10 0.5 3600 1Q 6.5 1806 11.08 465.4 18.06 LS MLE Barden 15 0.6 3600 <th< td=""><td>College</td><td></td><td>Filters</td><td>Meth.</td><td></td><td></td><td></td><td></td><td>y i</td><td>)</td><td>0/-</td><td>70.0</td><td>0.00</td><td>24.</td><td>0.78</td></th<>	College		Filters	Meth.					y i)	0/-	70.0	0.00	24.	0.78
p, area out 7.0 MLE - N-DN SRT 15 12 2.4 2300 2 Q 6.5 nort 7.2 MLE - Conv. MLE - N-DN 12.5 10 16.7 4000 2.5Q 0* ort 4.5 MLE N-DN 15 10 2.6 4500 3 Q 6.5 ling 32 Schreib- Denite 12 8 <1.0 2750 1Q 6.5 City 26 MLE Barden 15 10 0.5 3600 1Q 6.5	p. Area 7.0 MLE - N-DN SSRT 15 12 2.4 2300 2 Q 6.5 290 6.92 168.2 9.44 ort ALE - Conv. BAF N-DN 12.5 10 16.7 4000 2.5Q 0* 920 9.61 193.5 12.51 ort 4.5 MLE BAF N-DN 15 10 2.6 4500 3 Q 6.5 190 9.76 182.4 12.50 ling 32 Schreib- BAF 12 8 <1.0 2750 1Q 6.5 1330 24,69 716.9 35.44 City 26 MLE Filters 8 <1.0 2750 1Q 6.5 1080 11.08 465.4 18.06 Lity 227.3 3600 1Q 6.5 1080 11.08 465.4 18.06 Lity 227.3 227.3 460.5 166.5 460.37 235.56	Sus'hann Lanc area	12,0	MLE	Denite Filters	15	10	0.1>	3600	1.5Q	6.5	200	10.46	279	14.64	4.01
ort 7.2 MLE- N-DN 12.5 10 16.7 4000 2.5Q 0* ort 4.5 MLE N-DN 15 10 2.6 4500 3 Q 6.5 ling 3.2 Schreib- Denite 12 8 <1.0 2750 1Q 6.5 City 2.6 MLE Filters 15 10 0.5 3600 1Q 6.5	ort 7.2 MLE- Conv. BAF N-DN LS- N-DN 12.5 10 16.7 4000 2.5Q 0* 920 9.61 193.5 12.51 ort 4.5 MLE Sohreib- BAF N-DN LS Riters 15 10 2.6 4500 3Q 6.5 190 9.76 182.4 12.50 city 26 MLE Barden 15 10 0.5 3600 1Q 6.5 1080 11.08 465.4 18.06 LS 227.3 227.3 227.3 1Q 6.5 1080 1Q 6.5 1080 11.08 465.4 18.06	Throop, Lack area	7.0	MLE	>SRT	15	12	2.4	2300	2 Q	6.5	290	6.92	168.2	9,44	4.46
ort 4.5 MLE N-DN 15 10 2.6 4500 3 Q 6.5 ling 32 Schreib- Denite 12 8 <1.0 2750 1Q 6.5 City 26 MLE Filters 16 0.5 3600 1O 6.5	ort 4.5 MLE N-DN 15 10 2.6 4500 3 Q 6.5 190 9.76 182.4 12.50 ling 32 Schreib- Denite 12 8 <1.0 2750 1Q 6.5 1330 24.69 716.9 35.44 City 26 MLE Filters 15 10 0.5 3600 1Q 6.5 1080 11.08 465.4 18.06 LS 227.3 ALS ALS ALS ALS ALS ALS ALS ALS	Wm'port Central	7.2	MLE- Conv.	N-DN BAF	12.5	01	16.7	4000	2.5Q	*0	920	19.6	193.5	12.51	1.86
ing 32 Schreib- Denite 12 8 <1.0 2750 1Q 6.5 MLE Filters 15 10 0.5 3500 1O C.5	ing 32 Schreib- Denite MLE 12 8 <1.0 2750 1Q 6.5 1330 24.69 716.9 35.44 ity 26 MLE Filters 15 10 0.5 3600 1Q 6.5 1080 11.08 465.4 18.06 LS 227.3 227.3 () current maximum recycle rate *Incomplete nitrification *Incomplete nitrification	Wm'port West.	4.5	MLE	N-DN BAF	15	01	2.6	4500	30	6.5	190	9.76	182.4	12.50	\$.01
26 MLE Barden 15 10 05 3600 10 CE	26 MLE Barden 15 10 0.5 3600 1Q 6.5 1080 11.08 465.4 18.06 18.05 227.3 (C) current maximum recycle rate *Incomplete nitrification*	Wyoming Valley	32	Schreib- MLE	Denite Filters	12	∞	<1.0	2750	10	6.5	1330	24.69	716.9	35.44	3.65
One C. O Old-	() current maximum recycle rate *Incomplete nitrification	York City	26	MLE	Barden -pho	15	01	0.5	3600	16	6.5	1080	11.08	465.4	18.06	2.29
227.3	*Incomplete nitrification	TOTALS	227.3									94616	166.57	4602 7	70 000	;

12 A2/O Denite 112 12 0.2 A000 550 15 10 0.52	PLANT	Design Flow	BNR Config.	Reco- mend.	SRT Days	Design Temp	Eff NH ₁ *-N	MLSS 75%VS	Nitrate Recycle	BNR Eff.	Add'l N Rem.	Capital Cost	Ann. O&M	20 yr. Amort.	S per Add.lb
1.2 A2O Denite 15 12 0.2 4000 >50Q 1.5 10 0.52 0.7 Gyetic Denite 11.2 1.2 1.2 1.0 3500 3Q 6.5 30 2.65 0.8 Bactons Bacton)	ii iii	MARYLA	QN	NE CON	LUS/U	1111	4	P (AIII	N rem.
O.7 Cyclic Denite 112 12 12 1300 3Q 6.5 30 2.65 1.0 Bagons Bago	owie	2.2	A2/0 OD	Denite Filters	15	12	0.2	4000	>500	1.5	10	0.52	4 9	0.59	8.08
19 Biologous Biocora 13 13 10 13 10 13 10 15 15 10 15 10 15 10 15 10 10	runs-	0.7	Cyclic	Denite	11.2	12	<1.0	3500	30	6.5	30	2.65	30.4	3.11	14.20
1.2 Skep Denite 1.3 0.1 3000 2Q 6.5 50 2.78 2.0 Over- N-deN . 5 3.4 1.9 100 5.7 2.0 Over- N-deN . 5 3.4 1.9 100 5.7 2.1 Denite Meth. . 10 <1.0 	hecter-	60	Riolar	improve		0	3.0			3 3	40	-		-	
1.2 Step Denite 1.3 0.1 3000 2Q 6.5 5.0 2.78 2.0 Over N-deN . 5 3.4 	wn –		lagoons	lagoons		0	0.0		k:	0.0	04		× 0	0	0.38
2.0 Over- Land N-deN Action 5 3.4 - 1.9 100 5.7 2.7 BAF- Barden Action 1.0 <1.0	risfield	1.2	Step A2/O	Denite Filters	C	13	0.1	3000	2Q	6.5	50	2.78	39.7	3.38	9.26
2.7 BAF- Add - 10 <1.0 - 6.5 110 0 0.75 Filters Meth. - 1.2 0.2 - 3 90 2.65 1.0 Filters Meth. - 1.2 0.2 - 3 90 2.65 1.9 MLEs Filters 1.0 0.0 20 6.5 80 3.30 1.9 MLEs Filters 1.0 <1.0	aston	2.0	Over- land fl.	N-deN BAI:	×	S	3.4	,	,	9.1 TV 9.1	001	5.7	97.1	7.16	9.81
1.5 TF-Den. Add'1 12 0.2 3 90 2.65 1.5 Mal.E. Malh. 15 9 <1.0 2700 3Q 8 40 2.65 1.5 Mal.E. Denite 15 10 <1.0 3000 2Q 6.5 80 3.30 1.5 Mal.E. Denite 15 10 <1.0 3000 3Q(1.5) 8.5 30 0.52 1.5 Barden Add'1 20 12 <1.0 3000 3Q(1.5) 8.5 30 0.52 1.6 Barden Add'1 10 12 <1.0 3000 3Q 1.3 0 1.6 Mal.E. Add'1 10 12 <1.0 3000 3Q 6.5 690 0 1.6 Mal.E. Add'1 10 12 <1.0 3000 3Q 6.5 690 0 1.6 Mal.E. Meth. 12 <1.0 3000 3Q 6.5 690 0 1.7 Mal.E. Meth. 10 <1.0 3000 10 6.5 333.6 0 2. 33.0	Ikton	2.7	BAF. DeniteF	Add Meth.	j.	10	<1.0	23417	SIC)	6.5	110	0	25.4	0.38	0.47
0.63 2.Step Denite 15 9 <1.0 2700 3Q 8 40 2.65 1.9	ederals- urg	0.75	TF-Den. Filters	Add'l Meth.	(d)	12	0.2	1102	L	m	06	2.65	49.2	3.39	5.16
1.5 MLE w Denite 15 10 <1.0 3000 2Q 6.5 80 3.30	eorges reek	0.63	2 Step- ML.Es	Denite Filters	15	6	<1.0	2700	3Q	80	40	2.65	34	3.16	10.82
15 Barden	avre de	1.9	MLE w RBCs	Denite Filters	15	01	<1.0	3000	20	6.5	80	3.30	58.9	4.18	7.16
15 Barden- Add'l 20 12 <1.0 3000 >50 Q 1.0 0 0	ndian cad	0.5	A2/O	DeniteF ilters	7.2	14	0.5	3000	3Q(1.5)	8.5	30	0.52	10.6	0.68	3.11
t 1.26 5-Stage Constru - 12 <1.0 3000 1-3 Q 16 160 2.81 pho M Add'l 10 12 <1.0 3000 3Q 6.5 690 0 Solid Saden Ction 10 12 <1.0 3000 3Q 6.5 690 0 Solid Saden Ad.97 Ad.97 Ad.97 Ad.97 Ad.97 Ad.97 Ad.97 Ad.97 Ad.99 Ad.99 </td <td>latta- /oman</td> <td>15</td> <td>Barden- pho OD</td> <td>Add'l Meth.</td> <td>20</td> <td>12</td> <td><1.0</td> <td>3000</td> <td>>50 Q</td> <td>1.0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	latta- /oman	15	Barden- pho OD	Add'l Meth.	20	12	<1.0	3000	>50 Q	1.0	0	0	0	0	0
16.63 MLE w Add'l 10 12 <1.0 3000 3Q 6.5 690 0 2.6 RBC	rin. An	1.26	5-Stage Barden-	Constru	•	12	<1.0	3000	1-3 Q	16	160	2.81	21.6	3.13	2.68
in 16.63 MLE w Add'l Denite 10 12 <1.0 3000 3Q 6.5 690 0 ir 0.6 RBC- Denite - 12 0.6 - - 14.5 70 0 LS 46.97 A6.97 - 12 0.6 - - 14.5 70 0 LS 46.97 A6.97 Ac.97 - 12 0.6 - - 14.5 70 0 In 25 MLE- Denite - 10 - 16.72 19.72 19.72 LS 33.0 Add'l 10 < - 6.5 33.6 0 - LS 33.0 Add'l 10 12 A100 0 6.5 1376.1 19.72 LS Alt. Ac Denite 15 12 0.5 3000 none 6.5 12.0	ounty		pho M							0 11					
LS A6.97 RBC- Denite Denite Denite State 12 0.6 - 14.5 70 0 LS 46.97 Filters Isilters Image: Control of the point of th	/estern ranch	16.63	MLE w DeniteF	Add'1 Meth	10	12	<1.0	3000	3Q	6.5	069	0	160.6	2.41	0.48
ALS 46.97 Denit Form 10 <1.0 3000 IQ 6.5 1042.5 19.72 ham 25 MLE- Denite RAF 10 <1.0 <1.0 3000 IQ 6.5 1042.5 19.72 cott 8.0 TF-SC Denite - 10 <1.0 - 6.5 333.6 0 ALS 33.0 Step Add'l 10 12 <1.0 4000 0 6.5 1250 6.01 mial 2 Alt. Acr Denite 15 12 0.5 3000 none 5.5 70 3.36	/ine-	9.0	RBC-	Denite		12	9.0	Ju-		14.5	70	0	15.5	0.23	0.45
ham 25 MLE- DenitF - 10 <1.0 3000 IQ 6.5 1042.5 19.72 cott 8.0 TF-SC Denite - 10 <1.0 - 6.5 333.6 0 ALS 33.0 ALS Add*I 10 <1.0 <1.0 - 6.5 333.6 0 nial 2 Alt. Acr Denite 15 12 <1.0 4000 0 6.5 1250 6.01 th Anoxio Liters 15 12 0.5 3000 none 5.5 70 3.36	OTALS	46.97		1 11(4)							1500	23.68	5 19 7	31 01	10,
ham 25 MLE- BAF (Meth. There) 10 <1.0 <1.0 3000 1Q 6.5 1042.5 19.72 cott 8.0 TF-SC Denite - 10 <1.0 - 6.5 333.6 0 ALS 33.0 Step Add*1 10 12 <1.0 4000 0 6.5 1376.1 19.72 nial 2 Alt. Acr Denite 15 12 <0.5 3000 none 5.5 70 3.36								NEW YOU	ZK	9	0001	63.00	7.00	31.91	7.31
cott 8.0 TF-SC Denite - 10 <1.0 - 6.5 333.6 0 ALS 33.0 Step Add*l 10 12 <1.0 4000 0 6.5 1376.1 19.72 Igton 30 Step Add*l 10 12 <1.0 4000 0 6.5 1250 6.01 mial 2 Alt. Acr Denite 15 12 0.5 3000 none 5.5 70 3.36	ingham ton	25	MLE- BAF	DenitF .Meth.		01	<1.0	3000	1		1042.5	19.72	561.8	28.15	3.70
ALS 33.0 VIRGINIA igton 30 Step Add'l 10 12 <1.0 4000 0 6.5 1250 6.01 mial 2 Alt. Acr Denite 15 12 0.5 3000 none 5.5 70 3.36	ndicott	8.0	TF-SC	Denite	i	10	<1.0	h:•ir	()	6.5	333.6	0	76.1	1.14	0.47
on 30 Step Add'l 10 12 <1.0 4000 0 6.5 1250 6.01 al 2 Alt. Acr Denite , 15 12 0.5 3000 none 5.5 70 3.36	OTALS	33.0									1376.1	19.72	637.9	20.20	2 02
on 30 Step MLE Add'l Mth. 10 12 <1.0 4000 0 6.5 1250 6.01 al 2 Alt. Acr Denite 15 12 0.5 3000 none 5.5 70 3.36				7.0	•			VIRGINI	[A					/4:/4	7/:1
al 2 Alt. Acr Denite , 15 12 0.5 3000 none 5.5 70	rlington	30	Step MLE	Add'l Meth.	10	12	<1.0	4000		6.5	1250	6.01	336.2	11.05	1.21
-AIIONIC	Colonial Beach	7	Alt. Aer -Anoxic	Denitc Filters	1	12	0.5	3000	none	5.5	70	3.36	55.9	4.2	8.22

PLANT	Design	BNR	Reco-	SRT	Design	Eff.	MLSS	Nitrate	BNR	Add'l N	Capital	Ann.	20 yr.	S per
	Flow	Config.	mend Mod.	Days	Temp C	NH, '-N mg/L	75%vs mg/L	Recycle	Eff. NON	Rem. Lbs/d	Cost \$ Mil	O&M S K	Amort. § Mil	Add.lb N rem.
Dahlgren	0.325	Orbal 3	EQ &	>30	12	6.0	0006	>50 Q	4.5	10	0.52	4.9	0.59	80.8
		rings	Meth											
Dale Ser-	m	MLE	Denite	15	12	0.[>	5300	40	4.5	08	90.1	24.8	1.43	2.45
Vices #1		pri Ad.	rillers			,	0							
Dale Ser-	٠,	MLE	Denite	<u>^</u>	1.7	0.1>	2500	λ4	4.5	08	90.1	24.8	143	2.45
vices #8		ph Ad.	Fillers											
DuPont	0.5	Barden-	Constr	15	20	V-1.0	1400	50	47	190	0.54	49.2	1.26	0.91
W'boro		w orld	uction			il.								
		Meth.								(a.				
Fishers-	2	A2/0-	Denite	15	12	<1.0	3000	30	5.5	70	3.36	55.9	4.2	8.22
ville		MLE	Filters											
Front	4.0	Alt Ano	Denite	15	12	0.3	3000	none	6.5	170	4.79	104.4	6.36	5.12
Royal		-Aer	Filters											
Harrison-	16	A2/0 w	Denite	12	12	<1.0	3000	4Q	4.5	400	13.32	304.4	17.89	6.13
burg		Fermen.	Filters		e.									
H.L.	81	Step	Add:	61	12	<1.0	2200	0	6.5	750	3.8	202,8	6.84	1.25
Mooney		MLE	Meth.											
Leesburg	4.85	A2/0	Denite Filters	12	12	<1.0	3500	30	5.5	160	5.39	112.5	7.08	90.9
Lower Potomac	29	Step MLE	Denite Filters	8.3	12	<1.0	2700	0	6.5	2790	12.76	744.9	23.93	1.17
Luray	2.0	QO	Denite Filters	40	12	<1.0	4300	>500	5	70	3.36	55.9	4.2	8.22
Merck,	1.2	Barden-	Denite	10	25	<1.0	4100	40	41.7	390	0	90.2	1.35	0.47
Elkton		oud	FIITERS											
Middle River/Ver	4.5	00 -	Add Meth.	25	12	<1.0	2000	>500	8	80	5.13	87.3	6.44	11.03
Opequon Win'chest	6.25	Step A2/O	Denite Filters	12	12	0.4	3000	30	6.5	260	6:39	155	8.71	4.59
Parkins	2.0	Bio-De-	Denite	20	12	<1.0	3000	>500	2.5	16.7	3.36	44.6	4.03	27.6
Mill		nitro, 1 ft Filters	Filters			8		c	-					
Purcell-	1.0	Step	Add	15	10	<1.0	3000	30	4.5	30	0.52	9.8	0.67	3.06
ville		MLE-F	Meth.									14		_
Rivanna,	15	A2/0 -	Denite	15		0.5	3000	20	5.0	200	12.59	315.9	17.33	4.75
Char ville	1,0	MLE A2/O	Pillers	53	5	7	4000	001		6	2.10	701	,	76.3
Foods,	7:1	Sch'ber	_	J	2	0.7) -	2	2	0/.7	0.64	2.0.0	0.50
Strachura	0.975	00	Denite	25	12	V 10	4000	>50.0	4.5	20	396	33.6	2.15	21.50
ii asuurg	_	a a	Filters		7	2. /	4000	7 00 \	 J.	07	7.03	23.0	5.15	21.38
											2			

PLANT	Design	BNR	Reco-	SRT	Design	Eff.	MLSS	Nitrate	BNR	Add'I N	Capital	Ann.	20 yr.	S per
	Flow	Config.	mend	Days	Temp	Z-, HZ	75%vs	Recycle	Eff.	Rem.	Cost	O&M	Amort.	Add.lb
	MGD		Mod.	2	၁	mg/L	mg/L		NO3-N	Lbs/d	s Mil	S K	s Mil	N rem.
Stuarts	1.4	OD	PPY	25	12	<1.0	5000	>50 Q	3.5	20	0.52	1.6	99.0	4.52
Draft			Meth.											
Tyson	1.0	MLE	Denite	50	14	0.3	4000	4Q	28	210	2.65	74.5	3.77	2.46
Foods			Filters)*							41	
Waynes-	4.0	TF-	Add		12	1.2	3 %		6.5	170	0	39.4	0.59	0.48
boro City		RBC-	Meth		2						0			
		Filters				35 150								
Wilder-	1.0	Orbal 4	Add			<1.0		>500		40	0.52	14.1	0.73	2.50
ness	5	Ring	Meth.						A					
Nood-	1.0	OD	Denite		7240	0.5	3200	>500		40	2.65	37.9	3.22	11.03
Stock			Filters											
VA	193.2		2.							7956.7	60'66	3037.6	144.63	2.49
GRAND	500.42									20294.4	309.01	8827.9	441.39	2.98
Blue	370	3 stage	Convit	i	12	<1.0	¥.	None	3.5	6171.6	31.69	1675.7	56.82	1.26
Plains, DC		BNR w	to deN	4,0										
Revised	870.42						,			26466	340.7	10,504	198.21	2.58
LOIALS														
						TOTALS	BY SIZE	TOTALS BY SIZE CATEGORY	,					
>50 mgd	437.0				# of	# of plants = 2				9.1968	44.45	2420.6	80.75	1.234
15-50mgd	269.3				1 Jo #	plants = 11				9362.7	127.61	4187.9	190.4	2.786
5-15 mgd	92.7				l Jo#	plants = 11	8.0			4139.6	77.6	2026.4	108.1	3.577
I-5 mgd	65.6				# of I	plants = 27				3477.1	78.7	1571.5	102.3	4.030
pgm I>	5.9				Jo#	# of plants = 9	Ĭ.			522.8	12.3	228.2	15.68	4.108

Total Plants = 9

APPENDIX A

SUMMARY SHEETS FOR COST ESTIMATIONS FOR THE 60 WWTPS PLUS 7 WWTPS IN THE JAMES RIVER BASIN OF VIRGINIA

	Implementing a 3 mg/L	Annual Average Total N	litrogen Limit		
PROJECT:	USEPA, Chesapeake B	A Office	The state of the s		- 1
PREPARED FOR:	Virginia Tech with Stea	rns & Wheler, LLC			1
PREPARED BY:	March 24, 2001	ills or minorari			
DATE:					1
FACILITY:	Blue Plains WWTP	- 3	×'		-
LOCATION:	Washington DC	- 2	PE COD:	N/a mg/L	1
RATED FLOW:	370.0 mgd		PE TKN:	N/a mg/L	
CURRENT EFFLUENT TN:	5.0 mg/L		_		
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	6170 lbs/d				
	2252 1000 lbs/yr	e ·			
	45041 1000 lbs/20-year	3			***
CURRENT PROCESS (CHEC	W ALL THAT APPLY)	TMLE		Existing Aerated Volume (MG	N/a
CURRENT PROCESS (CHEC	ALL TOAT ALL ETT	BEPR (A2/0, VIP, etc.)		Existing Anoxic Volume (MG	N/a
	1	Bardenpho		Current MLSS at Winter ADI	F N/a
		Oxidation Dilch			
		Lagoon (Biolac, etc.)			
		Cyclical Aeration			
		SBR	K		
	. =	High-Rate Biofilter			
		Effluent Filtration		F 5.50000	
ŀ	13	Other: 3-Stage BN	R System with M	Methanol Addition	
		- April			
CURRENT EFFLUENT AMM	ONIA-N: <1.0 mg/L	From Report		IDT 400 C winter conditions)	-
8	20 .0	From Model (at ADF ar	nd load, 15 d MC	RT, 12° C winter conditions)	
	100	S. C. COMP.			
PROPOSED MODIFICATION	IS TO GET AMMONIA < 1.0	mg/L:	red		New MLSS
		No modifications require Raise MCRT/MLSS in	evieting tanks (cl	heck clarifier capacity)	N/a
		Construct additional as	existing tarms (or	Flow (mgd): 0	
1	(3)	Construct additional at	erated volume	Flow (mgd): 0	
4):	34	Construct additional cla	luma as aprohic	(construct separate denit facility	y)
	100	Use existing anoxic vo	ROD removal o	only (construct separate nit/deni	it facility)
	25	Add influent flow equal	ization tank	any (concerns see	
			izauori tarik	- 100 - 100	
	3	Other:			
PROPOSED MODIFICATION		Add downstream DeN Add downstream Nitrif Add methanol to existi Add downstream anox Add effluent filtration	it filter with methatication Biofilter a ng BNR process tic tank with meth	nd DeNit filter with methanol	nol there
1	L	X Other: Convert eff	nuent filters to de	till litters and ded more	
loronovanov		rea (from Bage 2).	\$15,600,000		
CAPITAL COST:	Equipment and Structu	res (Ironi Faye 2).			
	Electrical and Instrume	mation.			
1	Yard Piping and Site W	OIK.	\$19,810,000		
-	Subtotal:	15%			
12	Contractor OH&P:				
	Engineering and Const	r. wgm.	\$25,750,000		
1	Subtotal:	30%	\$5,943,000		
	Contingency:		\$31,690,000		
1	Total Capital Cost: Capital Cost per lb. 20	Yr. N removal:	\$0,70		
OPERATIONS COST:	Additional Horsepower	(from Page 2):		HP • \$hoor	
OF CHARLONG GOOT.	Electrical Power Cost:	0.05 \$/KVV		\$/year	
I	Nitrate Reduction usin	g Methanol:		mg/L	
I	Methanol Required:	14	\$769,200	gals/d	
T	Methanol Cost:	0.75 \$/gal		mg/L	
1	Separate Stage Ammo	onia Reduction:		_mg/L) gals/d	
:10	Caustic Soda @ 25%	conc) \$/year	
AL .	Caustic Soda Cost:	0.60 \$/gal	\$257,500	•	
II.	Equipment Maintenan	ce Cost) lbs/d	
1	Denitrification Sludge	Production w/Methanol:	\$649,000		
	Studge Disposal Cost:	400 \$/ton	\$1,675,700	•	
E:	Total Annual O&M Co	st: ,	2.91%		
	Effective Annual Intere	est Rate after Inflation	\$25,130,000		
	20-Year Present Wort	n of U&M Costs	420,.50,000		
	T WODTH COST:		\$56,820,000		
TOTAL 20-YEAR PRESEN	Total Cost per lb. 20-1	r. N removal:	\$1.26		
	Total Cost per lo. 20-				

SUMMARY COST SHEETS FOR THE 18 PENNSYLVANIA WWTPS

PROJECT:	Implementing a 3 mg/L Annual Average Total	Nitrogen Limit ~
PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY-	Altoona East WWTP	D5 00005 77 mg/l
LOCATION:	Altoona, PA	PE CBOD5 77 mg/L
RATED FLOW:	9.0 mgd	PE COD 213 mg/L
CURRENT EFFLUENT TN:	8.0 mg/L	PE TKN: 15 mg/L
EFFLUENT TN GOAL:	3.0 . mg/L	,
NITROGEN REDUCTION:	380 lbs/d	
	139 1000 lbs/yr	
	2774 1000 lbs/20-years	
		Existing Aerated Volume (MG). 2.27
CURRENT PROCESS (CHECK	ALL THAT APPLY): X MLE	Existing Aerated Volume (MG) 2.27 Existing Anoxic Volume (MG) 0.76
	BEPR (A2/0, VIP. etc.)	Current MLSS at Winter ADF: 2200
	Bardenpho	Current MLSS at Winter ADF
	Oxidation Ditch	
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
	SBR	
	High-Rate Biofilter	
	Effluent Filtration	
	Other:	E 747
CURRENT EFFLUENT AMMON	IA-N: 1.0 mg/L X From Report From Model (at ADF ar	d load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
0.00.6000000000000000000000000000000000	X No modifications requir	ed New MLSS
	Raise MCRT/MLSS in e	existing tanks (check clarifier capacity) 3000
	Construct additional ae	rated volume Flow (mgd): 0
	Construct additional cla	
	Use existing anexic vol	ume as aerobic (construct separate denit facility)
	Use existing arrower voi	BOD removal only (construct separate nit/denit facility)
	Use aeraled system for	BOD Terrioval only (constituot separate mederic identity)
	Add influent flow equali	zation tank
	Other:	
PROPOSED MODIFICATIONS	No modifications required Add downstream Nitrification Add methanol to existing Add downstream anoxional Add downstream a	filter with methanol cation Biofilter and DeNit filter with methanol
	Add effluent filtration Other:	AND EXPERT MAY PROPERTY . LO
CAPITAL COST:	Equipment and Structures (from Page 2):	\$4,100,000
ON TIME GOOT	Electrical and Instrumentation: 12%	\$492,000
	Yard Piping and Site Work: 15%	\$615,000
	Tata I iping and one trein	\$5,210,000
	Subtotal: Contractor OH&P: 15%	\$782,000
	Contractor Street :	\$782,000
	Engineering and Constr. Mgmt: 15%	
	Subtotal:	\$6,770,000
	Contingency: 30%	\$1,563,000
	Total Capital Cost:	\$8,330,000
	Capital Cost per lb. 20-Yr. N removal	\$3.00
OPERATIONS COST:	Additional Horsepower (from Page 2)	180 HP
OI ENATIONS COST.	Electrical Power Cost: 0.05 \$/kW	\$58,800 \$/year
	Nitrate Reduction using Methanol:	5.0 mg/L
		170 gals/d
l .	Methanol Required:	\$46.500 \$/year
91	Methanol Cost: 0.75 \$/gal	· · · · · · · · · · · · · · · · · · ·
	Separate Stage Ammonia Reduction:	0.0 mg/L
l	Caustic Soda @ 25% conc.	0 gals/d
l	Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
	Equipment Maintenance Cost:	\$67,700 \$/year
	Denitrification Sludge Production w/Methanol	540 lbs/d
	Sludge Disposal Cost: 400 \$/ton	\$39,400 \$/year
l	Cladge Bispecer Door	\$212,400 \$/year
	Total Annual O&M Cost:	2.91%
	Effective Annual Interest Rate after Inflation:	\$3,190,000
	20-Year Present Worth of O&M Costs:	40,100,000
TOTAL 20-YEAR PRESENT WO	ORTH COST:	\$11,520,000
	Total Cost per lb. 20-Yr. N removal:	\$4.15

PROJECT: PREPARED FOR; PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L Annual Average Total USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 19, 2001 Altoona West WWTP Altoona. PA 13.5 mgd 7.0 mg/L 3.0 mg/L 450 lbs/d 164 1000 lbs/yr 3285 1000 lbs/20-years	PE COD: <u>N/a</u> mg/L PE TKN: <u>N/a</u> mg/L
	X MLE BEPR (A2/0_VIP_etc Bardenpho Oxidation Ditch Lagoon (Biolac, etc) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration Other:	Existing Aerated Volume (MG) N/a Existing Anoxic Volume (MG) Current MLSS at Winter ADF 3524
		and foad, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	Construct additional at Construct additional of Use existing anoxic vo	existing tanks (check clarifier capacity) erated volume Flow (mgd): arifiers Flow (mgd): o slume as aerobic (construct separate denit facility) or BOD removal only (construct separate nit/denit facility)
PROPOSED MODIFICATIONS	No modifications requi X Add downstream DeN Add downstream Nitrif Add methanol to existi	nt filter with methanol ication Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000
OPERATIONS COST	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda Cost 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton- Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	270 HP \$88,200 \$/year 4.0 mg/L 210 gals/d \$57,500 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$93,700 \$/year \$93,700 \$/year 650 lbs/d \$47,500 \$/year \$286,900 \$/year 2,91% \$4,300,000
TOTAL 20-YEAR PRESENT W	ORTH COST: Total Cost per lb. 20-Yr N removal:	\$15,830,000 \$4.82

PROJECT:		Total Augreen Total A	litrogen Limit		
	Implementing a 3 mg/L An	inual Average Total N	ma ogen Emmt	-	
PREPARED FOR:	HISERA Chesaneake Bay	Office			
PREPARED BY:	Virginia Tech with Stearns	& Wheler, LLC			
	March 19, 2001	nace and			
DATE:					
FACILITY:	Altoona West WWTP				
LOCATION:	Altoona, PA		PE COD:	N/a mg/L	
RATED FLOW:	13.5 mgd				
CURRENT EFFLUENT TN:	7.0 mg/L		PE TKN: _	N/a mg/L	
EFFLUENT TN GOAL:	3.0 mg/L	5			
NITROGEN REDUCTION:	450 lbs/d				
	164 1000 lbs/yr				
	3285 1000 lbs/20-years				
	3203 1000 1000				
	WILL ADDING TY MI	c		Existing Aerated Volume (MG)	N/a
CURRENT PROCESS (CHECK	ALL THAT APPLY):	PR (A2/0 VIP etc.)		Existing Anoxic Volume (MG)	N/a
	L BE	EPR (AZIO VII CIC.)		Current MLSS at Winter ADF	
		ırdenpho		Culterit WESS at White ABI	
		cidation Ditch			
		goon (Biolac, etc.)			
		clical Aeration			
	SE	3R			
	Пні	gh-Rate Biofilter			
		fluent Filtration			
	0	ther:			
l	IIA-N: 0.9 mg/L X Fr	om Report			
CURRENT EFFLUENT AMMON	MA-N: U.S MIGIL A	Madel /- ADE one	Hoad 15 d MCI	RT, 12° C winter conditions)	1
	Fr	om Model (at ADF and	1 1080, 15 0 10101	(1, 12 O miles continue)	
	,			·	
	TO CET AMMONIA < 1.0 mg	α/L:			
PROPOSED MODIFICATIONS			d		New MLSS
	LA NO	aise MCRT/MLSS in ex	viatina tanks (ch	ack clarifier canacity)	N/a
	R	aise MCR1/MLSS in ea	xisung lanks (Ci	Flow (mad):	
		onstruct additional aera	ated volume	Flow (mgd): 0	- 1
		terest additional clar	ifiers	Flow (mgd): 0	_
		oristruct additional state	me as serobic (construct separate denit facility)	
1		se existing anoxic volu	me as acrosic (-t. (t-ust apparate put/denit	facility
	- Du	se aerated system for	BOD removal of	nly (construct separate nit/denit	lacility)
1	<u> </u>	dd influent flow equaliz	ation tank		
	0	ther:			
PROPOSED MODIFICATIONS	XAAAA	o modifications required downstream DeNit I do downstream Nitrification and methanol to existing	filter with metha ation Biofilter an BNR process	d DeNit tilter with methanol	
	⊟ _A	dd downstream anoxic dd effluent filtration	tank with meth		
	⊟ _A	dd downstream anoxio dd effluent filtration ither:	tank with meth		
1	A A O	dd effluent filtration ither:			
CAPITAL COST.	A A O	dd effluent filtration ither:	\$5,680,000	e e e e e e e e e e e e e e e e e e e	
CAPITAL COST:	Equipment and Structures	dd effluent filtration ther: (from Page 2):		H	11
CAPITAL COST:	Equipment and Structures Electrical and Instrumental	dd effluent filtration ther: (from Page 2): tion: 12%	\$5,680,000 \$682,000	н	+
CAPITAL COST:	Equipment and Structures	dd effluent filtration ther: (from Page 2): tion: 12%	\$5,680,000 \$682,000 \$852,000	K	41
CAPITAL COST:	Equipment and Structures Electrical and Instrumental	dd effluent filtration ther: (from Page 2): tion: 12% 15%	\$5,680,000 \$682,000 \$852,000 \$7,210,000		41
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal:	dd effluent filtration ther: (from Page 2): tion: 12%	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000	н	t
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P:	dd effluent filtration ther: (from Page 2): tion: 12% :: 15%	\$5,680,000 \$682,000 \$852,000 \$7,210,000	×	
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M	dd effluent filtration ther: (from Page 2): tion: 12% :: 15%	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000		41
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P:	dd effluent filtration (from Page 2): (ion: 12% :: 15% tgmt: 15%	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000		**
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal:	dd effluent filtration ther: (from Page 2): tion: 12% :: 15%	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000	н _	
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency:	dd effluent filtration (from Page 2): (ion: 12% :: 15% tgmt: 15%	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000	*	
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost:	dd effluent filtration ther: (from Page 2): tion: 12% 15% 15% 15% 15% 30%	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000		
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency:	dd effluent filtration ther: (from Page 2): tion: 12% 15% 15% 15% 15% 30%	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000		+1
CAPITAL COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr.	dd effluent filtration (from Page 2): (ion: 12% :: 15% dgmt: 15% 30%	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$2,163,000 \$2,163,000 \$3,51		
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro	dd effluent filtration ither: (from Page 2): ition: 12% 15% 15% 15% 15% 30% N removal: om Page 2):	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51	нр	
CAPITAL COST: OPERATIONS COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro	dd effluent filtration ither: (from Page 2): ition: 12% :: 15% dgmt: 15% 30% N removal: om Page 2): 0.05 \$/kW	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200	HP \$/year	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro	dd effluent filtration ither: (from Page 2): ition: 12% :: 15% dgmt: 15% 30% N removal: om Page 2): 0.05 \$/kW	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200	нр	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (from Electrical Power Cost: Nitrate Reduction using M.	dd effluent filtration ither: (from Page 2): ition: 12% :: 15% dgmt: 15% 30% N removal: om Page 2): 0.05 \$/kW	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4,0	HP \$/year mg/L	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost. Nitrate Reduction using M Methanol Required:	dd effluent filtration ither: (from Page 2): ition: 12% ition: 15% dgmt: 15% 30% N removal: om Page 2): 0.05 \$/kW ethanol:	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4.0	HP \$/year mg/L gals/d	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost:	dd effluent filtration (from Page 2): (ion: 12% 15% 15% 15% 15% 30% N removal: om Page 2): 0.05 \$/kW ethanol:	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4.0 210 \$57,500	HP S/year mg/L gals/d S/year	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost:	dd effluent filtration (from Page 2): (ion: 12% 15% 15% 15% 15% 30% N removal: om Page 2): 0.05 \$/kW ethanol:	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3.51 270 \$88,200 4.0 210 \$57,500 0.0	HP \$/year mg/L gals/d \$/year mg/L	*
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia	dd effluent filtration (from Page 2): (ion: 12% 15% 15% 15% 15% 30% N removal: om Page 2): 0.05 \$/kW ethanol: 0.75 \$/gal Reduction	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3.51 270 \$88,200 4.0 210 \$57,500 0.0	HP S/year mg/L gals/d S/year	*
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con-	dd effluent filtration Ither: (from Page 2): Ition: 12% Ition: 15% Ition: 15	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$2,163,000 \$2,163,000 \$3,51 270 \$88,200 4.0 210 \$57,500 0.0	HP \$/year mg/L gals/d \$/year mg/L gals/d	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost	dd effluent filtration Ither: (from Page 2): Ition: 12% Ition: 15% Ition: 15	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4.0 210 \$57,500 0.0	HP S/year mg/L gals/d S/year mg/L gals/d S/year	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost	dd effluent filtration ither: (from Page 2): ition: 12% ition: 15% 15% dgmt: 15% 30% N removal: om Page 2): 0.05 \$/kW ethanol: 0.75 \$/gal Reduction c 0.60 \$/gal Cost:	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4,0 210 \$57,500 0.0 0 \$0 \$93,700	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost	dd effluent filtration ither: (from Page 2): ition: 12% ition: 15% 15% dgmt: 15% 30% N removal: om Page 2): 0.05 \$/kW ethanol: 0.75 \$/gal Reduction c 0.60 \$/gal Cost:	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4,0 210 \$57,500 0.0 0 \$0 \$93,700	HP S/year mg/L gals/d S/year mg/L gals/d S/year	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost Equipment Maintenance C Denitrification Sludge Proce	dd effluent filtration Ither: (from Page 2): Ition: 12% Ition: 15% Ition: 15	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4,0 210 \$57,500 0.0 0 \$0 \$93,700 650	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost Equipment Maintenance C Denitrification Sludge Pro Sludge Disposal Cost:	dd effluent filtration ither: (from Page 2): ition: 12% ition: 15% 15% dgmt: 15% 30% N removal: om Page 2): 0.05 \$/kW ethanol: 0.75 \$/gal Reduction c 0.60 \$/gal Cost:	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4,0 210 \$57,500 0,0 \$93,700 650 \$47,500	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (frot Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost Equipment Maintenance C Denitrification Sludge Prod Sludge Disposal Cost: Total Angust O.SM Cost:	dd effluent filtration Ither: (from Page 2): Ition: 12% Ition: 15% Ition: 15	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3.51 270 \$88,200 4,0 210 \$57,500 0,0 \$93,700 650 \$47,500 \$286,900	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (frot Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost Equipment Maintenance C Denitrification Sludge Prod Sludge Disposal Cost: Total Angust O.SM Cost:	dd effluent filtration Ither: (from Page 2): Ition: 12% Ition: 15% Ition: 15	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4,0 210 \$57,500 0,0 \$93,700 650 \$47,500	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con: Caustic Soda Cost Equipment Maintenance C Denitrification Sludge Pro Sludge Disposal Cost: Total Annual O&M Cost: Total Annual O&M Cost:	dd effluent filtration Ither: (from Page 2): Ition: 12% Ition: 15% Ition: 15	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3.51 270 \$88,200 4,0 210 \$57,500 0,0 \$93,700 650 \$47,500 \$286,900	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	*
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (frot Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost Equipment Maintenance C Denitrification Sludge Proc Sludge Disposal Cost: Total Angust O.SM Cost:	dd effluent filtration Ither: (from Page 2): Ition: 12% Ition: 15% Ition: 15	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$9,370,000 \$2,163,000 \$11,530,000 \$3.51 270 \$88,200 4.0 210 \$57,500 0.0 \$93,700 650 \$47,500 \$286,900 2,91%	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	
OPERATIONS COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Castic Soda Cost Equipment Maintenance C Denitrification Sludge Pro Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest ff 20-Year Present Worth of	dd effluent filtration Ither: (from Page 2): Ition: 12% Ition: 15% Ition: 15	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$2,163,000 \$2,163,000 \$3,51 270 \$88,200 4.0 210 \$57,500 0.0 0 \$93,70,000 \$2,57,500 \$47,500 \$286,900 2,91% \$4,300,000	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	
OPERATIONS COST:	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Caustic Soda Cost Equipment Maintenance C Denitrification Sludge Pro Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest F 20-Year Present Worth of	dd effluent filtration ither: (from Page 2): ition: 12% 15% 15% 15% 15% 15% 15% 15% 20% N removal: 20	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$2,163,000 \$11,530,000 \$3,51 270 \$88,200 4.0 210 \$57,500 0.0 0 \$93,700 650 \$47,500 \$286,900 2,91% \$4,300,000	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	
	Equipment and Structures Electrical and Instrumental Yard Piping and Site Work Subtotal: Contractor OH&P: Engineering and Constr. M Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. Additional Horsepower (fro Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% con Castic Soda Cost Equipment Maintenance C Denitrification Sludge Pro Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest ff 20-Year Present Worth of	dd effluent filtration ither: (from Page 2): ition: 12% 15% 15% 15% 15% 15% 15% 15% 20% N removal: 20	\$5,680,000 \$682,000 \$852,000 \$7,210,000 \$1,082,000 \$1,082,000 \$2,163,000 \$2,163,000 \$3,51 270 \$88,200 4.0 210 \$57,500 0.0 0 \$93,70,000 \$2,57,500 \$47,500 \$286,900 2,91% \$4,300,000	HP S/year mg/L gals/d S/year mg/L gals/d S/year S/year Ibs/d	

	L Aussen Total I	Nitrogan Limit
PROJECT:	Implementing a 3 mg/L Annual Average Total I	Aurogen Canac
PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
	March 19, 2001	
DATE:		
FACILITY:	Chambersburg WWTP	
LOCATION:	Chambersburg, PA	
RATED FLOW:	6,8 mgd	PE COD: N/A mg/L
1755		PETKN: N/A mg/L
CURRENT EFFLUENT TN:	4.0 mg/L	
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	60 lbs/d	
THE SELL KEDGG HOLD	22 1000 lbs/yr	
	438 1000 lbs/20-years	
		Cuinting Annual Values (MC): N/a
CURRENT PROCESS (CHECK	ALL THAT APPLY): MLE	Existing Aerated Volume (MG) N/a
CORRENT PROCESS (CITEOR	BEPR (A2/0, VIP, etc.)	Existing Anoxic Volume (MG) N/a
		Current MLSS at Winter ADF N/a
	Bardenpho	
l	Oxidation Ditch	
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
	SBR	
1	High-Rate Biofilter	
ŀ		
1	X Effluent Filtration	
	Other	
_	,	
	A Ni do mail V Com Basad	
CURRENT EFFLUENT AMMON	IA-N: <1.0 mg/L X From Report	15 d MCDT 12° C winter conditions!
	From Model (at ADF and	l load, 15 d MCRT, 12° C winter conditions)
I	. 19324-2548-01	
1		
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	d New MLSS
	I V INo modifications require	
1	Raise MCRT/MLSS in ex	kisting tanks (check clarifier capacity) N/a
	Construct additional aera	ated volume Flow (mgd): 0
1	Construct additional aero	ifiers Flow (mgd): 0
	Construct additional clar	mers Flow (mgd).
	I les aveting apovic VGIII	me as aembic (construct separate denit facility)
1	Use existing driving to	200 removal only (construct separate nit/denit facility)
	Use aerated system ic.	CE Ellipsel of the Contract coperate the delice resembly
_	Add influent flow equaliz	ation tank
-	Other:	
1	Oulet.	
	Add methanol to existing Add downstream anoxic Add effluent filtration	ilter with methanol ation Biofilter and DeNit filter with methanol BNR process
	A Other.	
		\$0
CAPITAL COST:	Equipment and Structures (from Page 2)	
	Electrical and Instrumentation 12%	\$0
	Yard Piping and Site Work: 15%	\$0
U	Tatu Piping and Site Trom.	\$0
1	Subtotal:	\$0
1	Contractor OH&P 15%	
1	Engineering and Constr. Mgmt 15%	\$0
	Engineering and Const. Mg	\$0
1	Subtotal:	\$0
	Contingency: 30%	
	Total Capital Cost:	\$0
II.	Capital Cost per lb. 20-Yr. N removal:	\$0.00
1	Capital Cost per lo. 20-11. 14 ferroradi.	
I) "		0 ND
OPERATIONS COST:	Additional Horsepower (from Page 2):	0 HP
OI ERAHONS COST.	Electrical Power Cost: 0.05 \$/kW	\$0 S/year
1		1.0 mg/L
	Nitrate Reduction using Methanol:	
II =	Methanol Required:	30 gais/d
1		\$8,200 \$/year
I.		0.0 mg/L
I	Separate Stage Ammonia Reduction:	
1	Caustic Soda @ 25% conc.	0 gais/d
1	Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
1		SO S/year
1	Equipment Maintenance Cost:	· · · · · · · · · · · · · · · · · · ·
E	Denitrification Sludge Production w/Methanol:	80 lbs/d
	Sludge Disposal Cost: 400 \$/ton	\$5,800 \$/year
	Sibage Disposar Goon	\$14 C00 \$/year
	Total Annual O&M Cost:	•
	Effective Annual Interest Rate after Inflation:	2.91%
U	20-Year Present Worth of O&M Costs:	\$210,000
	ZU- I cal T Teacht 440th. of Cam accom-	1
		\$210,000
TOTAL 20-YEAR PRESENT W	ORTH COST:	
AVSAUL.	Total Cost per lb 20-Yr N removal	\$0.48
I	. 0.01 000. p	

PROJECT: PREPARED FOR: PREPARED BY:	Implementing a 3 mg/L Annual Average Total Nitrogen Limit
PREPARED FOR:	LIGHT Observation Pay Office
	USEPA, Chesapeake Bay Office
PRPPARMITT	Virginia Tech with Stearns & Wheler, LLC
DATE:	March 10, 2001
FACILITY:	Greater Hazleton WWTP
	Hazleton, PA
LOCATION:	DE COD: 180 mo//
RATED FLOW:	8.9 mga
CURRENT EFFLUENT TN:	8.0 mg/L
EFFLUENT TN GOAL:	3 0 mg/L
NITROGEN REDUCTION:	370 lbs/d
MINIOSEN NEBSONION	135 1000 lbs/yr
	2701 1000 lbs/20-years
	2701 -000 to 3724 years
ndision	Existing Aerated Volume (MG) 0.5
CURRENT PROCESS (CHE	CK ALL THAT APPLY): X MLE Existing Aerated Volume (MG) 0.5 BEPR (A2/0, VIP, etc.) Existing Anoxic Volume (MG) 0.21
	BEFR (AZIO VIII , CIC.)
	Balderipho
	Oxidation Ditch
	Lagoon (Biolac, etc.)
	Cyclical Aeration
	SBR
	X High-Rate Biofilter
	Effluent Filtration
	Other:
	200001
CURRENT EFFLUENT AMA	MONIA-N: 3.2 mg/L From Report
CONKENT ELLEGENT WANT	X From Model (at ADF and load, 15 d MCRT, 12° C winter conditions)
	A From Model (Street and 1997)
PROPOSED MODIFICATION	NS TO GET AMMONIA < 1.0 mg/L:
	I No modifications fedulted
	Raise MCRT/MLSS in existing tanks (check clarifier capacity) N/a
	Construct additional aerated volume Flow (mgd): 0
	Construct additional clarifiers Flow (mgd): 0
	Use existing anoxic volume as aerobic (construct separate denit facility)
	Ose existing for BOD removal only (construct separate nil/denit facility)
	Use aerated system for BOD removal only (construct separate nil/denit facility)
	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank
PROPOSED MODIFICATIO	Use aerated system for BOD removal only (construct separate nt/denit facility) Add influent flow equalization tank X Other: Abandon activated sludge process and use biofilter for all flow NS TO GET NTRATE < 1.0 mg/L:
PROPOSED MODIFICATIO	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank X. Other: Abandon activated sludge process and use biofilter for all flow NS TO GET NITRATE < 1.0 mg/L: No modifications required X. Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed
PROPOSED MODIFICATIO	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank X Other Abandon activated sludge process and use biofilter for all flow NS TO GET NITRATE < 1.0 mg/L: No modifications required X Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed
PROPOSED MODIFICATIO	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank X Other: Abandon activated sludge process and use biofilter for all flow NS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration
PROPOSED MODIFICATIO	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank X Other: Abandon activated sludge process and use biofilter for all flow NS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration X Other: Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd flow
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	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank X Other: Abandon activated sludge process and use biofilter for all flow NS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other: Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd flow Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% \$1,523,000 \$1,523,000
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	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank X Other Abandon activated sludge process and use biofilter for all flow NS TO GET NITRATE < 1.0 mg/L: No modifications required X Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd flow Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: S1,523,000 \$13,200,000 \$16,250,000 \$16,250,000
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CAPITAL COST:	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank X Other Abandon activated sludge process and use biofilter for all flow NS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNit filter with methanol For all 8.9 mgd Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process. Add downstream anoxic tank with methanol feed Add effluent filtration X Other: Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd flow Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$959,000 Yard Piping and Site Work: 15% \$1,199,000 Subtotal: \$15,523,000 Subtotal: \$1,523,000 Subtotal: \$1,523,000 Subtotal: \$15,523,000 Subtotal: \$1,523,000 Subtotal: \$1,52
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CAPITAL COST:	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank X Other Abandon activated sludge process and use biofilter for all flow NS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNit filter with methanol For all 8.9 mgd Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration X Other Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd flow Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$959,000 Yard Piping and Site Work: 15% \$1,99,000 Subtotal: \$10,150,000 Subtotal: \$150,000 Subtotal: \$150,000 Contractor OH&P: 15% \$1,523,000 Engineering and Constr. Mgmt: 15% \$1,523,000 Subtotal: \$13,200,000 Subtotal: \$13,200,000 Subtotal: \$13,200,000 Subtotal: \$15,23,000 Subtotal: \$13,200,000 Subtotal: \$15,23,000 Subto
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CAPITAL COST:	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank \[\text{X}\] Other: \[\text{Abandon activated sludge process and use biofilter for all flow} \] NS TO GET NITRATE < 1.0 mg/L: \[\text{No modifications required} \] \[\text{X}\] Add downstream DeNit filter with methanol} \] \[\text{Formula Add downstream DeNit filter with methanol} \] \[\text{Add downstream DeNit filter with methanol} \] \[\text{Add downstream Nitrification Biofilter and DeNit filter with methanol} \] \[\text{Add downstream anoxic tank with methanol} \] \[\text{Add effluent filtration} \] \[\text{Add effluent filtration} \] \[\text{Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd flow} \] \[\text{Equipment and Structures (from Page 2):} \] \[\text{Electrical and Instrumentation:} \] \[\text{15%} \] \[\text{\$1,199,000} \] \[\text{\$11,199,000} \] \[\text{\$11,200,000} \] \[\$11
CAPITAL COST:	Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank \[\text{X}\] Other: \[\text{Abandon activated sludge process and use biofilter for all flow} \] NS TO GET NITRATE < 1.0 mg/L: \[\text{No modifications required} \] \[\text{X}\] Add downstream DeNit filter with methanol} \] \[\text{Formula Add downstream DeNit filter with methanol} \] \[\text{Add downstream DeNit filter with methanol} \] \[\text{Add downstream Nitrification Biofilter and DeNit filter with methanol} \] \[\text{Add downstream anoxic tank with methanol} \] \[\text{Add effluent filtration} \] \[\text{Add effluent filtration} \] \[\text{Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd flow} \] \[\text{Equipment and Structures (from Page 2):} \] \[\text{Electrical and Instrumentation:} \] \[\text{15%} \] \[\text{\$1,199,000} \] \[\text{\$11,199,000} \] \[\text{\$11,200,000} \] \[\$11
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PROJECT: PREPARED FOR: PREPARED BY:	Implementing a 3 mg/L Annual Average Total USEPA, Chesapeake Báy Office Virginia Tech with Stearns & Wheler, LLC March 19, 2001	Nitrogen Limit ~
DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Hanover Area WWTP Hanover, PA 4.5 mgd 6.0 mg/L 3.0 mg/L 110 lbs/d 40 1000 lbs/yr 803 1000 lbs/20-years	PE BOD5 135 mg/L PE COD N/a mg/L PE TKN 30 mg/L
CURRENT PROCESS (CHECK	BEPR (A20, VIP, etc.) Bardenpho X Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration Other:	Existing Aerated Volume (MG). Existing Anoxic Volume (MG). Current MLSS at Winter ADF. N/a.
CURRENT EFFLUENT AMMON	IIA-N: 0.5 mg/L X From Report From Model (at ADF an	d load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	Raise MCRT/MLSS in e Construct additional ae Construct additional cla	ated volume Flow (mgd): 0 rifers Flow (mgd): 0 rifers Flow (mgd): 0 rifers as aerobic (construct separate denit facility) ECD :emoval only (construct separate nit/denit facility)
PROPOSED MODIFICATIONS	X Add downstream Nithio	filter with methanol ation Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$2,530,000 \$304,000 \$380,000 \$3,210,000 \$482,000 \$4,170,000 \$963,000 \$5,130,000 \$6.39
OPERATIONS COST:	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 S/kW Nitrate Reduction using Methanol Methanol Required: Methanol Cost. 0.75 S/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 S/gal Equipment Maintenance Cost: Dentrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 S/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	90 HP \$29.400 S/year 3.0 mg/L 50 gals/d \$13.700 S/year 0.0 mg/L 0 gals/d \$0 S/year \$41.700 S/year 160 lbs/d \$11,700 \$/year \$96.500 \$/year 2.91% \$1,450,000
TOTAL 20-YEAR PRESENT W	ORTH COST: Total Cost per lb. 20-Yr, N removal:	\$6,580,000 \$8.19

PROJECT: Implementing a 3 mg/L Annual Average Total Nitrogen Limit PREPARED FOR: USEPA, Chesapeake Bay Office PREPARED BY: Virginia Tech with Stearns & Wheler, LLC DATE: March 10, 2001 FACILITY: Greater Hazleton WWTP LOCATION: Hazleton. PA PE COD: 180 mg/L RATED FLOW: 8.9 mgd PE TKN: 25 mg/L CURRENT EFFLUENT TN: 8.0 mg/L NITROGEN REDUCTION: 370 lbs/d 135 1000 lbs/yr 2701 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) Bardenpho Current, MLSS at Winter A Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	G) 0.5 G): 0.21
PREPARED FOR: PREPARED BY: Virginia Tech with Stearns & Wheler, LLC DATE: March 10, 2001 FACILITY: Greater Hazleton WWTP LOCATION: Hazleton. PA RATED FLOW: RATED FLOW: RATED FLOW: GURRENT EFFLUENT TN: 8.0 mg/L PETKN: 25 mg/L PETKN: 25 mg/L PETKN: 25 mg/L CURRENT PROCESS (CHECK ALL THAT APPLY): CURRENT PROCESS (CHECK ALL THAT APPLY): Bardenpho Oxidation Ditch Lagoon (Biolac. etc.) Cyclical Aeration	3) 0.5
PREPARED BY: DATE: March 10, 2001 FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: B.0 mg/L 135 1000 lbs/yr 2701 1000 ibs/20-years Existing Aerated Volume (No. 1) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	G) 0.5 G) 0.21
DATE:	3) 0.5
FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: 8.0 mg/L BFFLUENT TN GOAL: 370 lbs/d 135 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	3) 0.5
LOCATION: Hazleton, PA RATED FLOW: 8.9 mgd pgd pE TKN: 25 mg/L CURRENT EFFLUENT TN: 8.0 mg/L EFFLUENT TN GOAL: 30 mg/L NITROGEN REDUCTION: 370 lbs/d 135 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) Existing Aerated Volume (Machine Machine) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	3) 0.5
RATED FLOW: 8.9 mgd CURRENT EFFLUENT TN: 8.0 mg/L EFFLUENT TN GOAL: 30 mg/L NITROGEN REDUCTION: 370 lbs/d 135 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE BEPR (A2/0. VIP. etc.) Bardenpho Oxidation Ditch Lagoon (Biolac. etc.) Cyclical Aeration	3) 0.5
RATED FLOW: CURRENT EFFLUENT TN: 8.0 mg/L EFFLUENT TN GOAL: 30 mg/L NITROGEN REDUCTION: 37 loo0 lbs/d 135 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	3) 0.5
CURRENT EFFLUENT TN: 8.0 mg/L FFFLUENT TN GOAL: 370 lbs/d 135 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): 8.0 mg/L 135 1000 lbs/yr 2701 1000 lbs/20-years Existing Aerated Volume (N BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	3) 0.5
EFFLUENT TN GOAL: 3 0 mg/L NITROGEN REDUCTION: 370 lbs/d 135 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	3) 0.5
NITROGEN REDUCTION: 370 lbs/d 135 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (N BEPR (A2/0, VIP, etc.) Existing Anoxic Volume (N Current MLSS at Winter A Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	3) 0.5
135 1000 lbs/yr 2701 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Management of the content of t	G) 0.5
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Management of the content	G) 0.5
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Management of the Court o	G) 0.5
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Anoxic Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (Modern Process (CHECK ALL THAT APPLY): X MLE Existing Aerated (Modern Process (CHECK A	G) 0.5
CURRENT PROCESS (CHECK ALL THAT APPLY): BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	G): 0.5 G): 0.21
CURRENT PROCESS (CHECK ALL THAT APPLY): BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	3): 0.21
Bardenpho Current MLSS at Winter A Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	(1) (1) 2(1)
Bardenpho Current MLSS at Winter A Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	7.6.1
Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	OF: 3500
Lagoon (Biolac. etc.) Cyclical Aeration	-
Cyclical Aeration	
Cyclical Aeration	
SBR	
X High-Rate Biofilter	
Effluent Filtration	
Other:	
CURRENT EFSLUENT AMMONIA-N: 3.2 mg/L From Report	
CURRENT EFFLUENT AMMONIA-N: 3.2 mg/L From Report X From Model (at ADF and load, 15 d MCRT, 12° C winter conditions)	
X J From Model (at ADP and load, 15 d Mott), 12 d Minter destations	
1	
THE PROPERTY OF THE PROPERTY O	
PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: No modifications required	New MLSS
	N/a
Raise MCRT/MLSS in existing tanks (check clarifier capacity)	ING
Construct additional aerated volume Flow (mgd):0	
Construct additional clarifiers Flow (mgd): U	
Use existing anoxic volume as aerobic (construct separate dent faci	W)
Use existing anoxic volume as aeropic (construct separate with	it familias
Use existing arrows to the body construct separate nit/de	at facility)
to the second flow equalization tank	
X Other Abandon activated sludge process and use biofilter for all	flow
X Other. Abandon activated sludge process and use biolitier for all	11.011
No modifications required X Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration	
	N
Other Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd fic	
X Other: Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd fic	
X Other: Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd like	tion
X Other: Add downstream Anoxic/Aerobic Biofilter for 3.41 mga its CARITAL COST: Fourierment and Structures (from Page 2): \$7,990,000 Adjusted for Special Cond	tion
X Other: Add downstream Anoxic/Aerobic Biofilter for 3.41 mga its CARITAL COST: Equipment and Structures (from Page 2): \$7,990,000 Adjusted for Special Cond	tion
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CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Add downstream Anoxic/Aerobic Biofiliter for 3.41 mgd its \$7,990,000 Adjusted for Special Cond \$959,000 \$1,199,000 \$10,150,000 \$10,150,000 \$1,523,000	ition
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CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd its \$7,990,000 Adjusted for Special Conc \$12% \$959,000 \$11,199,000 \$11,199,000 \$11,523,000 \$11,523,000 \$13,200,000 \$13,200,000 \$13,200,000 \$13,200,000 \$16,250,000	ition
CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Add downstream Anoxic/Aerobic Biofilter for 3.41 mgd its \$7,990,000 Adjusted for Special Conc \$12% \$959,000 \$11,199,000 \$11,199,000 \$11,523,000 \$11,523,000 \$13,200,000 \$13,200,000 \$13,200,000 \$13,200,000 \$16,250,000	ition
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CAPITAL COST: Equipment and Structures (from Page 2): \$7,990,000 Adjusted for Special Conditions 12% \$959,000 S1,199,000 S1,199,000 S10,150,000 S10,150,150,150,150,150,150,150,150,150,1	ition
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CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: Nitrate Reduction using Methanol: Methanol Required: Add downstream Anoxic/Aerobic Biofiliter for 3.41 mgd its \$7,990,000 Adjusted for Special Cond \$1,199,000 \$10,150,000 \$10,150,000 \$15,253,000 \$13,200,000 \$13,200,000 \$16,250,000 \$16,250,000 \$16,250,000 \$16,250,000 \$16,250,000 \$173,200 \$i/year 5.0 mg/L 170 gals/d	ition
CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$959,000 Yard Piping and Site Work: 15% \$1,199,000 Subtotal: Contractor OH&P: 15% \$1,523,000 Engineering and Constr. Mgmt: 15% \$1,523,000 Subtotal: \$13,200,000 Subtotal: \$13,200,000 Subtotal: \$3,045,000 Subtotal: Contingency: 30% \$3,045,000 Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: \$6.02 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 S/kW Nitrate Reduction using Methanol: 5.0 mg/L Methanol Cost 0.75 S/gal \$46.500 S/year	ition
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CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: Nitrate Reduction using Methanol: Methanol Required: Methanol Cost Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda Cost: Capital Cost: O 75 S/gal Separate Stage Ammonia Reduction Caustic Soda Gost: O 60 S/gal S7,990,000 Adjusted for Special Conc S10,150,000 S10,250,000 S10,250,000 S10,250,000 S16,250,000 S16,250,000 S16,250,000 S17,200 S/year S173,200 S/year O.0 mg/L S170 gals/d S46,500 S/year O.0 gals/d S1,270,000 S1,2	ition
Equipment and Structures (from Page 2): Electrical and Instrumentation:	ition
CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Sife Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: Methanol Required: Methanol Cost Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Studge Production w/Methanol: Denitrification Studge Production w/Methanol: Equipment and Structures (from Page 2): \$7,990,000 Adjusted for Special Conc. \$15,000 \$11,192,000 \$11,223,000 \$11,223,000 \$16,250,000 \$16,250,000 \$16,250,000 \$16,250,000 \$16,250,000 \$16,250,000 \$173,200 \$/year \$173,200 \$/year \$5.0 mg/L \$170 gals/d \$46.500 \$/year \$0 \$/year \$132,000 \$/year	ition
CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per ib. 20-Yr. N removal: OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: Methanol Required: Methanol Required: Methanol Cost Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Studge Production w/Methanol: Stylear	ition
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CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per ib. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: Methanol Required: Methanol Required: Methanol Cost Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: Enguipment Add downstream Anoxic/Aerobic Biofiliter tor 3.41 mgd ric \$7,990,000 Adjusted for Special Conc \$959,000 \$10,150,000 \$1,1523,000 \$1,1523,000 \$1,1523,000 \$16,250,000 \$16,250,000 \$16,250,000 \$173,200 S/year \$5.0 mg/L \$170, gals/d \$46,500 S/year \$132,000 S/year \$132,000 S/year \$132,000 S/year \$30,400 S/year \$38,700 S/year \$390,400 S/year \$390,400 S/year \$390,400 S/year \$390,400 S/year \$5,860,000	ition
CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Contingency: Total Capital Cost Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: Nitrate Reduction using Methanol: Methanol Required: Methanol Cost Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Vival Annual New Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Ffective Annual Interest Rate after Inflation: Equipment Maintenance Cost: Ffective Annual Interest Rate after Inflation: Equipment Maintenance Cost: Ffective Annual Interest Rate after Inflation: Equipment Maintenance Cost: Ffective Annual Interest Rate after Inflation: Equipment Maintenance Cost: Ffective Annual Interest Rate after Inflation:	ition

PROJECT: PREPARED FOR:	Implementing a 3 mg/L Annual Average To USEPA, Chesapeake Bay Office	tal Nitrogen Limit	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC		
DATE:	March 19, 2001		
FACILITY:	Harrisburg WWTP		
LOCATION:	Harrisburg, PA	PE COD N/a	mg/L
RATED FLOW:	30.0 mgd	PE TKN 16	mg/L
CURRENT EFFLUENT TN:	40 mg/L	-	
EFFLUENT TN GOAL:	3 0 mg/L 250 lbs/d		
NITROGEN REDUCTION:	91 1000 lbs/yr		
	1825 1000 lbs/20-years		
	1020		g Aerated Volume (MG): N/a
CURRENT PROCESS (CHEC	K ALL THAT APPLY): MLE		g Aerated Volume (MG) N/a ng Anoxic Volume (MG) N/a
oomen.	BEPR (AZIO, VIP. 6		ent MLSS at Winter ADF. N/a
	Bardenpho	Curie	III WESS at Witter ADI
	Oxidation Ditch		
	Lagoon (Biolac, etc.)	
	Cyclical Aeration		
_	SBR Set Bieflies		
	High-Rate Biofilter		
	X Effluent Filtration	rocess. Aerobic-Anoxic BAF	·s
	X Other: UNOX P	100633, 71010010 711101115	
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L X From Report From Model (at ADI	F and load, 15 d MCRT ₌ 12°	C winter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	5514	New MLSS
		quired in existing lanks (check clai	
	Raise MCR1/MLSS	In existing tanks (check clair	Flow (mgd): 0
	Construct additiona	l aerateu volume	Flow (mgd): 0
	Construct additiona	volume as aerobic (construc	
	Use existing arrows	to BOD removal only (cons	struct separate nit/denit facility)
l	Add influent flow ed	uralization tank	242200
	Other:	duranton tann	
PROPOSED MODIFICATION	S TO GET NITRATE < 1.0 mg/L: No modifications re	quired	
	Add downstream D	eNit filter with methanol	filter with methanol
	Add downstream N	itrification Biofilter and DeNit	Tiller Will methanor
V-1	Add methanol to ex	isting BNR process noxic tank with methanol fee	d
	Add downstream at	- With the dation lee	•
	Add effluent filtration	thand	1.53
II.	X Other: Add Me	ulation	
	Equipment and Structures (from Page 2):	\$0	
CAPITAL COST:	Electrical and Instrumentation:	2% \$0	
1	Figerneal and institutionation.	5% \$0	
I	Subtotal:	\$0	
	Contractor OH&P:	5% \$0	
-		5% \$0	
1		\$0	
	Subtotal: Contingency: 3	0% \$0	
	Total Capital Cost:	\$0	
	Capital Cost per lb 20-Yr N removal	\$0.00	
		0.110	
OPERATIONS COST:	Additional Horsepower (from Page 2)	0 HP	
	Electrical Power Cost: 0.05 S/kW	\$0 S/year	
	Nitrate Reduction using Methanol:	1.0 mg/L 110 gals/d	
1	Methanol Required:	\$30,100 \$/year	
1	Methanol Cost: 0.75 \$/gal	0.0 mg/L	
1	Separate Stage Ammonia Reduction:	0.0 thg/L	
1	Caustic Soda @ 25% conc.	\$0 \$/year	
		\$0 \$/year	
1	Equipment Maintenance Cost:		
1	Denitrification Sludge Production w/Methano	\$26,300 \$/year	
1	Siddle Disposar Cost	\$56.400 \$/year	
1	Tixal Annual O&M Cost: Effective Annual Interest Rate after Inflation		
1	20-Year Present Worth of O&M Costs:	\$850,000	
	∠0-Year Present Worth of Odivi Çosa.		
TOTAL OF VELS SEESTIT	WORTH COST:	\$850,000	
TOTAL 20-YEAR PRESENT	Total Cost per lb. 20-Yr, N removal:	\$0.47	
1	1.2. ON MARKS BET THE THE THE THE		

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION;	USEPA, Chesapea	Stearns & Wheler, LLC	PE COD: _ PE TKN: _		
CURRENT PROCESS (CHECK		BEPR (A2/0, VIP, etc. Bardenpno Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration Other:)	Existing Aerated Volun Existing Anoxic Volun Current MLSS at Win	ne (MG) N/a
CURRENT EFFLUENT AMMON	IIA-N: <u>0.5</u> mg/L	X From Report From Model (at ADF a	ind load, 15 d MCF	RT_12° C winter condition	ons)
PROPOSED MODIFICATIONS	TO GET AMMONIA <	X No modifications required Raise MCRT/MLSS in Construct additional actions and Construct additional clusters existing apoxic volume.	existing tanks (che erated volume larifiers nume as aerobic (c or BOD removal on	eck clarifier capacity) Flow (mgd): Flow (mgd): Flow (mgd): construct separate denit ly (construct separate ni	New MLSS N/a 0 facility) it/denit facility)
PROPOSED MODIFICATIONS	TO GET NITRATE <	No modifications requi	it filter with methan ication Biofilter and ng BNR process	DeNit filter with methar	not
CAPITAL COST:	Equipment and Structectrical and Instructivary Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2	15% 15% nstr. Mgmt: 15% 30%	\$1,703,000 \$14,420,000 \$2,163,000 \$2,163,000 \$18,750,000		*
OPERATIONS COST:	Sludge Disposal Cos Total Annual O&M C	st: 0.05 \$/kW ing Methanol: 0.75 \$/gal	590 HI \$192,800 \$/ 550 ga \$153,300 \$/ 0.0 mi 0 ga \$0 \$/ \$187,500 \$/ \$129,900 \$/ \$663,500 \$/ 2,91%	year g/L uls/d year g/L uls/d year year s/d year	W W
TOTAL 20-YEAR PRESENT WO	ORTH COST: Total Cost per lb. 20	-Yr N removal	\$33,030,000 \$3.65		

PROJECT:	Implementing a 3 mg/	Annual Average Tot	al Nitrogen Limit	-2	
PREPARED FOR:	HISEPA Chesaneake	Bay Office	11 1/2	77	
PREPARED BY:	Virginia Tech with Ste	arns & Wheler, LLC			
	March 19, 2001	arrise sp. st. st. st. st. st. st. st. st. st. st			
DATE:	Lebanon WWTP			2	
FACILITY:					
LOCATION:	Lebanon, PA	-	PE COD:	175 mg/L	
RATED FLOW:	8.0 mgd		PE TKN:		
CURRENT EFFLUENT TN:	<u>8.0</u> mg/L				
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	330 lbs/d				
	120 1000 lbs/yr			*	
	2409 1000 lbs/20-year	S			
	V	Dine 1		Existing Aerated Volume (MC	G): N/a
CURRENT PROCESS (CHECK	(ALL THAT APPLY): LX	MLE	• 1	Existing Anoxic Volume (MC	
	<u></u>	BEPR (A2/0, VIP, etc	×.1	Current MLSS at Winter AD	
	_	Bardenpho		Cultent Medo at Winter 7.5	
		Oxidation Ditch			
		Lagoon (Biolac, etc.)			
		Cyclical Aeration			
		SBR			
		High-Rate Biofilter			
		Effluent Filtration			
2:		Other			
		- Internet			
CURRENT EFFLUENT AMMO	NIA-N: 0.5 ma/L X	From Report			
CONTRACT EN LOCKY AMINO	111 111 0.00 1119 12 12	From Model (at ADF	and load, 15 d MC	RT, 12° C winter conditions)	
	Ļ_				
DECEMBER MODIFICATIONS	TO OUT ABABAONIA - 4	0 mail ·			
PROPOSED MODIFICATIONS	TO GET AMINIONIA	No modifications req	uired		New MLSS
	<u> -</u>	Deine MCDTMI SS	n avietina tanks (c	heck clarifier capacity)	N/a
		Haise MCR MINILOS	ti existing talino (c	Flow (mad): 0	- 1
		Construct additional	aerated volume		_
		Construct additional	clarifiers	Flow (mgd): 0	
		Use existing anoxic v	olume as aerobic	(construct separate denit facility	/)
	, I	Use aerated system	for BOD removal o	only (construct separate nit/deni	t facility)
		Add influent flow equ	alization tank		
EX	i i	Other:			
PROPOSED MODIFICATIONS		No modifications req	Nit filter with metha rification Biofilter a sting BNR process	nd DeNit filter with methanol	
		Add effluent filtration			
		Other:			
ľ					
CAPITAL COST:	Equipment and Structu	res (from Page 2)	\$3,750,000		
GAI TIAL GGGT.	Electrical and Instrume	ntation 12	% \$450.000		
i	Yard Piping and Site W	/ork15	% \$563.000		
	Subtotal:	- 7.	\$4,760,000		
l	Contractor OH&P:	15	% \$714.000		
	Engineering and Const				
h :			\$6,190,000		
1	Subtotal:	30			
	Contingency:	•	\$7,620,000		
1	Total Capital Cost:	Vr. N. romoval:	\$3.16	F	
1	Capital Cost per lb. 20-	TIE M TELLIONAL	45		
		(from Dage 3):	160	HP	
OPERATIONS COST:	Additional Horsepower	(from Page 2):	\$52,300		
1	Electrical Power Cost:	0.05 \$/kW			
I -	Nitrate Reduction using	Methanol:		mg/L	
1	Methanol Required:			gals/d	
1	Methanol Cost:	0.75 \$/gal	\$41,100		
1	Separate Stage Ammo	nia Reduction:		mg/L	
I .	Caustic Soda @ 25%	conc.		gals/d	
	Caustic Soda Cost:	0.60 \$/gal		\$/year	
1	Equipment Maintenand		\$61,900	S/year ==	
1	Denitrification Sludge I	Production w/Methanol:		lbs/d	
1		400 \$/ton	\$35,000		
1	Sludge Disposal Cost:		\$190.300		
1	Total Annual O&M Cos	Onto effection	2.91%	-,	
1	Effective Annual Intere	st Rate after Inflation:			
1	20-Year Present Worth	of O&M Costs:	\$2,850,000		
1			£40.470.000		
TOTAL 20-YEAR PRESENT V	WORTH COST:		\$10,470,000		
	Total Cost per lb 20-Y	r N removal:	\$4.35		

PROJECT:	Illibiguiguiguigu 4 2 Mart Witing Macing 1000	i Mitrogen Elline
PREPARED FOR:	Implementing a 3 mg/L Annual Average Tota USEPA, Chesapeake Bay Office	-
PREPARED BY:	Virginia Tech with Steams & Wheler, LLC	
DATE:	March 10, 2001	
FACILITY:	LJSA WWTP	
LOCATION:	Lewisburg, PA	
RATED FLOW:	2.4 mgd Current Eff. TN	PE COD: 450 mg/L
BNR EFFLUENT TN:	8.0 mg/L 27.5	PE TKN: 35 mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	100 lbs/d Total N Rem, 490 4 lbs	s/d
by Denite Filters	37 1000 lbs/yr 179 k/yr	
	730 1000 lbs/20-years 3,580 k/20-	yrs
CURRENT PROCESS (CHE	CK ALL THAT APPLY): MLE	Existing Aeraled Volume (MG) 0.324/0.434
	X BEPR (A2/0 VIP etc.)	Existing Anoxic Volume (MG) 0.222/0 111
	Bardenpho	Current MLSS at Winter ADF4500
	Oxidation Ditch	
	Lagoon (Biolac, etc.)	
l	Cyclical Aeration	
	SBR	
	High-Rate Biofilter	G G
	Effluent Filtration	
	Other:	
156		
CURRENT EFFLUENT AMM	ONIA-N: 1.5 mg/L From Report	nd load, 25 d MCRT, 12° C winter conditions)
	X From Model (at ADF ar	nd load, 25 d MCR1, 12 C winter conditions)
00000000 40000004700	IC TO CET AMMONIA < 4 0 II .	
PROPOSED MODIFICATION	IS TO GET AMMONIA < 1.0 mg/L: No modifications require	red New MLSS
	No modifications requir	existing tanks (check clarifier capacity) 4750
	Construct additional ae	rated volume Flow (mgd): 0
	Construct additional cla	riflers Flow (mgd): 0
	Lies existing apovic with	ਟਾ ਤ as aerobic (construct separate denit facility)
	Use parated system (at	SCC removal only (construct separate nit/denit facility)
	Use aerated system ter	202 chief a chij (contact act acparate me dame laam)
	Add influent flow equal	zation tank
	Add influent flow equal	zaten tank
	Other:	zation tank
DDODOSED MODIFIC ATION	Other:	zation tank
PROPOSED MODIFICATION	Other:	
PROPOSED MODIFICATION	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require X Add downstream DeNit	ed filter with methanol
PROPOSED MODIFICATION	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require X Add downstream DeNit	ed filter with methanol
PROPOSED MODIFICATION	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require X Add downstream Denit Add downstream Nitnfic	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process
PROPOSED MODIFICATION	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require X Add downstream Denit Add downstream Nitnfic	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process
PROPOSED MODIFICATION	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxic	ed filter with methanol cation Biofilter and DeNit filter with methanol
PROPOSED MODIFICATION	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require X Add downstream DeNit Add downstream Nitnfic Add methanol to existin Add downstream anoxic Add effluent filtration	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process
PROPOSED MODIFICATION	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxic	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process
*	Other: Other: Other: No modifications require Add downstream DeNit Add downstream Nichtanol to existin Add downstream anoxic Add effluent filtration Other:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process
PROPOSED MODIFICATION	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNited Add downstream Nitriced Add methanol to existing Add downstream anoxiced Add effluent filtration Other: Equipment and Structures (from Page 2):	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNite Add downstream Nitrice Add methanol to existing Add downstream anoxide Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12%	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed , \$1,790,000
*	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required to the second s	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed , \$1,790,000 \$215,000
*	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required add downstream DeNith Add downstream Nitrifice Add methanol to existin Add downstream anoxice Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000
*	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add downstream anoxic Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15%	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2.270,000
*	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15%	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2.270,000 \$341,000
*	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitnfic Add downstream Nitnfic Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitnfic Add methanol to existin Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30%	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$225,000 \$2,270,000 \$341,000 \$341,000 \$2,950,000
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxid Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2.270,000 \$341,000 \$341,000 \$2,950,000 \$681,000
*	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitnfic Add methanol to existin Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30%	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required add downstream DeNith Add downstream Nitrific Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000
*	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxid Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% Subtotal: Contingency: Total Capital Cost: Capital Cost capital Cost Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$225,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$3,630,000 \$1,02 \$1,02
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitnfic Add downstream Nitnfic Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanot:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$3,41,000 \$3,630,000 \$1,02 50 HP \$16,300 \$/year
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxid Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost: Capital Cost: Capital Cost: Capital Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2.270,000 \$341,000 \$341,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxid Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$225,000 \$269,000 \$3,41,000 \$341,000 \$3,41,000 \$3,630,000 \$1,02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNit Add downstream Nitrific Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gai Separate Stage Ammonia Reduction	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$3,41,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L 50 gats/d \$13,700 \$/year
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNith Add downstream Nitrifich Add downstream Nitrifich Add downstream Nitrifich Add downstream anoxich Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Seoarate Stage Ammonia Reduction Caustic Soda @ 25% conc.	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$3,41,000 \$3,41,000 \$3,630,000 \$1,02 50 HP \$16,300 \$/year 5.0 mg/L 50 gats/d \$13,700 \$/year 0.0 mg/L
CAPITAL COST:	S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Seoarate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$2,15,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$3,41,000 \$3,630,000 \$1,02 50 HP \$16,300 \$/year 50 mg/L 50 gals/d \$13,700 \$/year 0.0 mg/L 0 gals/d
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNith Add downstream Nitrifich Add methanol to existin Add downstream anoxidhad effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Egupment Maintenance Cost	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$225,000 \$229,000 \$341,000 \$341,000 \$341,000 \$341,000 \$3,630,000 \$1.02 50 HP \$16.300 \$/year 5.0 mg/L 50 gals/d \$13,700 \$/year 0.0 mg/L 0 gals/d \$0 \$/year
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNith Add downstream Nitrifich Add methanol to existin Add downstream anoxidhad effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: Seoarate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda Cost: 0 60 \$/gal Eguipment Maintenance Cost Dentification Sludge Production w/Methanol	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$3,41,000 \$3,630,000 \$1,02 50 HP \$16,300 \$/year 5.0 mg/L 50 gats/d \$13,700 \$/year 0.0 mg/L 0 gats/d \$0 \$/year \$29,500 \$/year
CAPITAL COST:	S TO GET NITRATE < 1.0 mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add downstream Nitrific Add downstream anoxid Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost: Capital Cost cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Seoarate Stage Ammonia Reduction Caustic Soda @ 25% cone. Caustic Soda © 25% cone. Caustic Soda Cost: 0.60 \$/gal Egepment Maintenance Cost Dentrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/lon	filter with methanol cation Biofilter and DeNit filter with methanol g BNR process clank with methanol feed \$1,790,000 \$215,000 \$225,000 \$269,000 \$341,000 \$341,000 \$3,41,000 \$3,630,000 \$1,02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d \$13,700 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$29,500 \$/year \$29,500 \$/year
CAPITAL COST:	S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNit Add downstream Nitrific Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Dentification Studge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost:	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$3,41,000 \$3,630,000 \$1,02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d \$13,700 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$29,500 \$/year 140 lbs/d \$10,200 \$/year
CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNith Add downstream Nitrifich Add downstream Nitrifich Add downstream Add downstream anoxich Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Seoarate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic So	ed filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$341,000 \$3,41,000 \$3,630,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d \$13,700 \$/year 0.0 mg/L 0 gals/d \$0 \$3/year \$29,500 \$/year
CAPITAL COST:	S TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNit Add downstream Nitrific Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Dentification Studge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost:	filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$3,41,000 \$3,41,000 \$3,630,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L 50 gats/d \$13,700 \$/year 0.0 mg/L 0 gais/d \$0 \$/year \$29,500 \$/year
CAPITAL COST:	S TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNith Add downstream Nitrifich Add downstream Nitrifich Add downstream And downstream And Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Subtotal: Contractor OH&P: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost: Capital Cost: Capital Cost: Capital Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Dentification Studge Production w/Methanol Studge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed \$1,790,000 \$215,000 \$269,000 \$2,270,000 \$341,000 \$341,000 \$341,000 \$3,41,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L 50 gats/d \$13,700 \$/year 0.0 mg/L 0 gais/d \$0 \$/year \$29,500 \$/year \$29,700 \$/year \$29,700 \$/year \$29,700 \$/year

PROJECT:	Implementing a 3 mg/L Annual Average Total	Nitrogen Limit
PROJECT: PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY:	Lock Haven WWTP	
LOCATION:	Lock Haven, PA	
RATED FLOW:	3.8 mgd	PE COD mg/L
CURRENT EFFLUENT TN:	15,5 mg/L	PE TKN <u>26</u> mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	390 lbs/d	
	142 1000 lbs/yr	
	2847 1000 lbs/20-years	
AURDEUT BROSERS (SUES)	ALL THAT APPLY): MLE	Existing Aerated Volume (MG): 1.344
CURRENT PROCESS (CHECK	BEPR (A2/0, VIP, etc.)	Existing Anoxic Volume (MG). 0
	Bardenpho	Current MLSS at Winter ADF: 2500
-	Oxidation Ditch	
	Lagoon (Biolac, etc.)	i
	Cyclical Aeration	1874
	SBR	
	High-Rate Biofilter	
=	Effluent Filtration	
	X Other: Conventiona	I Activated Sludge
	University of the Control of the Con	
CURRENT EFFLUENT AMMON	IIA-N: 9.5 mg/L X From Report	d load, 15 d MCRT, 12 ³ C winter conditions)
	From Model (at ADF and	gload, 13 d MOTT. 12 d witter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	346
I NOT OBED MODITIONS	I INo modifications (equifications)	ed New MLSS
	X Raise MCRT/MLSS in e	xisting tanks (check clarifier capacity) 4500
	Construct additional aer	ated volume Flow (mgd): 0
9	Construct additional clai	rifiers Flow (mgd): 0
-	Use existing anoxic volu	ime as aerobic (construct separate denit facility)
	Use aerated system for	BOD removal only (construct separate nit/denit facility)
	Add influent flow equaliz	ration tank
	X Other: Add Baffles.	Mixers and nitrate recycle
	A	2 2 2
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modifications require	nd .
	X Add downstream DeNit	filter with methanol
	Add downstream Nitrific	ation Biofilter and DeNit filter with methanol
	Add methanol to existing	a RNR process
l	Add methanic to existing	tank with methanol feed
	Add effluent filtration	, was the state of
l	Other:	1.90
	Outer.	
CAPITAL COST:	Equipment and Structures (from Page 2):	\$2,260,000
CALITAL COST:	Electrical and Instrumentation: 12%	\$271,000
	Yard Piping and Site Work: 15%	\$339,000
	Subtotal:	\$2,870,000
	Contractor OH&P: 15%	\$431,000
41	Engineering and Constr. Mgmt: 15%	\$431,000
	Subtotal:	\$3,730,000
	Contingency: 30%	\$861.000
.*:	Total Capital Cost:	\$4,590,000
	Capital Cost per lb. 20-Yr N removal	\$1.61
		80 HP
OPERATIONS COST:	Additional Horsepower (from Page 2) Flectrical Power Cost 0.05 \$/kW	\$26_100 S/year
	Liectical i ovici oost	12.5 mg/L
1	Nitrate Reduction using Methanol:	180 gals/d
1	Methanol Required: Methanol Cost: 0.75 \$/gal	\$49,300 \$/year
F-		0.0 mg/L
1	Separate Stage Ammonia Reduction:	0 gals/d
1	Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
I i		\$37,300 \$/year
d ne	Equipment Maintenance Cost:	560 lbs/d
I.	Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton	\$40,900 \$/year
1	Sladge Bispecar Cour.	\$153,600 \$/year
	Total Annual O&M Cost:	2.91%
	Effective Annual Interest Rate after Inflation:	\$2,300,000
¥	20-Year Present Worth of O&M Costs:	
TOTAL 20 VEAD DOCCENT	OPTH COST.	\$6,890,000
TOTAL 20-YEAR PRESENT W	Total Cost per lb. 20-Yr. N removal:	\$2.42
7	Total Gost per lo. 20-11, 14 fellional.	· · · · · · · · · · · · · · · · · · ·

BBO IECT:	Implementing a 3 mg/L Annual Average Total	al Nitrogen Limit
PROJECT:	USEPA, Chesapeake Bay Office	
PREPARED FOR: PREPARED BY:	Virginia Tech with Steams & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY:	Scranton WWTP	
LOCATION:	Scranton, PA	PE COD: 220 mg/L
RATED FLOW:	16.0 mgd	PE TKN: 20 mg/L
CURRENT EFFLUENT TN:	9.2 mg/L	
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	830 lbs/d	
	303 1000 lbs/yr	
	6059 1000 lbs/20-years	
		Existing Aerated Volume (MG) 4.59
CURRENT PROCESS (CHECK		
1	BEPR (A2/0, VIP. etc.	Current MLSS at Winter ADF 2750
	Bardenpho	Current WESS at Winter ADI 2750
1	Oxidation Ditch	
1	Lagoon (Biolac_etc)	
1	Cyclical Aeration	
	SBR	
	High-Rate Biofilter	
	Effluent Filtration	
	Other:	
	· ·	
CURRENT EFFLUENT AMMON	IA-N: 1.2 mg/L X From Report	
	From Model (at ADF a	and load, 15 d MCRT, 12° C winter conditions)
		(6)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
	No modifications requi	red New MLSS
	X Raise MCRT/MLSS in	existing tanks (check clarifier capacity)3000
	Construct additional ad	erated volume Flow (mgd): 0
	Construct additional cl	arifiers Flow (mgd): 0
	Use existing anoxic vo	nume as aerobic (construct separate denit facility)
	Use aerated system for	r BOD removal only (construct separate nit/denit facility)
	Add influent flow equa	lization tank
(4)	Other:	
PROPOSED MODIFICATIONS	No modifications requi X Add downstream DeNi Add downstream Nitrifi Add methanol to existi	it filter with methanol ication Biofilter and DeNit filter with methanol
CAPITAL COST	Equipment and Structures (from Page 2):	\$6,550,000
O' II TINE GOOT	Electrical and Instrumentation 12%	\$786,000
	Yard Piping and Site Work: 15%	\$983,000
	Subtotal:	\$8,320,000
	Contractor OH&P: 15%	\$1,248,000
	Engineering and Constr. Mgmt: 15%	\$1,248,000
	Subtotal:	\$10.820,000
	Contingency: 30%	\$2,496,000
	Total Capital Cost:	\$13,320,000
	Capital Cost per lb. 20-Yr. N removal:	\$2.20
	Capital Cost per los 20 Transcomers	
OPERATIONS COST:	Additional Horsepower (from Page 2):	320 HP
OF ERATIONS COST.	Electrical Power Cost: 0,05 \$/kW	\$104,600 \$/year
	Nitrate Reduction using Methanol:	6.2 mg/L
I	_	380 gals/d
	Methanol Required: Methanol Cost: 0.75 \$/gal = -	\$104.000 \$/year
	Methanol Cost: 0,75 \$/gai = 5 Separate Stage Ammonia Reduction:	0.0 mg/L
	,	0 gals/d
	Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
		\$108,200 \$/year
	Equipment Maintenance Cost:	1190 lbs/d
	Denitrification Sludge Production w/Methanol: Sludge Disposal Cost 400 \$/ton	\$86,900 \$/year
	Ciddge Diopose, Com	\$403.700 \$/year
	Total Annual O&M Cost:	2.91%
	Effective Annual Interest Rate after Inflation:	\$6,050,000
	20-Year Present Worth of O&M Costs:	44,000,000
TOTAL OR VETE BETTER		\$19,370,000
TOTAL 20-YEAR PRESENT WO		\$3.20
	Total Cost per lb 20-Yr N removal	40.20

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L Annual Average Total USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 19, 2001 UAJA WWTP State College, PA 6.0 mgd 8.0 mg/L 3 0 mg/L 250 lbs/d 91 1000 lbs/yr 1825 1000 lbs/20-years	PE COD 334 mg/L PE TKN 36 mg/L
CURRENT PROCESS (CHEC	X MLE BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter X Effluent Filtration Other:	Existing Aerated Volume (MG). Existing Anoxic Volume (MG). Current MLSS at Winter ADF. 2.55 2650
CURRENT EFFLUENT AMM	DNIA-N: 1.8 mg/L From Report X From Model (at ADF at	nd load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATION	Construct additional ac	existing tanks (check clarifier capacity) erated volume Flow (mgd): 0 arifiers Flow (mgo): 0 lume as aerobic (construct separate denit facility) r BOD removal only (construct separate niVdenit facility)
PROPOSED MODIFICATION	Add methanol to existing Add downstream anox	t filter with methanol ication Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal:	
	Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$48,000 \$420,000
OPERATIONS COST:	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost 0.75 \$/gal	0 HP \$0 \$/year
TOTAL 20-YEAR PRESENT	Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0 60 \$/gal Equipment Maintenance Cost: Denitinfication Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: WORTH COST: Total Cost per lb. 20-Yr. N removal:	0 gals/d \$0 \$/year \$4,200 \$/year 360 lbs/d \$26,300 \$/year \$60,600 \$/year 2.91% \$910,000 \$1,430,000 \$0.78

PROJECT:	Implementing a 3 mg/L Annual Average Tot	al Nitrogen Limit
PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY:	CONTRACTOR	
	Chambersburg WWTP Chambersburg, PA	
LOCATION:	***************************************	PE COD: N/A mg/L
RATED FLOW:	6.8 mgd	PE TKN: N/A mg/L
CURRENT EFFLUENT TN	4.0 mg/L	. 2
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	60 lbs/d	<u> </u>
	22 1000 lbs/yr	
	438 1000 lbs/20-years	
CURRENT PROCESS (CHEC	K ALL THAT APPLY):	Existing Aerated Volume (MG): N/a
CORRENT PROCESS (CHEC.	BEPR (A2/0, VIP. etc	
	Bardenpho	Current MLSS at Winter ADF: N/a
	Oxidation Dilch	
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
	SBR	
	High-Rate Biofilter	
	X Effluent Filtration	
	Other	
	Other	
CURRENT FEEL LIGHT AMMO	NIA-N: <1.0 mg/L X From Report	
CORRENT EFFEUENT AMINIO	Trom Model (at ADE :	and load, 15 d MCRT 12" C winter conditions)
	LI FIGHT MODEL (at AD)	and load, to a more 12 Symmer conditions,
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	- W
FROFOSED MODIFICATIONS	X No modifications requ	ired New MLSS
	Price MCPT/MI SS in	existing tanks (check clarifier capacity) N/a
	Construct additional a	erated volume Flow (mgd): 0
	Construct additional of	larifiers Flow (mgd): 0
	Constitut additional C	olume as aerobic (construct separate denit facility)
	Use existing anoxic vo	or BOD removal only (construct separate nit/denit facility)
	Add influent flow equa	IIZALIOII LATIK
1	Other:	
DESTRUCTION OF THE PROPERTY OF	TO OFT AUTDATE 4 4 6 !! .	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	irod
	No modifications requ Add downstream DeN	
	Add downstream Nitri	ication Biofilter and DeNit filter with methanol
	Add methanol to existi	ng PMP process
	Add methanol to exist	ic tank with methanol feed
		ic talk with methanoriced
	Add effluent filtration	lethanol Addition
	X Other Increase M	ettanoi Addition
OARITAL COOT	5	\$0
CAPITAL COST:	Equipment and Structures (from Page 2) Electrical and Instrumentation 12%	
	Electrical and monarmonia.	
(e	raid riping and one reem	\$0
	Subtotal:	1
	Contractor OH&P 15%	
	Engineering and Constr Mgmt 15%	
	Subtotal	\$0
	Contingency. 30%	
	Total Capital Cost:	\$0
	Capital Cost per lb 20-Yr. N removal:	\$0.00
		0.110
OPERATIONS COST:	Additional Horsepower (from Page 2):	0 HP
	Electrical Power Cost: 0.05 \$/kW	\$0 \$/year
	Nitrate Reduction using Methanol:	1.0_ mg/L
	Methanol Required:	30 gals/d
	Methanol Cost: 0.75 \$/gal	\$8,200 \$/year
	Separate Stage Ammonia Reduction:	0.0_mg/L
	Caustic Soda @ 25% conc.	0 gals/d
	Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
	Equipment Maintenance Cost:	\$0 \$/year
	Denitrification Sludge Production w/Methanol:	80 lbs/d
	Sludge Disposal Cost: 400 \$/lon	\$5,800 \$/year
	Total Annual O&M Cost:	\$14,000 \$/year
	Effective Annual Interest Rate after Inflation:	2.91%
	20-Year Present Worth of O&M Costs:	\$210,000
		4
TOTAL 20-YEAR PRESENT W	ORTH COST:	\$210,000
	Total Cost per lb 20-Yr N removal	\$0.48

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L Annual Average Total USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 10, 2001 Greater Hazleton WWTP Hazleton, PA 8.9 mgd 8.0 mg/L 3 0 mg/L 370 lbs/d 135 1000 lbs/yr 2701 1000 lbs/20 years	PE COD:180mg/L PE TKN25mg/L
CURRENT PROCESS (CHECK	ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR X High-Rate Biofilter Effluent Filtration Other:	Existing Aerated Volume (MG): Existing Anoxic Volume (MG) Current MLSS at Winter ADF: 3500
CURRENT EFFLUENT AMMON	IIA-N: 3.2 mg/L From Report X From Model (at ADF a	nd load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	No modifications required Raise MCRT/MLSS in Construct additional and Construct additional and Use existing anoxic vouse aerated system for Add influent flow equal X Other: Abandon a	existing tanks (check clarifier capacity) erated volume Flow (mgd): 0 arifiers Flow (mgd): 0 lume as aerobic (construct separate denit facility) or BOD removal only (construct separate nit/denit facility)
PROPOSED MODIFICATIONS	No modifications requi X Add downstream DeNi Add downstream Nitrifi Add methanol to existi Add downstream anox Add effluent filtration	it filter with methanol For all 8.9 mgd ication Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: 15% Engineering and Constr. Mgmt: 15% Subtotal: 2000 2000 30% Total Capital Cost: Capital Cost per lb. 2000 Yr. N removal:	\$7,990,000 Adjusted for Special Condition \$959,000 \$1,199,000 \$10,150,000 \$1,523,000 \$1,523,000 \$13,200,000
OPERATIONS COST:	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	530 HP \$173,200 \$/year
TOTAL 20-YEAR PRESENT W	ORTH COST: Total Cost per Ib. 20-Yr. N removal:	\$22,110,000 \$8.19

IRRO IECT:	Implementing a 3 mg/L Annual Average Total	Nitrogen Limit
PROJECT:		A CONTRACT OF THE PARTY OF THE
PREPARED FOR	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY:	Hanover Area WWTP	DE DODE: 125 mg/l
LOCATION:	Hanover, PA	PE BOD5: 135 mg/L
RATED FLOW:	<u>4.5</u> mgd	PE COD N/a mg/L
CURRENT EFFLUENT TN:	6.0 mg/L	PE TKN 30 mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	110 lbs/d	
	40 1000 lbs/yr	
	803 1000 lbs/20-years	
CURRENT PROCESS (CHECK	ALL THAT APPLY): MLE	Existing Aerated Volume (MG) 4.29 Existing Anoxic Volume (MG): N/a .Current MLSS at Winter ADF: N/a
	High-Rate Biofilter Effluent Filtration Other:	
CURRENT EFFLUENT AMMON	NIA-N: 0.5 mg/L X From Report From Model (at ADF an	d load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	Nov.MI CC
	X No modifications require	
-		(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	Construct additional aer	4,55 (5,51)
Y .	Construct additional cla	rifiers Flow (mgd): 0 ume as aerobic (construct separate denit facility)
	Use existing anoxic volu	ime as aerobic (construct separate denit facility)
		BOD removal only (construct separate nit/denit facility)
	Add influent flow equalize	zation tank
	Other	
	Add methanol to existing	filter with methanol ation Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2)	\$2,530,000
CAPITAL COST:		\$304,000
	Electrical and inclination	\$380,000
	Tara t iping and one tree	\$3,210,000
	Sublotal:	\$482,000
	Contractor OH&P: 15%	
	Engineering and Constr. Mgmt: 15%	\$482,000
	Subtotal:	\$4,170,000
1.0	Contingency: 30%	\$963,000
	Total Capital Cost:	\$5,130,000
	Capital Cost per lb 20-Yr N removal	\$6.39
		00.110
OPERATIONS COST:	Additional Horsepower (from Page 2)	90 HP
	Electrical Power Cost: 0 05 \$/kW	\$29.400 \$/year
	Nitrate Reduction using Methanol	3.0 mg/L
	Methanol Required:	50 gals/d
	Methanol Cost 0 75 \$/gal	\$13,700 \$/year
	Separate Stage Ammonia Reduction	0.0 mg/L
	Caustic Soda @ 25% conc	0 gals/d
	Caustic Soda Cost 0.60 \$/gal	\$0 \$/year
	Equipment Maintenance Cost:	\$41,700 \$/year
	Denitrification Sludge Production w/Methanol	160 lbs/d
	Sludge Disposal Cost: 400 \$/ton	\$11,700 \$/year
	Total Annual O&M Cost:	\$96,500 \$/year
	Effective Annual Interest Rate after Inflation:	2.91%
	20-Year Present Worth of O&M Costs:	\$1,450,000
TOTAL 20-YEAR PRESENT WO	ORTH COST: Total Cost per lb. 20-Yr N removal	\$6,580,000 \$8.19

		- Augrage Total Nit	rogen Limit		
PROJECT:	Implementing a 3 mg/L Ann	tual Average Total N	aogen Cinii		
PREPARED FOR:	USEPA, Chesapeake Bay C	Office			
PREPARED BY:	Virginia Tech with Stearns	& Wheler, LLC			
Selection and the selection of the selec	March 19, 2001				
DATE:					
FACILITY:	Harrisburg WWTP				
LOCATION:	Harrisburg, PA		05.000	N/a ma/l	
RATED FLOW:	30.0 mgd		PE COD		
CURRENT EFFLUENT TN:	4.0 mg/L		PE TKN:	16 mg/L	
100 Control (1) 100 Control (1					
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	250 lbs/d				
	91 1000 lbs/yr				
	1825 1000 lbs/20-years				
	ALL THAT APPLY):	E		Existing Aerated Volume	e (MG) N/a
CURRENT PROCESS (CHECK				Existing Anoxic Volum	e (MG): N/a
		PR (A2/0, VIP, etc.)		Current MLSS at Winte	os ADE: N/a
	Bar	denpho		Current MESS at Milite	er ADF: N/a
	Oxi	dation Ditch			
	1 20	joon (Biolac, etc.)			
		clical Aeration			
	SBI				X0
	Hig	h-Rate Biofilter			
	X Eff	uent Filtration			
	X Oth		Aerobic-An	noxic BAFs	
	LAJOth	OI. OHOA FIOCES	1		
				* B	
CURRENT EFFLUENT AMMON	IA-N: <1.0 mg/L X Fro	m Report			
	Fro	m Model (at ADF and le	oad, 15 d MC	CRT, 12° C winter condition	ns)
l					
	3120 50	w =			
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg	Li			N M4 CC
	X INO	modifications required			New MLSS
	Rai	se MCRT/MLSS in exis	sting tanks (c	check clarifier capacity)	N/a
	H	nstruct additional aerate	ed volume	Flow (mgd):	0
		ISTRUCT Additional acres	20 10101110	Flow (mgd):	0
	Cor	nstruct additional clarific	215	(low (mga).	
	Use	existing anoxic volum	e as aerobic	(construct separate denit)	(acility)
	Use	aerated system for BC	D removal o	only (construct separate ni	Vdenit facility)
l		influent flow equal zat			
1	—				
l	Oth	ier:			
	Ado	I methanol to existing E I downstream anoxic ta I effluent filtration	on Biofilter a SNR process	ind DeNit filter with methan	iol
	X Oth	er: Add Methanol			
CAPITAL COST:	Equipment and Structures (f	rom Page 2):	\$0		
CAPITAL COST.			\$0		
1	Electrical and Instrumentatio	15%	\$0		
ì	Yard Piping and Site Work:	15%			
1	Subtotal:		\$0		
	Contractor OH&P:	15%	\$0		
I	Engineering and Constr. Mg	mt: 15%	\$0		
		int.	\$0		
I	Subtotal:	. 2007	\$0		9)
	Contingency:	. 30%			
ł	Total Capital Cost:		\$0		
l	Capital Cost per lb 20-Yr N	removal	\$0.00		6
I	Capital Cost per lo 20-11 14				
		Page 21	n	HP	
OPERATIONS COST:	Additional Horsepower (from	1 raye 2)			
I	Electrical Power Cost:	0.05 \$/kW		\$/year	
I	Nitrate Reduction using Meth	nanol:		mg/L	
1	Methanol Required:		110	gals/d	
	·	0.75 S/gal	\$30,100	\$/year	
1	Methanol Cost:			mg/L	
1	Separate Stage Ammonia R	Eduction.		gals/d	
1	Caustic Soda @ 25% conc.			-	
	Caustic Soda Cost:	0.60 \$/gal		\$/year	
	Equipment Maintenance Cos	st:		\$/year	
1	Denitrification Sludge Produ	ction w/Methanol	360	lbs/d	
I		400 \$/ton	\$26,300	\$/year	
	Sludge Disposal Cost:	700 9/10/11	\$56,400	•	
	Total Annual O&M Cost:	-AInffeliant		-,,54	
	Effective Annual Interest Ra	te after inflation:	2.91%		
	20-Year Present Worth of O	&M Costs:	\$850,000		
1					
TOTAL 20 VEAD DESCRIPTION	DETU COST:		\$850,000		
TOTAL 20-YEAR PRESENT WO			\$0.47		
1	Total Cost per lb. 20-Yr. N re	emovai.	40.47		

PROJECT: PREPARED FOR:		
The state of the s	Implementing a 3 mg/L Annual Average To USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY:	Lancaster WWTP	S S
LOCATION:	Lancaster, PA	
RATED FLOW:	29.7 mgd	PE COD: N/a mg/L
CURRENT EFFLUENT TN		PE TKN: 22 mg/L
EFFLUENT TN GOAL:		12 1101
	3	
NITROGEN REDUCTION:		
	453 1000 lbs/yr	
	9052 1000 lbs/20-years	
CURRENT BROCESS (O)	ISON ALL THAT ADDING TYPING	Existing Aerated Volume (MG) N/a
CURRENT PROCESS (CF	IECK ALL THAT APPLY): X MLE	
	BEPR (A2/0, VIP, etc	
	Bardenpho	Current MLSS at Winter ADF N/a
	Oxidation Ditch	
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
	SBR	
	High-Rate Biofilter	
	Effluent Filtration	
	Other	
CURRENT EFFLUENT AM	MONIA-N: 0.5 mg/L X From Report	
	From Model (at ADF	and load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATION	ONS TO GET AMMONIA < 1.0 mg/L:	
	X No modifications requ	rired New MLSS
		n existing tanks (check clarifier capacity) N/a
	Construct additional a	• • • • • • • • • • • • • • • • • • • •
		(
	Construct additional of	
		olume as aerobic (construct separate denit facility)
	Use aerated system f	or BOD removal only (construct separate nit/denit facility)
		dization tank
	Add influent flow equa	anzanori tarik
PROPOSED MODIFICATION	ONS TO GET NITRATE < 1.0 mg/L:	
PROPOSED MODIFICATIO	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requ X Add downstream DeN Add downstream Nitri Add methanol to exist Add downstream anox Add effluent filtration	ired it filter with methanol fication Biofilter and DeNit filter with methanol
PROPOSED MODIFICATIO	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requ Add downstream Den Add downstream Nitri Add methanol to exist Add downstream anox	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process
	Other Other Other No modifications requ X Add downstream DeN Add downstream Nitri Add methanol to exist Add offluent filtration Other	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process arc tank with methanol feed
	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requ X Add downstream DeN Add downstream Nitri Add methanol to exist Add downstream ano Add effluent filtration Other Equipment and Structures (from Page 2)	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process ac tank with methanol feed \$11,350,000
	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requive Add downstream Den Add downstream Nitrice Add methanol to exist Add downstream and Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and Instrumentation 12%	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000
	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requ Add downstream Den Add downstream Nitri Add methanol to exist Add downstream and Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and Instrumentation Yard Piping and Site Work: 15%	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000
	Other No modifications requ Add downstream Den Add downstream Nitri Add methanol to exist Add downstream ano Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and Instrumentation 12% Yard Piping and Site Work: 15% Subtotal:	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$11,362,000 \$1,703,000 \$14,420,000
	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requ Add downstream Den Add downstream Nitri Add methanol to exist Add downstream ano Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15%	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$14,420,000 \$2,163,000
	Other No modifications requ Add downstream Den Add downstream Nitri Add methanol to exist Add downstream ano Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and Instrumentation 12% Yard Piping and Site Work: 15% Subtotal:	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fice tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$14,420,000 \$2,163,000 \$2,163,000 \$2,163,000
	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requ Add downstream Den Add downstream Nitri Add methanol to exist Add downstream ano Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15%	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$14,420,000 \$2,163,000
	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications reques Add downstream DeN Add downstream Nitrice Add downstream Nitrice Add downstream and Add downstream and Add deffluent filtration Other Equipment and Structures (from Page 2) Electrical and Instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt 15% Subtotal:	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fice tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$14,420,000 \$2,163,000 \$2,163,000 \$18,750,000
	Other No modifications requ X Add downstream Den Add downstream Nitri Add methanol to exist Add downstream ano: Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and instrumentation Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt Subtotal: Contingency: 30%	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fice tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$14,420,000 \$2,163,000 \$2,163,000 \$18,750,000
	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications reques the first of the fir	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$1,420,000 \$2,163,000 \$2,163,000 \$18,750,000 \$18,750,000 \$4,326,000
PROPOSED MODIFICATION	Other No modifications requ X Add downstream Den Add downstream Nitri Add methanol to exist Add downstream ano: Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and instrumentation Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt Subtotal: Contingency: 30%	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$23,080,000
	Other No modifications requested and downstream DeN Add downstream Nitri Add methanol to exist Add downstream another Add deffluent filtration Other Equipment and Structures (from Page 2) Electrical and Instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$23,080,000
CAPITAL COST:	Other No modifications requ Add downstream DeN Add downstream Nitri Add downstream Nitri Add downstream Nitri Add downstream ano Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and Instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2):	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$18,750,000 \$4,326,000 \$23,080,000 \$23,080,000 \$2,55
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requ X Add downstream Den Add downstream Nitri Add methanol to exist Add downstream ano: Add effluent filtration Other Equipment and Structures (from Page 2) Electrical and instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000
CAPITAL COST:	Other No modifications requested and downstream Den Add downstream Nitri Add methanol to exist Add downstream and Add deffluent filtration Other Equipment and Structures (from Page 2) Electrical and instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol:	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$1,4,420,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$23,080,000 \$2,55 590 HP \$192,800 \$/year 5.0 mg/L
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requive form Page 2): Electrical and Instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required:	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$14,420,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$23,080,000 \$2,55 590 HP \$192,800 \$/year
CAPITAL COST:	Other No modifications requested and downstream DeN Add downstream Nitri Add methanol to exist Add downstream another Add deffluent filtration Other Equipment and Structures (from Page 2): Electrical and Instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Cost: 0.75 \$/gal	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$23,080,000 \$23,080,000 \$2,55 \$590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year
CAPITAL COST:	Other No modifications requested and downstream DeN Add downstream Nitri Add methanol to exist Add downstream another Add deffluent filtration Other Equipment and Structures (from Page 2): Electrical and Instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction:	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process act tank with methanol feed \$11,350,000 \$11,362,000 \$1,703,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$23,080,000 \$23,080,000 \$2,55 590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year 0.0 mg/L
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requive form the following form of the following form	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,163,000 \$2,3000 \$2,3000 \$2,55 ### MP ### Single And Singl
CAPITAL COST:	Other No modifications requested and downstream Den Add downstream Nitri Add methanol to exist Add downstream and Add deffluent filtration Other Equipment and Structures (from Page 2) Electrical and instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc.	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$2,3080,000 \$2,55 \$590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year 0.0 mg/L 0 gals/d \$0 \$/year
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requated to the second of the	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$23,080,000 \$2,55 590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$187,500 \$/year
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requated to the second of the	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$2,3080,000 \$2,55 \$590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year 0.0 mg/L 0 gals/d \$0 \$/year
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requated to the second of the	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$4,326,000 \$23,080,000 \$2,55 590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$187,500 \$/year
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requived to the provided and power stream. No modifications requived to the provided and power stream. No modifications requived to the provided and downstream Nitrical Add downstream Nitrical Add downstream and Add effluent filtration. Add effluent filtration. Other Equipment and Structures (from Page 2): Electrical and Instrumentation. 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal:	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$14,420,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$23,080,000 \$2,55 590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$187,500 \$/year \$187,500 \$/year
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requive Add downstream Den Add downstream Nitrice Add downstream Nitrice Add downstream and Add effluent filtration Other Equipment and Structures (from Page 2): Electrical and instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Denitrification Sludge Production w/Methanol Sludge Disposal Cost 400 \$/ton Total Annual O&M Cost	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$1,4420,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$2,3080,000 \$2,55 590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$187,500 \$/year \$187,500 \$/year \$187,500 \$/year \$1780 lbs/d \$129,900 \$/year \$663,500 \$/year
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requive downstream Den Add downstream Nitri Add methanol to exist Add downstream and Add effluent filtration Other Equipment and Structures (from Page 2): Electrical and instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Denitrification Sludge Production w/Methanol Sludge Disposal Cost 400 \$/ton Total Annual O&M Cost Effective Annual Interest Rate after Inflation	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$1,92,100 \$1
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requive Add downstream Den Add downstream Nitrice Add downstream Nitrice Add downstream and Add effluent filtration Other Equipment and Structures (from Page 2): Electrical and instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Denitrification Sludge Production w/Methanol Sludge Disposal Cost 400 \$/ton Total Annual O&M Cost	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$1,4420,000 \$2,163,000 \$2,163,000 \$2,163,000 \$4,326,000 \$2,3080,000 \$2,55 590 HP \$192,800 \$/year 5.0 mg/L 560 gals/d \$153,300 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$187,500 \$/year \$187,500 \$/year \$187,500 \$/year \$1780 lbs/d \$129,900 \$/year \$663,500 \$/year
CAPITAL COST:	Other ONS TO GET NITRATE < 1.0 mg/L: No modifications requive Add downstream Den Add downstream Nitri Add methanol to exist Add downstream and Add effluent filtration Other Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Caustic Soda @ 25% conc. Caustic Soda © 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Denitrification Sludge Production w/Methanol Sludge Disposal Cost 400 \$/ton Total Annual O&M Cost Effective Annual Interest Rate after Inflation 20-Year Present Worth of O&M Costs	ired it filter with methanol fication Biofilter and DeNit filter with methanol ing BNR process fic tank with methanol feed \$11,350,000 \$1,362,000 \$1,703,000 \$1,703,000 \$2,163,000 \$1,173,000 \$2,163,000 \$2,163,000 \$1,173,000 \$2,163,

PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL:	USEPA, Chesapeal Virginia Tech with March 19, 2001	POSTONIA PROGRAMA DE LA COMPANSA DEL COMPANSA DE LA COMPANSA DEL COMPANSA DE LA C	Total Nitrogen Limit		
DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL:		(e Bay Office			
FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL:	March 19, 2001	Stearns & Wheler, LLC	•		
LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL:					
RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL:	Lebanon WWTP				
CURRENT EFFLUENT TN: EFFLUENT TN GOAL:	Lebanon, PA			475	
EFFLUENT TN GOAL:	8.0 mgd		PE COD:		
17	8.0 mg/L		PE TKN:	<u>27</u> mg/L	
	3.0 mg/L				
NITROGEN REDUCTION:	330 lbs/d				
	120 1000 lbs/yr				
	2409 1000 lbs/20-y	ears			
				Existing Aerated Volum	e (MG): N/a
CURRENT PROCESS (CHEC	K ALL THAT APPLY):	X MLE	-4- \	Existing Aerated Volum	
		BEPR (A2/0, VIP,	eic)	Current MLSS at Wint	
		Bardenpho		Current MESS at Wint	CIADI IVA
		Oxidation Ditch	. 55	22	
19		Lagoon (Biolac, etc	c)		
		Cyclical Aeration			
	(A)	SBR -			
		High-Rate Biofilter			
		Effluent Fillration			
		Other			
CURRENT EFFLUENT AMMO)NIA-N: <u>0.5</u> mg/L	X From Report	55 11-4 45 4440	RT, 12° C winter conditio	50)
		From Model (at AL	JF and load, 15 0 MC	R1, 12 C willer conditio	115)
PROPOSED MODIFICATIONS	S TO GET AMMONIA <	: 1.0 mg/L:			
		X No modifications re	equired		New MLSS
		Raise MCRT/MLS	S in existing tanks (c	heck clarifier capacity)	N/a
		Construct addition	al aerated volume	Flow (mgd):	0
		Construct addition		Flow (mgd):	0
		Lice existing anoxi	c volume as aerobic	(construct separate denit	facility)
		Use existing arrow	m for BOO removal o	only (construct separate ni	t/denit facility)
		Add influent flow e		ini) (containact copulation	
			qualization with		11/1/2011 P.54
		Other:			
PROPOSED MODIFICATIONS	C TO CET NITDATE	1.0 ma/l :			
PROPOSED MODIFICATIONS	5 TO GET NITRATE	No modifications re	equired		
		X Add downstream [DeNit filter with metha	anol	
		Add downstream t	ditrification Biofilter at	nd DeNit filter with metha	nol
		Add cownstream	xisting BNR process	No Della men	
		Add methanol to e	anoxic tank with meth	and food	
				and reed	
		Add effluent filtration	on		
		Other:			
CARITAL COST:	Faultoment and Stru	ctures (from Page 2)	\$3,750,000		
CAPITAL COST:	Equipment and Stru	Clures (IIOIII Fage 2)	12% \$450.000		
	Electrical and Instru	incination.	15% \$563.000		
	Yard Piping and Sile	VVork:			
,			\$4,760,000		
	Subtotal:				_
	Contractor OH&P:		15% \$714,000		-
		nstr. Mgmt:	15% \$714.000		-
	Contractor OH&P:		\$714,000 \$6,190,000	N.	-
	Contractor OH&P: Engineering and Co Subtotal:		15% \$714.000	K.	-
	Contractor OH&P: Engineering and Co Subtotal: Contingency:		\$714,000 \$6,190,000	×	-
	Contractor OH&P: Engineering and Co Subtotal:		\$714,000 \$6,190,000 30% \$1,428,000		
	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb.	; 20-Yr. N removal:	\$714,000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16	NO.	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov	; 20-Yr. N removal: ver (from Page 2):	\$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16		
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW	\$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16	\$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW	\$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 \$52,300 5.0	\$/year mg/L	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol:	15% \$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 160 \$52,300 5.0	\$/year mg/L gals/d	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required:	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol:	15% \$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 160 \$52,300 5.0 150 \$41,100	\$/year mg/L gals/d \$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost:	:20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0,75 \$/gal	15% \$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 160 \$52,300 5.0 150 \$41,100	\$/year mg/L gals/d	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0,75 \$/gal monia Reduction:	15% \$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 160 \$52.300 5.0 150 \$41,100 0.0	\$/year mg/L gals/d \$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25'	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0.75 \$/gal monia Reduction: % conc.	\$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 \$52,300 5.0 150 \$41,100 0.0	\$/year mg/L gals/d \$/year mg/L	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25' Caustic Soda Cost:	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0,75 \$/gal monia Reduction: % conc. 0.60 \$/gal	\$714,000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 \$52,300 5.0 \$150 \$41,100 0.0 \$0	\$/year mg/L gals/d \$/year mg/L gals/d \$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25' Caustic Soda Cost: Equipment Maintens	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0,75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost:	\$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 \$52,300 5.0 \$51,100 0.0 \$5 \$61,900	\$/year mg/L gals/d \$/year mg/L gals/d \$/year \$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25' Caustic Soda Cost: Equipment Maintens Denitrification Sludg	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0.75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanol	\$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 \$52,300 5.0 \$150 \$41,100 0.0 \$0 \$61,900 oi: 480	\$/year mg/L gals/d \$/year mg/L gals/d \$/year lbs/d	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25' Caustic Soda Cost: Equipment Mainten Denitrification Sludg Sludge Disposal Co	20-Yr. N removal: ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0,75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanolst: 400 \$/ton	15% \$714.000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 160 \$52,300 5.0 150 \$41,100 0.0 \$61,900 oi: 480 \$35,000	\$/year mg/L gals/d \$/year mg/L gals/d \$/year \$/year \$/year \$/year lbs/d \$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25' Caustic Soda Cost: Equipment Mainten: Denitrification Sludge Sludge Disposal Co Total Annual O&M 0	ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0.75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanols: 400 \$/ton	15% \$714,000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 160 \$52,300 5.0 150 \$41,100 0.0 0 \$61,900 oi: 480 \$35,000 \$190,300	\$/year mg/L gals/d \$/year mg/L gals/d \$/year \$/year \$/year \$/year lbs/d \$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25' Caustic Soda Cost: Equipment Mainten: Denitrification Sludge Sludge Disposal Co Total Annual O&M C Effective Annual Inte	ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0,75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanols: 400 \$/ton Cost: erest Rate after Inflation	15% \$714,000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 60 \$52,300 5.0 150 \$41,100 0.0 0 \$61,900 \$35,000 \$190,300 \$190,300 \$190,300 \$2,91%	\$/year mg/L gals/d \$/year mg/L gals/d \$/year \$/year \$/year \$/year lbs/d \$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25' Caustic Soda Cost: Equipment Mainten: Denitrification Sludge Sludge Disposal Co Total Annual O&M 0	ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0,75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanols: 400 \$/ton Cost: erest Rate after Inflation	15% \$714,000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 160 \$52,300 5.0 150 \$41,100 0.0 0 \$61,900 oi: 480 \$35,000 \$190,300	\$/year mg/L gals/d \$/year mg/L gals/d \$/year \$/year \$/year \$/year lbs/d \$/year	
OPERATIONS COST:	Contractor OH&P: Engineering and Co Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. Additional Horsepov Electrical Power Co Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Am Caustic Soda @ 25' Caustic Soda Cost: Equipment Mainten: Denitrification Sludg Sludge Disposal Co Total Annual O&M C Effective Annual Inte	ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0,75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanols: 400 \$/ton Cost: erest Rate after Inflation	15% \$714,000 \$6,190,000 30% \$1,428,000 \$7,620,000 \$3.16 60 \$52,300 5.0 150 \$41,100 0.0 0 \$61,900 \$35,000 \$190,300 \$190,300 \$190,300 \$2,91%	\$/year mg/L gals/d \$/year mg/L gals/d \$/year \$/year \$/year \$/year lbs/d \$/year	

DATE:	Implementing a 3 mg/L Annual Average 1 USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 10, 2001	
FACILITY:	LJSA WWTP	
LOCATION:	Lewisburg, PA	
RATED FLOW:	2.4 mgd Current Eff. TN	PE COD: 450 mg/L
BNR EFFLUENT TN:	8.0 mg/L 27.5	PE TKN: 35 mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	100 lbs/d Total N Rem 490	4 lbs/d
by Denite Filters	37 1000 lbs/yr 179 k/y	ſ
(22)	730 1000 lbs/20-years 3 580 k	J20-yrs
CURRENT PROCESS (CHE		Current MLSS at Winter ADF: 4500
CURRENT EFFLUENT AMI	MONIA-N: 1.5 mg/L From Report X From Model (at AD	F and load, 25 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIO	NS TO GET AMMONIA < 1.0 mg/L: No modifications re	auired New MLSS
		in existing tanks (check clarifier capacity) 4750
	Construct additiona	
	Construct additiona	· · · · · · · · · · · · · · · · · · ·
		volume as aerobic (construct separate denit facility)
	Use agrated system	n for BOD removal only (construct separate nit/denit facility)
	Add influent flow eq	
	Other:	
	Add downstream Ni Add methanol to exi	eNit filter with methanol itrification Biofilter and DeNit filter with methanol isting BNR process loxic tank with methanol feed
CAPITAL COST:	Equipment and Structures (from Page 2)	\$1,790,000
	Electrical and Instrumentation: 12	2% \$215,000
	Yard Piping and Site Work: 15	5% \$269,000
	raid riping and one work.	1/6 \$269,000
	Subtotal:	\$2,270,000
	Subtotal: Contractor OH&P:	\$2,270,000 5% \$341,000
	Subtotal: Contractor OH&P: 15	\$2,270,000 5% \$341,000 5% \$341,000
	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal:	\$2,270,000 5% \$341,000 5% \$341,000 \$2,950,000
	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal:	\$2,270,000 5% \$341,000 5% \$341,000 \$2,950,000 0% \$681,000
	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost:	\$2,270,000 5% \$341,000 5% \$341,000 \$2,950,000 3681,000 \$3,630,000
	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal: Contingency: 30	\$2,270,000 5% \$341,000 5% \$341,000 \$2,950,000 0% \$681,000
	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$2,270,000 5% \$341,000 5% \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb, 20-Yr, N removal: Additional Horsepower (from Page 2):	\$2,270,000 5% \$341,000 5% \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb, 20-Yr, N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW	\$2,270,000 \$341,000 \$5% \$341,000 \$2,950,000 \$61,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol:	\$2,270,000 \$341,000 \$5% \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required:	\$2,270,000 5% \$341,000 5% \$341,000 \$2,950,000 \$681,000 \$1,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal	\$2,270,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb, 20-Yr, N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrale Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction	\$2,270,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb, 20-Yr, N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc	\$2,270,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal	\$2,270,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d \$13,700 \$/year 0.0 mg/L 0 gals/d \$0 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost	\$2,270,000 \$341,000 \$2,950,000 \$2,950,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d \$13,700 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$29,500 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Denitrification Sludge Production w/Methanol	\$2,270,000 \$341,000 \$2,950,000 \$2,950,000 \$3,630,000 \$1,02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d \$13,700 \$/year 0.0 mg/L 0 gals/d \$0 \$/year 140 lbs/d
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda © 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Dentification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton	\$2,270,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year 5.0 mg/L 50 gals/d \$13,700 \$/year 0 mg/L 0 gals/d \$0 \$/year \$29,500 \$/year 140 lbs/d \$10,200 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr, N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda @ 25% conc Caustic Soda Cost 0.60 \$/gal Equipment Maintenance Cost Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost	\$2,270,000 \$341,000 \$2,950,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr, N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Slage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost Effective Annual Interest Rate after Inflation:	\$2,270,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr, Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr, N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda @ 25% conc Caustic Soda Cost 0.60 \$/gal Equipment Maintenance Cost Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost	\$2,270,000 \$341,000 \$2,950,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year
OPERATIONS COST:	Subtotal: Contractor OH&P: 15 Engineering and Constr. Mgmt: 15 Subtotal: Contingency: 30 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost Dentification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	\$2,270,000 \$341,000 \$2,950,000 \$681,000 \$3,630,000 \$1.02 50 HP \$16,300 \$/year

PROJECT:	Implementing a 3 mg/L Annu	al Average Total I	Nitrogen Limit	
PROJECT: PREPARED FOR:	HSEPA Chesaneake Bay Off	fice		
PREPARED BY:	Virginia Tech with Stearns &	Wheler, LLC		
DATE:	March 19, 2001			
FACILITY:	Lock Haven WWTP			
LOCATION:	Lock Haven, PA			
RATED FLOW:	3.8 mgd		PE COD mg/L	
CURRENT EFFLUENT TN:	15.5 mg/L		PE TKN 26 mg/L	
EFFLUENT TN GOAL:	3.0 mg/L			
NITROGEN REDUCTION:	390 lbs/d			
1	142 1000 lbs/yr			
	2847 1000 lbs/20-years			
AND ENT DE OFFICE (OUE)	CK ALL THAT APPLY):		Existing Aerat	ed Volume (MG):1.344
CURRENT PROCESS (CHEC	REPERE	R (A2/0, VIP, etc.)	Existing Anox	kic Volume (MG):
		enpho		S at Winter ADF: 2500
		ation Ditch		/ *
		on (Biolac, etc.)		
		cal Aeration		
	SBR			
	High-	Rate Biofilter		
	Efflue	ent Filtration		
	X Other		Activated Sludge	
CURRENT EFFLUENT AMM	ONIA-N: 9.5 mg/L X From	Report	11 145 4140DT 4000	s conditions)
0.1	From	Model (at ADF and	d load, 15 d MCRT, 12° C winte	(conditions)
PROPOSED MODIFICATION	S TO GET AMMONIA < 1.0 mg/L	: adifications require	ad.	New MLSS
	No m	odifications require	id xisting tanks (check clarifier cat	
	X Raise	truct additional aer	ated volume Flow (mad): 0
	Cons	truct additional clar	ated reserve	
	Cons	truct additional Cal	me as aerobic (construct separ	
	Use	existing anoxic voto	BOD removal only (construct se	eparate nit/denit facility)
	- Ose a	nfluent flow equaliz	ration tank	,,
		Illidelit now equaliz	ation torin	
	I Y IOther	Add Baffles	Mixers and nitrate recycle	
	X Other	Add Baffles,	Mixers and nitrate recycle	
PROPOSED MODIFICATION		Add Baffles.	Mixers and nitrate recycle	
PROPOSED MODIFICATION	IS TO GET NITRATE < 1.0 mg/L:	nodifications require	ed	-
PROPOSED MODIFICATION	IS TO GET NITRATE < 1.0 mg/L:	nodifications require	ed filter with methanol	
PROPOSED MODIFICATION	IS TO GET NITRATE < 1.0 mg/L: No m X Add c	nodifications require downstream DeNit downstream Nitrific	ed filter with methanol ation Biofilter and DeNit filter wi	th methanol
PROPOSED MODIFICATION	IS TO GET NITRATE < 1.0 mg/L: No m X Add d Add d	nodifications require downstream DeNit downstream Nitrific methanol to existing	ed filter with methanol ation Biofilter and DeNit filter wi g BNR process	th methanol
PROPOSED MODIFICATION	IS TO GET NITRATE < 1.0 mg/L: No m X Add d Add d	nodifications require downstream DeNit downstream Nitrific methanol to existing	ed filter with methanol ation Biofilter and DeNit filter wi	th methanol
PROPOSED MODIFICATION	IS TO GET NITRATE < 1.0 mg/L: No m X Add d Add d Add d Add d	nodifications require downstream DeNit downstream Nitrific methanol to existing	ed filter with methanol ation Biofilter and DeNit filter wi g BNR process	
PROPOSED MODIFICATION	IS TO GET NITRATE < 1.0 mg/L: No m X Add d Add d Add d Add d	nodifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration	ed filter with methanol ation Biofilter and DeNit filter wi g BNR process	th methanol
PROPOSED MODIFICATION	No mg/L: No mg/L: No mg/L: No mg/L: Add d Add d Add d Add d	nodifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r:	ed filter with methanol ation Biofilter and DeNit filter wi g BNR process tank with methanol feed	
PROPOSED MODIFICATION	IS TO GET NITRATE < 1.0 mg/L: No m X Add c Add c Add c Other	nodifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r:	ed filter with methanol ation Biofilter and DeNit filter wi g BNR process tank with methanol feed \$2,260,000	
	IS TO GET NITRATE < 1.0 mg/L: No m X Add a Add a Add a Other Equipment and Structures (fro Electrical and instrumentation:	nodifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: m Page 2):	sid filter with methanol ation Biofilter and DeNit filter wi g BNR process tank with methanol feed \$2,260,000 \$271,000	
	IS TO GET NITRATE < 1.0 mg/L: No m X Add c Add c Add c Other	nodifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r:	sid filter with methanol ation Biofilter and DeNit filter wi g BNR process tank with methanol feed \$2,260,000 \$271,000 \$339,000	
	IS TO GET NITRATE < 1.0 mg/L: No m X Add d Add d Add d Add d Other Equipment and Structures (fro Electrical and instrumentation: Yard Piping and Site Work: Subtotal:	nodifications required downstream DeNit downstream Nitrificon methanol to existing downstream anoxice filuent filtration r: m Page 2): 12% 15%	sid filter with methanol ation Biofilter and DeNit filter wi g BNR process tank with methanol feed \$2,260,000 \$271,000 \$339,000 \$2,870,000	
	IS TO GET NITRATE < 1.0 mg/L: No m X Add d Add	nodifications require downstream DeNit downstream Nitrific methanol to existin downstream anoxic effluent filtration r: 12% 15%	sid filter with methanol ation Biofilter and DeNit filter wi g BNR process tank with methanol feed \$2,260,000 \$271,000 \$339,000 \$2,870,000 \$431,000	
	IS TO GET NITRATE < 1.0 mg/L: No m X Add d Add d Add d Add d No me No m X Add d Add	nodifications require downstream DeNit downstream Nitrific methanol to existin downstream anoxic effluent filtration r: 12% 15%	sed filter with methanol ation Biofilter and DeNit filter wi g BNR process tank with methanol feed \$2,260,000 \$271,000 \$339,000 \$2,870,000 \$431,000 \$431,000	
	No m X Add d A	modifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxid effluent filtration r: 12% 15% 15% t: 15%	sed filter with methanol ation Biofilter and DeNit filter wi g BNR process tank with methanol feed \$2,260,000 \$271,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$3,730,000	
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	IS TO GET NITRATE < 1.0 mg/L: No m X Add d Add	nodifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxice effluent filtration r. 12% 15% 15% 15% 15% 30%	std filter with methanol ation Biofilter and DeNit filter wit g BNR process tank with methanol feed \$2,260,000 \$271,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$3,730,000 \$861,000 \$4,590,000	
	S TO GET NITRATE < 1.0 mg/L: No m X Add a A Add a Add a A Add a A Add a A Add a A A A A A A A A	nodifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxice effluent filtration r. 12% 15% 15% 15% 15% 30%	\$2,260,000 \$2,271,000 \$2,870,000 \$431,000 \$3,730,000 \$3,730,000 \$861,000	
CAPITAL COST:	STO GET NITRATE < 1.0 mg/L: No m X Add d	modifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 30% emoval	std filter with methanol ation Biofilter and DeNit filter wit g BNR process tank with methanol feed \$2,260,000 \$271,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$3,730,000 \$861,000 \$4,590,000	
	STO GET NITRATE < 1.0 mg/L: No m X Add d	modifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxice effluent filtration r: 12% 15% 15% 15% 15% 20% emoval	\$2,260,000 \$2,71,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$431,000 \$4,590,000 \$1,61	
CAPITAL COST:	Equipment and Structures (fro Electrical Power Cost Capital Cost Capital Cost Capital Cost Capital Cost Capital Horsepower (from Electrical Power Cost	modifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% t: 15% 30% emoval Page 2) 0.05 \$/kW	\$2,260,000 \$2,71,000 \$2,870,000 \$2,870,000 \$2,870,000 \$431,000 \$3,730,000 \$4,590,000 \$1,61	
CAPITAL COST:	Equipment and Structures (fro Electrical Power Cost Notate Capital Cost: Capital Cost per lb. 20-Yr N re Electrical Power Cost Nitrate Reduction using Metha	modifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% t: 15% 30% emoval Page 2) 0.05 \$/kW	\$2,260,000 \$2,71,000 \$3,870,000 \$271,000 \$339,000 \$431,000 \$431,000 \$3,730,000 \$4,590,000 \$1,61	
CAPITAL COST:	STO GET NITRATE < 1.0 mg/L: No m X Add d	modifications require downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% t: 15% 30% emoval Page 2) 0.05 \$/kW	\$2,260,000 \$2,71,000 \$339,000 \$431,000 \$431,000 \$431,000 \$4,590,000 \$1.61 \$60 HP \$26,100 \$/year 12.5 mg/L 180 gals/d \$49,300 \$/year 200 \$/year	
CAPITAL COST:	Equipment and Structures (fro Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgml Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 20-Yr N re Additional Horsepower (from F Electrical Power Cost Nitrate Reduction using Methanol Required: Methanol Cost:	modifications required downstream DeNit downstream Nitrificomethanol to existing downstream anoxice effluent filtration r: 12% 15% 15% 15% 30% emoval Page 2) 0.05 \$/kW anol:	\$2,260,000 \$2,71,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$431,000 \$431,000 \$431,000 \$431,000 \$4,590,000 \$1.61 \$0 HP \$26,100 \$/year 12.5 mg/L 180 gals/d \$49,300 \$/year 0.0 mg/L	
CAPITAL COST:	Equipment and Structures (fro Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgml Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr N re Additional Horsepower (from F Electrical Power Cost Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammonia Rec	modifications required downstream DeNit downstream Nitrificomethanol to existing downstream anoxice effluent filtration r: 12% 15% 15% 15% 30% emoval Page 2) 0.05 \$/kW anol:	\$2,260,000 \$2,71,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$431,000 \$4,590,000 \$4,590,000 \$1,61 \$0 HP \$26,100 \$/year 12.5 mg/L 180 gals/d \$49,300 \$/year 0,0 gals/d	
CAPITAL COST:	Equipment and Structures (fro Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgm/ Subtotal: Contingency: Total Capital Cost per lb. 20-Yr N re Additional Horsepower (from F Electrical Power Cost: Nitrate Reduction using Methan Methanol Required: Methanol Cost: Separate Stage Ammonia Rec Caustic Soda @ 25% conc.	modifications required downstream DeNit downstream Nitrificomethanol to existing downstream anoxice effluent filtration r: 12% 15% 15% 15% 30% emoval Page 2) 0.05 \$/kW anol:	\$2,260,000 \$2,71,000 \$3,870,000 \$2,71,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$4,590,000 \$1,61 80 HP \$26,100 S/year 12.5 mg/L 180 gals/d \$49,300 \$/year 0,0 mg/L 0 gals/d \$0 \$/year	
CAPITAL COST:	Equipment and Structures (from Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmi Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N. re. Additional Horsepower (from Electrical Power Cost: Nitrate Reduction using Methamol Required: Methanol Cost: Separate Stage Ammonia Rec Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost:	modifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 30% emoval Page 2) 0.05 \$/kW inot: 0.75 \$/gal duction:	\$2,260,000 \$2,71,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$431,000 \$4,590,000 \$4,590,000 \$1,61 \$0 HP \$26,100 \$/year 12.5 mg/L 180 gals/d \$49,300 \$/year 0,0 gals/d	
CAPITAL COST:	Equipment and Structures (from Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmi Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N. re. Additional Horsepower (from Electrical Power Cost: Nitrate Reduction using Methamol Required: Methanol Cost: Separate Stage Ammonia Rec Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost:	modifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 30% emoval Page 2) 0.05 \$/kW inot: 0.75 \$/gal duction:	\$2,260,000 \$271,000 \$339,000 \$271,000 \$339,000 \$431,000 \$	
CAPITAL COST:	Equipment and Structures (fro Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmi Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N. re. Additional Horsepower (from F. Electrical Power Cost: Nitrate Reduction using Methamol Required: Methanol Cost: Separate Stage Ammonia Rec. Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Production add of the cost.	modifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 30% emoval Page 2) 0.05 \$/kW inot: 0.75 \$/gal duction:	\$2,260,000 \$2,71,000 \$339,000 \$431,000 \$431,000 \$4,590,000 \$1.61 \$80 HP \$26,100 \$/year 1.2.5 mg/L 180 gals/d \$49,300 \$/year 0.0 mg/L 0 gals/d \$0 \$/year 560 lbs/d \$40,900 \$/year 660 lbs/d \$40,900 \$	
CAPITAL COST:	Equipment and Structures (fro Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgm/ Subtotal: Contingency: Total Capital Cost per lb. 20-Yr N re Additional Horsepower (from F Electrical Power Cost Nitrate Reduction using Methanol Required: Methanol Required: Methanol Cost: Separate Stage Ammonia Rec Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Producti Sludge Disposal Cost: Total Annual O&M Cost:	modifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 15% 30% emoval 2age 2) 0.05 \$/kW emoval 20,75 \$/gal duction: 0.60 \$/gal ion w/Methanol: 400 \$/ton	### State	
CAPITAL COST:	Equipment and Structures (fro Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmi Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N. re. Additional Horsepower (from F. Electrical Power Cost: Nitrate Reduction using Methan Methanol Required: Methanol Cost: Separate Stage Ammonia Rec. Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Producti Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest Rate	nodifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 15% 15% 10% 10% 10% 10% 10% 10% 10% 10% 10% 10	\$2,260,000 \$2,71,000 \$339,000 \$431,000 \$431,000 \$431,000 \$4,590,000 \$1.61 \$100 \$100 \$1.61 \$1.61 \$100 \$1.61 \$	
CAPITAL COST:	Equipment and Structures (from Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmi Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N. re. Additional Horsepower (from Electrical Power Cost: Nitrate Reduction using Methan Methanol Required: Methanol Cost: Separate Stage Ammonia Rec Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Production Sludge	nodifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 15% 15% 10% 10% 10% 10% 10% 10% 10% 10% 10% 10	### State	
CAPITAL COST:	Equipment and Structures (fro Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmi Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N. re. Additional Horsepower (from F. Electrical Power Cost: Nitrate Reduction using Methan Methanol Required: Methanol Cost: Separate Stage Ammonia Rec. Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Producti Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest Rate	nodifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 15% 15% 10% 10% 10% 10% 10% 10% 10% 10% 10% 10	\$2,260,000 \$271,000 \$339,000 \$2,870,000 \$431,000 \$431,000 \$431,000 \$4,590,000 \$1.61 \$180 gals/d \$49,300 \$/year 0.0 mg/L 0 gals/d \$40,900 \$/year 560 lbs/d \$40,900 \$/year 2.91% \$2,300,000	
CAPITAL COST:	Equipment and Structures (fro Electrical and instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmi Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N. re. Additional Horsepower (from F. Electrical Power Cost: Nitrate Reduction using Methamol Required: Methanol Cost: Separate Stage Ammonia Rec. Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Producti Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest Rate 20-Year Present Worth of O&F.	modifications required downstream DeNit downstream Nitrific methanol to existing downstream anoxic effluent filtration r: 12% 15% 15% 15% 15% 30% emoval Page 2) 0.05 \$/kW inot: 0.75 \$/gal duction: 0.60 \$/gal ion w/Methanol: 400 \$/ton after Inflation: M Costs:	\$2,260,000 \$2,71,000 \$339,000 \$431,000 \$431,000 \$431,000 \$4,590,000 \$1.61 \$100 \$100 \$1.61 \$1.61 \$100 \$1.61 \$	

PROJECT:	Implementing a 3 mg/L Annual Average To	otal Nitrogen Limit
PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Steams & Wheler, LLC	
DATE:	March 19, 2001	ž.
FACILITY: LOCATION:	UAJA WWTP	
RATED FLOW:	State College, PA	DE COD: 224 mail
CURRENT EFFLUENT TN:	6.0 mgd	PE COD: 334 mg/L PE TKN 36 mg/L
EFFLUENT TN GOAL:	8.0 mg/L 3.0 mg/L	PE TKN 36 mg/L
NITROGEN REDUCTION:	250 lbs/d	
THE SERVICE OF THE STATE OF THE	91 1000 lbs/yr	
	1825 1000 lbs/20-years	
CURRENT PROGRAM (AUS		West
CORRENT PROCESS (CREC	K ALL THAT APPLY): X MLE	Existing Aerated Volume (MG) 2.55
	BEPR (A2/0, VIP, et	
	Bardenpho Oxidation Dilch	Current MLSS at Winter ADF: 2650
l Y	Lagoon (Biolac, etc.) Cyclical Aeration	
	ISBR SBR	
	High-Rate Biofilter	
	— •	
	X Effluent Filtration Other	
OUDDELLE SELECTION	\$	
CURRENT EFFLUENT AMMO		and land 45 d MCDT 42° C winter and trans
	A Profit Model (at ADF	and load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
	No modifications requ	ired New MLSS
	X Raise MCRT/MLSS in	n existing tanks (check clarifier capacity) 3650
	Construct additional a	erated volume Flow (mgd): 0
	Construct additional of	larifiers Flow (mgd): 0
	Use existing anoxic vi	olume as aerobic (construct separate denit facility)
	Use aerated system for	or BOD removal only (construct separate nit/denit facility)
	Add influent flow equa	alization tank
	Other:	
	X Add methanol to exist Add downstream anox Add effluent filtration	it filter with methanol fication Biofilter and DeNit filter with methanol
	A Journ Mounty den	anon rams to deale post anone zone
CAPITAL COST:	Equipment and Structures (from Page 2):	\$250,000
	Electrical and Instrumentation: 12%	\$30,000
	Yard Piping and Site Work: 15%	\$38,000
	Subtotal:	\$320,000
	Contractor OH&P: 15%	\$48,000
	Engineering and Constr. Mgmt: 15%	\$48,000
	Subtotal:	\$420,000
+1	Contingency: 30%	\$96,000
	Total Capital Cost:	\$520,000
	Capital Cost per lb. 20-Yr. N removal:	\$0.28
PERATIONS COST:	Additional Horsepower (from Page 2)	0 HP
- 2.441010 00312	Electrical Power Cost: 0.05 \$/kW	\$0 \$/year
A1 12	Nitrate Reduction using Methanol Methanol Required	5.0 mg/L
		110 gals/d \$30 100 \$/year
	Methanol Cost 0.75 \$/gal	\$30.100 \$/year
	Separate Stage Ammonia Reduction:	0.0 mg/L
	Caustic Soda @ 25% conc	0 gals/d
	Caustic Soda Cost 0.60 \$/gal	\$0 \$/year \$4,200 \$/year
	Equipment Maintenance Cost:	\$4,200 \$/year
	Denitrification Sludge Production w/Methanol:	360 lbs/d
	Sludge Disposal Cost: 400 \$/ton	\$26,300 \$/year
	Total Annual O&M Cost:	\$60,600 \$/year
	Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	2.91% \$910,000
2000-0001		*******
OTAL 20-YEAR PRESENT WO	RTH COST: Total Cost per lb. 20-Yr. N removal:	\$1,430,000 \$0.78

PROJECT: PREPARED FOR:		
	Implementing a 3 mg/L Annual Average Total Nitrogen Limit	
	USEPA, Chesapeake Bay Office	
	USEFA, Chesapeane B. Mibolog I. C	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 19, 2001	
HT34 T 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Susquehanna WWTP	
FACILITY:		
LOCATION:	Lancaster Area, PA	
RATED FLOW:	12.0 mgd PE COD: 220 mg/L	-
CURRENT EFFLUENT TN:	8.0 mg/L PE TKN:24mg/L	
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	500 lbs/d	
	183 1000 lbs/yr	
l	Cartina Manager Contractors	
	3650 1000 lbs/20-years	
CURDENT BROCESS (CHECK	K ALL THAT APPLY): X MLE Existing Aerated	Volume (MG) 1.9
CURRENT PROCESS (CHECK	TO ALL HIM AT LETT A MILE	Volume (MG): 0.944
	BEPR (A2/0, VIP, etc.) Existing Anoxic	Voldine (MO):
	Bardenpho Current MLSS	at Winter ADF: 3600
	Oxidation Dilch	
ı		55
l .	Lagoon (Biolac, etc.)	
l	Cyclical Aeration	_
		the second secon
	SBR	
l	High-Rate Biofilter	
I	Effluent Filtration	
I		
I	Other.	
I		
	Suit to and TV From Poport	
CURRENT EFFLUENT AMMOR	DNIA-N: <1.0 mg/L X From Report	
	From Model (at ADF and load, 15 d MCRT, 12° C winter	conditions)
PROPOSED MODIFICATIONS	S TO GET AMMONIA < 1.0 mg/L:	
The state of the s	X No modifications required	New MLSS
	Raise MCRT/MLSS in existing tanks (check clarifier capa	city) N/a
	Raise MCR PAVICSS III existing tariks (credit clarific capital	
	Construct additional aerated volume Flow (m	
	Construct additional clarifiers Flow (m	qd): 0
	Construct additional distincts	o donit facility)
	Use existing anoxic volume as aerobic (construct separate	e defin facility)
	Use aerated system for BOD removal only (construct sep	arate nit/denit facility)
	Ose actions of the control topk	Carrege, A.
1	Add influent flow equalization tank	
	Other:	
	0.110.1	
1		
PROPOSED MODIFICATIONS	S TO GET NITRATE < 1.0 mg/L:	
FROI COED MODII IOATIONO	No modifications required	
1)	No modifications required	
	X Add downstream DeNit filter with methanol	
	Add downstream Nitrification Biofilter and DeNit filter with	methanol
	Add methanol to existing BNR process	
	Add methanol to existing blan process	
	Add downstream anoxic tank with methanol feed	
	Add effluent filtration	
	100/101/2 au	*
	I Other	
1	Other:	
	Other.	
CAPITAL COST:	Equipment and Structures (from Page 2): \$5,150,000	
CAPITAL COST:	Equipment and Structures (from Page 2): \$5,150,000 Electrical and Instrumentation: 12% \$618,000	
CAPITAL COST:	Equipment and Structures (from Page 2): \$5,150,000 Electrical and Instrumentation: 12% \$618,000	
CAPITAL COST:	Equipment and Structures (from Page 2): \$5,150,000 Electrical and Instrumentation: 12% \$618,000 Yard Piping and Site Work: 15% \$773,000	
CAPITAL COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: \$5,150,000 \$6,18000 \$773,000 \$6,540,000	
CAPITAL COST:	Equipment and Structures (from Page 2): \$5,150,000 Electrical and Instrumentation: 12% \$618,000 Yard Piping and Site Work: 15% \$773,000 Subtotal: \$6,540,000 Contractor OH&P: 15% \$981,000	
CAPITAL COST:	Equipment and Structures (from Page 2): \$5,150,000 Electrical and Instrumentation: 12% \$618,000 Yard Piping and Site Work: 15% \$773,000 Subtotal: \$6,540,000 Contractor OH&P: 15% \$981,000	
CAPITAL COST:	Equipment and Structures (from Page 2): \$5,150,000 Electrical and Instrumentation: 12% \$618,000 Yard Piping and Site Work: 15% \$773,000 Subtotal: \$6,540,000 Contractor OH&P: 15% \$981,000 Engineering and Constr. Mgmt: 15% \$981,000	
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CAPITAL COST:	Equipment and Structures (from Page 2): \$5,150,000 Electrical and Instrumentation: 12% \$618,000 Yard Piping and Site Work: 15% \$773,000 Subtotal: \$6,540,000 Contractor OH&P: 15% \$981,000 Engineering and Constr. Mgmt: 15% \$981,000 Subtotal: \$8,500,000 Subtotal: \$8,500,000 Contingency: 30% \$1,962,000 Total Capital Cost: \$10,460,000	
	Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: \$5,150,000 \$773,000 \$6,540,000 \$6,540,000 \$981,000 \$8,500,000 \$8,500,000 \$1,962,000 \$10,460,000 \$2.87	
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OPERATIONS COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Electrical Power Cost: Methanol Required: Methanol Required: Methanol Cost: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: 15% \$51,50,000 \$5773,000 \$56,540,000 \$981,000 \$981,000 \$\$981,000 \$\$1,962,000 \$\$10,460,000 \$\$10,460,000 \$\$10,460,000 \$\$2.87 240 HP \$78,400 \$/year \$5.0 mg/L \$63,000 \$/year \$5.0 mg/L \$63,000 \$/year \$63,000 \$/year \$50,000 \$10,460,000 \$52,87 240 HP \$78,400 \$/year \$50,000 \$/year	
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PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW:	implementing a 3 mg/L Annual Average To USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 19, 2001 Throop WWTP Lackawanna RBSA. PA 7.0 mgd	
CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	8.0 mg/L 3.0 mg/L 290 lbs/d 106 1000 lbs/yr 2117 1000 lbs/20-years	PE TKN: mg/L
CURRENT PROCESS (CHECK		Existing Aerated Volume (MG) Existing Anoxic Volume (MG) Current MLSS at Winter ADF 2.025 0.675 2300
CURRENT EFFLUENT AMMO		and load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	Construct additional a Construct additional c Use existing anoxic vo	n existing tanks (check clarifier capacity) erated volume Flow (mgd): Jarifiers Flow (mgd): Of the properties of the
PROPOSED MODIFICATIONS	No modifications requivations Add downstream DeN Add downstream Nitrification Add methanol to existing the street of the street	it filter with methanol fication Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: 15% Subtotal: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$510,000 \$4,320,000 \$648,000 \$648,000 \$5,620,000
OPERATIONS COST:	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc Caustic Soda Cost 0 60 \$/gal Equipment Maintenance Cost: Denitrification Studge Production w/Methanol Studge Disposal Cost 400 \$/ton Total Annual O&M Cost Effective Annual Interest Rate after Inflation. 20-Year Present Worth of O&M Costs	140 HP \$45,700 \$/year 5.0 mg/L 130 gals/d \$35,600 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$56,200 \$/year 420 lbs/d \$30,700 \$/year \$168,200 \$/year 2.91% \$2,520,000
TOTAL 20-YEAR PRESENT WO	RTH COST: Total Cost per lb. 20-Yr. N removal	\$9,440,000 \$4.46

	The second secon	I Mitropos I imit
PROJECT:	Implementing a 3 mg/L Annual Average Tota	n Mitrogen Limit
PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY:		
· ·	Susquehanna WWTP	
LOCATION:	Lancaster Area, PA	DE COD: 220 mg/l
RATED FLOW:	12.0 mgd	PE COD: <u>220</u> mg/L
CURRENT EFFLUENT TN:	8.0 mg/L	PE TKN: <u>24</u> mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	500 lbs/d	
THE OCEN REDOCTION	183 1000 lbs/yr	
		The state of the s
	3650 1000 lbs/20-years	
0.000		Existing Aerated Volume (MG): 1.9
CURRENT PROCESS (CHECK	ALL THAT APPLY): X MLE	
	BEPR (A2/0, VIP, etc.)	Existing Anoxic Volume (MG): 0.944
	Bardenpho	Current MLSS at Winter ADF: 3600
	Oxidation Ditch	
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
		all.
	SBR	. 8 9
	High-Rate Biofilter	
	Effluent Filtration	
I	Other	
I		97
CURRENT EFFI LIENT AMMON	IIA-N: <1.0 mg/L X From Report	,
	From Model (at ADE a	nd load, 15 d MCRT, 12° C winter conditions)
I	L Tom Model (at Abil a	in the second se
	TO THE STATE OF TH	
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
	X No modifications requi	red New MLSS
	Raise MCRT/MLSS in	existing tanks (check clarifier capacity) N/a
	Construct additional ac	erated volume Flow (mgd): 0
1	Construct additional cla	arifiers Flow (mgd): 0
	Lice existing anexic vo	lume as aerobic (construct separate denit facility)
	Use existing atlante vo	r BOD removal only (construct separate nit/denit facility)
	Add influent flow equal	ization tank
	Other:	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	
	No modifications requi	red .
	X Add downstream DeNi	t filter with methanol
	Add downstroam Nitrifi	cation Biofilter and DeNit filter with methanol
ľ		
l	Add methanol to existing	
l —	Add downstream anox	ic tank with methanol feed
_	Add effluent filtration	
	Other:	
>1		
CAPITAL COST:	Equipment and Structures (from Page 2):	\$5,150,000
CAPITAL COST.	Electrical and Instrumentation 12%	
	Electrical on a motion of the management of the	1
	Yard Piping and Sile Work 15%	
	Subtotal:	\$6,540,000
	Contractor OH&P: 15%	\$981,000
	Engineering and Constr. Mgmt 15%	\$981.000
1	Engineering and contact ing.	\$8,500,000
	Subtotal: 30%	\$1,962,000
	Contingency.	
2	Total Capital Cost:	\$10,460,000
I	Capital Cost per lb. 20-Yr. N removal:	\$2.87
OPERATIONS COST:	Additional Horsepower (from Page 2):	240 HP
PROVINCE IN CO.	Electrical Power Cost: 0.05 \$/kW	\$78,400 \$/year
	Electrical Land.	5.0 mg/L
I	Nitrate Reduction using Methanol:	230 gals/d
	Methanol Required:	•
	Methanol Cost: 0.75 \$/gal	\$63,000 \$/year
I 🗸	Separate Stage Ammonia Reduction:	0.0_mg/L
	Caustic Soda @ 25% conc	0 gals/d
	Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
	Equipment Maintenance Cost:	\$85,000 \$/year
	Denitrification Sludge Production w/Methanol:	720 lbs/d
1		\$52,600 \$/year
	Cladge Clopses. 2 22.	\$279,000 \$/year
	Total Annual O&M Cost:	
	Effective Annual Interest Rate after Inflation:	2.91%
F2	20-Year Present Worth of O&M Costs:	\$4,180,000
TOTAL 20-YEAR PRESENT WO	ORTH COST:	\$14,640,000
	Total Cost per lb 20-Yr N removal	\$4.01

PROJECT: PREPARED FOR:	Implementing a 3 mg/L Annual Average To USEPA, Chesapeake Bay Office	otal Nitrogen Limit
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	2
DATE:	March 19, 2001	
FACILITY:	Williamsport Central WWTP	
LOCATION:	Williamsport, PA	DE 000 000
RATED FLOW:	7.2 mgd	PE COD: 268 mg/L
CURRENT EFFLUENT TN: EFFLUENT TN GOAL:	18.4 mg/L	PE TKN 32 mg/L
NITROGEN REDUCTION:	3.0 mg/L 920 lbs/d	
MITROGEN REDUCTION:	920 lbs/d 336 1000 lbs/yr	
	6716 1000 lbs/20-years	¥
CURRENT PROCESS (CHEC	K ALL THAT APPLY): X MLE	Existing Aerated Volume (MG) 1.061
	BEPR (A2/0, VIP, et	
ŀ	Bardenpho Ovidation Ditab	Current MLSS at Winter ADF 1318
	Oxidation Ditch	
l'	Lagoon (Biolac, etc.)	Table 1
1)	Cyclical Aeration	
	SBR	
-	High-Rate Biofilter	
	Effluent Filtration	
	Other:	
CURRENT EFFLUENT AMMO	NIA-N: 16.7 mg/L X From Report	and load, 15 d MCRT, 12° C winter conditions)
		and load, 13 d MCR1, 12 C winter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
	No modifications requ	
		n existing tanks (check clarifier capacity) 4000
	Construct additional a	
	X Construct additional of	· · · · · · · · · · · · · · · · · · ·
		olume as aerobic (construct separate denit facility)
	(A)	or BOD removal only (construct separate nit/denit facility)
	Add influent flow equ	alization tank
	Other:	
2	Add methanol to exist Add downstream and Add effluent filtration	lit filter with methanol fication Biofilter and DeNit filter with methanol
	Other:	
CAPITAL COST:	Equipment and Structures (from Page 2):	\$4,730,000
	Electrical and Instrumentation: 12%	
	Yard Piping and Site Work: 15%	\$710,000
	Subtotal:	\$6,010,000
	Contractor OH&P: 15%	\$902,000
	Engineering and Constr. Mgmt: 15%	\$902,000
	Subtotal:	\$7,810,000
	Contingency 30%	\$1,803,000
	Total Capital Cost:	\$9,610,000
	Capital Cost per lb 20-Yr N removal:	\$1.43
PERATIONS COST:	Additional Horsensiver (from Page 2)	140 HP
PERATIONS COST.	Additional Horsepower (from Page 2)	\$45,700 \$/year
	Electrical Power Cost 0.05 \$/kW	
	Nitrate Reduction using Methanol:	5.0 mg/L
	Methanol Required:	140 gals/d
	Methanol Cost: 0.75 \$/gal	\$38,300 \$/year
	Separate Stage Ammonia Reduction:	0.0 mg/L
	Caustic Soda @ 25% conc.	0 gals/d
	Caustic Soda Cost: 0.60,\$/gal	\$0 \$/year
	Equipment Maintenance Cost:	\$78,100 \$/year
	Denitrification Studge Production w/Methanol:	430 lbs/d
	Sludge Disposal Cost: 400 \$/ton	\$31,400 \$/year
	Total Annual O&M Cost:	\$193,500 \$/year
	Effective Annual Interest Rate after Inflation:	2.91%
	20-Year Present Worth of O&M Costs:	\$2,900,000
OTAL 20-YEAR PRESENT WO		
DIVE TO LEVIL LIVE DE IAL AND	ORTH COST:	\$12,510,000 \$1.86

SEPR AJO, VIP, etc.) Backer RAJO, VIP, etc.) Barderenno Ovidation Dilch Lapaon (Blobac etc.) Cyclical Agration Sign High-Rale Biofilite Effluent Filtration Other CURRENT EFFLUENT AMMONIA-N: 2.6 mg/L From Report X From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) FROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L Raise MCRTML/SS in existing tanks (check clarifier capacity) Viviant Construct additional addirents of addirents and addirents addirent ad			1 1174 1 1 Impl
PREPARED FOR: USEPA_Chesapeake Bay Office PREPARED FOR: Vigilian Toch with Steams & Wheler, LLC DATE: March 19, 2001 PREPARED FOR: Vigilian Toch with Steams & Wheler, LLC DATE: March 19, 2001 PETKN: 37 mg/L	PROJECT:	Implementing a 3 mg/L Annual Average Total	al Nitrogen Limit
PREPARED PY: Virginia Tech with Steams & Wheler, LLC	PREPARED FOR:	USEPA, Chesapeake Bay Office	
DATE: March 14, 2001		Virginia Tech with Stearns & Wheler, LLC	
FACILITY:			
LOCATION: Williamsport, PA For Market PE COD 300 mg/L	E1050.0		
RATED FLOW: 45			
EFFLUENT TIN: \$0 mg/L EFFLUENT TIN: \$0 mg/L SIT 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): \$\frac{1}{2}\$ MALE BEPR (AZIO, VIP, etc.) Existing Agrated Volume (MG): 0.89 Backenho Collech Lagoon (Bolch Lagoon (Bo			BE COD: 300 mg/l
EFFLUENT TN GOAL: 130 mg/L 137 1000 lbs/d 137 1000 lbs/d 137 1000 lbs/d 138 1000 lbs/d 139 1000 lbs/d 130 1000 lbs/d 1	RATED FLOW:	4.5 mgd	
NITROGEN REDUCTION: 190 bis/d 1000 bis/d 100	CURRENT EFFLUENT TN:	8.0mg/L	PETKN:mg/L
NITROGEN REDUCTION: 190 bis/d 1000 bis/d 100	EFFLUENT TN GOAL:	3.0 mg/L	*
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) BEPR (A2/0, VIP, etc.) Berenoho Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current MLSS at Winter ADF. 4500 Current Blothier Belliuer Filtration Current Blothier Belliuer Filtration Current Blothier Belliuer Filtration Current Cardional arared volume Construct additional arared volume Flow (mgd) Construct additional clarifiers Flow (mgd) Construct separate entitionally Add downsteram Devil filter with methanol Add downsteram Natification Blothier and DeNit filter with methanol Add methanol to existing BNR process Add downsteram Natification Blothier and DeNit filter with methanol Add methanol to existing BNR process Add downsteram Natification Blothier and DeNit filter with methanol Add methanol to existing BNR process Add downsteram Natification Blothier and DeNit filter with methanol Add methanol to existing BNR process Add downsteram Natification Blothier and DeNit filter with methanol Add methanol to existing BNR process Add downsteram Natification Blothier and DeNit filter with methanol Add methanol to existing BNR process Add downsteram Natification Blothier and DeNit filter with methanol Add downsteram Natification Blothier with methanol Add downsteram Natification Bloth	(F. 17)	190 lbs/d	
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) Beren (A2			
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) Bardeneho Oxidation Dirich Laggoon (Risloac etc.) Cyclical Aeration SSR High-Rate Brofilter Effluent Fairation Owner CURRENT EFFLUENT AMMONIA-N: 2.6 mg/L From Report X From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X No modifications required X No modifications required X No modifications required X Raises MCRTMLSS in existing tanks (check clarifier capacity) X Use aerated system for BOD removal only (construct separate mil/denit facility) X Use aerated system for BOD removal only (construct separate mil/denit facility) Add influent flow equalization tank Other. PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: Add downstream DeNit filter with methanol Add defluent filtration Other: CAPITAL COST: Equipment and Situctures (from Page 2) Electrical and Instrumentation: 12% 5576,000 Yard Piping and Site Work: 15% 3720,000 Subtolat: Subtolat: Si, 100,000 Contractor OH&P: 15% 8915,000 Subtolat: Subtolat: Si, 100,000 Contractor OH&P: 15% 8915,000 Subtolat: Subtolat: Si, 100,000 Contractor OH&P: Solyr: N removal: 100 mg/L Capital Cost per ib. 20-Yr: N removal: 100 mg/L Capital Cost per ib. 20-Yr: N removal: 100 mg/L Capital Cost per ib. 20-Yr: N removal: 100 mg/L Capital Cost per ib. 20-Yr: N removal: 100 mg/L Causitic Soda Gost: 0.06 S/gal Equipment Mintenance Cost: 0.75 S/gal Subtolatication Side Production witherland Sylver Egited Production witherlander Side Sylver Equipment Mintenance Cost: 0.06 S/gal Equipment Mintenance Cost: 0.75 S/gal Sylver Equipment Mintenance Cost: 0.06 S/gal Equipmen			
BECR (A20), VIP, etc.) Bardenon Current MLSS at Winter ADF Bardenon Current MLSS at Winter ADF A500 A600 Current MLSS at Winter ADF A600 A600 Current MLSS at Winter ADF A600 A600 Current MLSS at Winter ADF A600		1001 1000 103120 700.0	
BEPR (A20, VPI, etc.) Bardenoho Oxidation Ditch Agodo Cyclical Aeration	CURRENT PROCESS (CUECK	ALL THAT ADDI VI-TY MIF	Existing Aerated Volume (MG): 0.89
Bardenoho Current MLSS at Winter ADF. 4500 Oxidation Ditch Lagoon (Biolac etc.) Cyclectal Agation SBR High-Rate Biofilter Effluent Filtration Other CURRENT EFFLUENT AMMONIA-N: 2.6 mg/L From Report X Raise MCRT/MLSS in existing tanks (check clarifier capacity) New ML Raise MCRT/MLSS in existing tanks (check clarifier capacity) V Use accepted additional carties of the sacrobic (construct additional carties and construct separate dent facility) X Use accepted additional carties and sacrobic (construct separate dent facility) Add influent flow equalization tank Other PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream Nitrification Biofilier and DeNit filter with methanol Add methanol to existing BR process Add downstream Anitrification Biofilier and DeNit filter with methanol Add methanol to existing BR process Add downstream anoxic tank with methanol feed Add downstream Constr. Mgmt: 15% \$378,000 Yard Piping and Site Work: 15% \$378,000 Yard Piping and Site Work: 15% \$315,000 Subtolal: 5% 500.000 Subtolal: 5% 500.0000 Subtolal: 5% 500.0000 Subtolal: 5% 500.00000000000000000000000000000000	GURKENT PROCESS (CHECK	BEDD (A2/0 VIP elc	Existing Anoxic Volume (MG): 0.33
Overation Ditch Lagoon (Blobac etc.) Cyclical Acration Sign High-Rate Biofilite Effluent Filtration Other CURRENT EFFLUENT AMMONIA-N: 2.6 mg/L High-Rate Biofilite Effluent Filtration Other From Report X From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X No modifications required Raise MCRTML/SS in existing tanks (check clarifier capacity) Construct additional adriented volume Flow (mg/l): Use existing anxiet wolume as aerobic (construct separate denit facility) X Use acrated dystein for BOP removal only (construct separate nit/denit facility) Add influent flow equalization tank Other: PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add downstream anoxic tank with methanol feed Add defluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2) Electrical and Instrumentation: Contractor OHRP: Engineering and Constr. Mgmt: 15% Subtotal: Contractor OHRP: Electrical Power Cost: 0.05 S/kW Subtotal: Contractor OHRP: Electrical Power Cost: 0.05 S/gal Equipment Minterance Cost: 0.05 S/gal Equipment Mintera			
CURRENT EFFLUENT AMMONIA-N: 2.6 mg/L			Garrent Medd at William I at 1
CURRENT EFFLUENT AMMONIA-N: 2.6 mg/L From Report Report Report Raise Michites Full Full Construct additional aerated volume Flow (mgd): 0 Construct additional aerated volume sexting anotox (volume as aerobic (construct separate mit/dentify facility) Add influent flow equalization tank Other: PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream Nitrification Biofiler and DeNit filter with methanol Other: No modifications required Add downstream Nitrification Biofiler and DeNit filter with methanol Add methanol to existing BNR process Add downstream Nitrification Biofiler and DeNit filter with methanol Other: 15% \$76,000 Vard Piping and Site Work: 15% \$76,000 Vard Piping and Site Work: 15% \$15,000 Subtotal: Contractor OH8P: 15% \$15,000 Engineering and Constr. Mgmt: 15% \$15,000 Subtotal: Contractor OH8P:			
CURRENT EFFLUENT AMMONIA-NI: 2.6 mg/L Effluent Filtration Other CURRENT EFFLUENT AMMONIA-NI: 2.6 mg/L From Report X From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: A loss MCRT/MLSS in existing tanks (check clarifier capacity) Construct additional darferies Construct additional darferies Use existing anoxic volume as aerobic (construct separate denit facility) Add influent flow equalization tank Other: PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: Add downstream for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank Other: Add downstream anoxic tank with methanol Add downstream anoxic tank with methanol exident filter with methanol exidence of the properties o			
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CURRENT EFFLUENT AMMONIA-N: 2.6 mg/L From Report X From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: A loss MCRT/MLSS in existing tanks (check clarifier capacity) Raise MCRT/MLSS in existing tanks (check clarifier capacity) Construct additional aerated volume Flow (mgd): 0 Construct additional darifiers Flow (mgd): 0 Use existing anoxic volume as aerobic (construct separate denit facility) Add influent flow equalization tank Other: PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream Debit filter with methanol Add downstream anoxic tank with methanol Bink process Add downstream anoxic tank with methanol feed Add defluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2) Electrical and Instrumentation: 12% \$576,000 Yard Piping and Site Work: 15% \$915,000 Subtolat: 56,100,000 Contractor OH&P: 15% \$915,000 Subtolat: 57,300,000 Contractor OH&P: 15% \$915,000 Subtolat: 50,75 \$/gal Solutional Horsepower (from Page 2): 50,000 Contractor OH&P: 50,0		Effluent Fillration	
PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: No modifications required Raise MCRT/MLSS in existing tanks (check clarifier capacity) New ML: N/e No construct additional clarifiers Flow (mgd): 0 Construct separate denit facility) Use existing anoxic volume as aerobic (construct separate denit facility) Add influent flow equalization tank Other: No modifications required Add downstream DeNit filter with methanol Add downstream DeNit filter with methanol Add downstream Nitrification Biofilier and DeNit filter with methanol Add downstream Anoxic tank with methanol Add downstream anoxic tank with methanol feed Add downstream anoxic tank with methanol feed Add downstream anoxic tank with methanol feed Add downstream anoxic tank with methanol Add downstream anoxic tank with methanol Replace Repla		Other	
PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: No modifications required Raise MCRT/MLSS in existing tanks (check clarifier capacity) New ML: N/e Construct additional clarifiers Flow (mgd): 0 Construct separate denit facility) Use existing anoxic volume as aerobic (construct separate of mit facility) Add influent flow equalization tank Other: No modifications required Add downstream DeNit filter with methanol Add downstream DeNit filter with methanol Add downstream Nitrification Biofilier and DeNit filter with methanol Add downstream Anoxic tank with methanol feed Add felluent filtration 12% \$578.000 S7815.000 S7815.00			
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PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X	South Elifebert Addition	X From Model (at ADF	and load, 15 d MCRT, 12° C winter conditions)
X No modifications required Raise MCRTMLSS in existing tanks (check clarifier capacity) New Miles		X i i i i i i i i i i i i i i i i i i i	
X No modifications required Raise MCRTMLSS in existing tanks (check clarifier capacity) New Miles	PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
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PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNit filler with methanol Add downstream Nitrification Biofilter and DeNit filler with methanol Add downstream Nitrification Biofilter and DeNit filler with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2) Electricat and Instrumentation: 12% \$576,000 Yard Piping and Site Work: 15% \$776,000 Yard Piping and Site Work: 15% \$915,000 Contractor OH&P: 15% \$915,000 Contractor OH&P: 15% \$915,000 Subtotal: 57,930,000 Subtotal: 57,930,000 Subtotal: 27,930,000 Subtotal: 57,930,000 Subtotal: 27,930,000 Subtotal: 27,930,000 Subtotal: 57,930,000 Subtotal: 27,930,000 Subtotal: 29,936 Subtotal: 29,936 Subtotal: 29,936 Subtotal: 29,936 Subtotal: 27,930,000	N	Use existing anoxic vo	DOD
Other:		X Use aerated system to	or BOD removal only (construct separate his definit racinty)
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No modifications required Add downstream DeNit filler with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other:		Other:	
No modifications required Add downstream DeNit filler with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other:			
No modifications required Add downstream DeNit filler with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other:	PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	
Add downstream DeNit filter with methanol X Add downstream Nitrification Disfilter and DeNit filter with methanol Add methanot to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other S76,000 S4,800,000 Electricat and Instrumentation: 12% \$576,000 Yard Piping and Site Work: 15% \$720,000 Subtotal: \$6,100,000 Subtotal: \$6,100,000 Subtotal: \$915,000 S10,000 Subtotal: \$915,000 S793,000 Subtotal: \$7,93,000 S10,000 S1	In the second se	No modifications requ	ired
Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process		Add downstream DeN	lit filter with methanol
Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other:		X Add downstream Nitri	fication Biofilter and DeNit filter with methanol
Add downstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2) Electrical and Instrumentation: 12% \$576,000 Yard Piping and Site Work: 15% \$720,000 Subtotal: 57,000 Engineering and Constr. Mgmt: 15% \$915,000 Engineering and Constr. Mgmt: 15% \$915,000 Subtotal: 7,930,000 Contingency: 30% \$1,830,000 Stubiotal: 57,930,000 Contingency: 30% \$1,830,000 S1,830,000 S		Add methanol to exist	ing BNR process
Add effluent filtration		Add downstream and	vic tank with methanol feed
CAPITAL COST: Equipment and Structures (from Page 2) \$4,800,000			
CAPITAL COST: Equipment and Structures (from Page 2) Electrical and Instrumentation: 12% \$576,000 Yard Piping and Site Work: 15% \$720,000 Subtotal: \$6,100,000 Contractor OH&P: 15% \$915,000 Engineering and Constr. Mgmt: 15% \$915,000 Subtotal: \$7,930,000 Contingency: 30% \$1,830,000 Contingency: 30% \$1,830,000 Total Capital Cost: \$9,760,000 Capital Cost per lb. 20-Yr. N removal: \$7.04 OPERATIONS COST: Additional Horsepower (from Page 2): 180 HP Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: 5.0 mg/L Methanol Required: 90 gals/d Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: 0.75 \$/gal Denitrification Sludge Production w/Methanol: 50 mg/L Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: 100 \$/ton Total Annual O&M Cost: 100 \$/ton Total Annual Interest Rate after Inflation 2.91%			
Electricat and Instrumentation: 12% \$576,000 Yard Piping and Site Work: 15% \$720,000 Subtotal: \$6,100,000 Contractor OH&P: 15% \$915,000 Engineering and Constr. Mgmt: 15% \$915,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Standard Cost: \$7,930,000 Total Capital Cost: \$7,930,000 Contingency: 30% \$1,830,000 Standard Cost: \$7,930,000 Standard Cost: \$7,930,000 Standard Cost: \$1,000 Stan	8	Other.	
Electricat and Instrumentation: 12% \$576,000 Yard Piping and Site Work: 15% \$720,000 Subtotal: \$6,100,000 Contractor OH&P: 15% \$915,000 Engineering and Constr. Mgmt: 15% \$915,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Subtotal: \$7,930,000 Standard Cost: \$7,930,000 Total Capital Cost: \$7,930,000 Contingency: 30% \$1,830,000 Standard Cost: \$7,930,000 Standard Cost: \$7,930,000 Standard Cost: \$1,000 Stan	12000 (2004220 V)	- 1 Objectives (from Boso 2)	\$4.800.000
Yard Piping and Site Work: 15% \$720,000	CAPITAL COST:	Equipment and Structures (from Page 2)	
Subtotal: \$6,100,000	1	Liectrical and matternation	
Contractor OH&P: 15% \$915,000 Engineering and Constr. Mgmt: 15% \$915,000 Subtotal: \$7,930,000 Contingency: 30% \$1,830,000 Total Capital Cost: \$9,760,000 Capital Cost per lb. 20-Yr. N removal: \$7.04 OPERATIONS COST: Additional Horsepower (from Page 2): 180 HP Electrical Power Cost: 0.05 \$/kW \$58,800 \$/year Nitrate Reduction using Methanol: 90 gals/d Methanol Required: 90 gals/d Methanol Cost: 0.75 \$/gal \$24,600 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: 0.75 \$/gal \$0 \$/year Denitrification Sludge Production w/Methanol: 270 lbs/d Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: \$19,700 \$/year Effective Annual Interest Rate after Inflation 2,91%	1	Yard Piping and Site Work: 15%	
Engineering and Constr. Mgmt: 15%		Subtotal:	·
Engineering and Constr. Mgmt: 15% \$915,000	24	Contractor OH&P: 15%	\$915,000
Subtotal:			\$ \$915,000
Contingency: 70tal Capital Cost: 70tal Capital Cost: 87,760,000 Capital Cost per lb. 20-Yr. N removal: \$7.04 OPERATIONS COST: Additional Horsepower (from Page 2): 180 HP Electrical Power Cost: 0.05 \$/kW \$58,800 \$/year Nitrate Reduction using Methanol: 90 gals/d Methanol Required: 90 gals/d Methanol Cost: 0.75 \$/gal \$24,600 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc 0 gals/d Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: \$79,300 \$/year Denitrification Sludge Production w/Methanol: 270 lbs/d Sludge Disposal Cost: 400 \$/ton \$19,700 \$/year Total Annual O&M Cost: 5182,400 \$/year Effective Annual Interest Rate after Inflation 2,91%	1		\$7,930,000
Total Capital Cost:			\$ \$1,830,000
Capital Cost per lb. 20-Yr. N removal: \$7.04	l	Contingency.	
OPERATIONS COST: Additional Horsepower (from Page 2):	l		
Addition Holsepote (16st) Addition Holsepote (16st) Addition Holsepote (16st)	l	Capital Cost per ib. 20-11-in removal.	VII.0-7
Addition Holsepote (16st) Addition Holsepote (16st) Addition Holsepote (16st)		A LUC I Harman was from Dago 21:	180 HP
Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation Methanol: 90 gals/d \$24.600 \$/year \$24.600 \$/year 0.0 mg/L 0.0 mg/L 0.0 spla/d 0.0 \$/year	OPERATIONS COST:		
Methanol Required: Methanol Cost: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest Rate after Inflation. Methanol Squisy \$90 gals/d \$24.600 \$/year 90 gals/d \$24.600 \$/year 90 gals/d \$19.400 \$/year		Licetifical Court	
Methanol Cost: 0.75 \$/gal \$24,600 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc 0 gals/d Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$79,300 \$/year Denitrification Sludge Production w/Methanol: 270 lbs/d Sludge Disposal Cost: 400 \$/ton \$19,700 \$/year Total Annual O&M Cost: \$182,400 \$/year Effective Annual Interest Rate after Inflation 2.91%			
Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Caustic Sod			
Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Caustic Sod			
Caustic Soda @ 25% conc. Caustic Soda Cost: Caustic Soda Cost Styear Caustic Soda Cost: Caustic Soda Cost Styear Caustic Soda Cost: Caustic Soda C	1	Separate Stage Ammonia Reduction:	
Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$79,300 \$/year Denitrification Sludge Production w/Methanol: 270 lbs/d Sludge Disposal Cost: 400 \$/ton \$19,700 \$/year Total Annual O&M Cost: \$182,400 \$/year Effective Annual Interest Rate after Inflation 2,91%			9
Equipment Maintenance Cost: \$79,300 \$/year Denitrification Sludge Production w/Methanol: 270 lbs/d Sludge Disposal Cost: 400 \$/ton \$19,700 \$/year Total Annual O&M Cost: \$182,400 \$/year Effective Annual Interest Rate after Inflation 2,91%			
Denitrification Sludge Production w/Methanol: 270 lbs/d Sludge Disposal Cost: 400 \$/ton \$19,700 \$/year Total Annual O&M Cost: \$182,400 \$/year Effective Annual Interest Rate after Inflation 2,91%			\$79,300 \$/year
Sludge Disposal Cost: 400 \$/ton \$19,700 \$/year Total Annual O&M Cost: \$182,400 \$/year Effective Annual Interest Rate after Inflation 2,91%		Denitrification Studge Production w/Methanol	270 lbs/d
Total Annual O&M Cost: \$182,400 \$/year Effective Annual Interest Rate after Inflation 2.91%			
Effective Annual Interest Rate after Inflation 2.91%		Sladge Biopera. Gran	
Ellective Airtidal interest rate sites		Figuriar Appeal Interest Rate offer Inflation	
20-Year Present Worth of Odivi Costs.		20-Year Present Worth of O&M Costs:	#£,1 40,000
\$12,500,000			\$12,500,000
TOTAL 20-YEAR PRESENT WORTH COST: \$12,500,000	TOTAL 20-YEAR PRESENT WO	ORTH COST:	
Total Cost per lb 20-Yr N removal \$9.01		Total Cost per ib 20-Yr N removal	43.01

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L Annual Average To USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 19, 2001 Wyoming Valley WWTP Luzerne Cty, PA 32.0 mgd 8.0 mg/L 3.0 mg/L 1330 lbs/d 485 1000 lbs/yr 9709 1000 lbs/y20-years	PE BOD5: 200 mg/L PE COD: N/a mg/L PE TKN: 27 mg/L
CURRENT PROCESS (CHEC	K ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) X Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Schreiber	Current MLSS at Winter ADF: 3000
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L X From Report From Model (at ADF	and load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	Construct additional a Construct additional o Use existing anoxic v	n existing tanks (check clarifier capacity) perated volume Flow (mgd): clarifiers Flow (mgd): olume as aerobic (construct separate denit facility) or BOD removal only (construct separate nit/denit facility)
PROPOSED MODIFICATIONS	No modifications requ X Add downstream DeN Add downstream Nitri Add methanol to exist	lit filter with methanol fication Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2) Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: 15% Engineering and Constr. Mgmt: 15% Subtotal: 15% Subtotal: 20% Contingency: 30% Total Capital Cost: Capital Cost per lb 20-Yr. N removal:	\$1,823,000 \$15,430,000 \$2,315,000 \$2,315,000 \$20,060,000
DPERATIONS COST:	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required:	640 HP \$209,100 \$/year
	Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation 20-Year Present Worth of O&M Costs:	\$167,000 \$/year 0.0 mg/L 0 gais/d \$0 \$/year \$200,600 \$/year 1920 lbs/d \$140,200 \$/year \$716,900 \$/year 2,91% \$10,750,000
OTAL 20-YEAR PRESENT WO	RTH COST: Total Cost per lb 20-Yr. N removal	\$35,440,000 \$3.65

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	USEPA, Chesapeal	Stearns & Wheler, LL(
CURRENT PROCESS (CHECK		BEPR (A2/0, VIP, Bardenpho Oxidation Ditch Lagoon (Biolac, et Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration Other:	c.)	Existing Aerated Volume (MG; Existing Anoxic Volume (MG; Current MLSS at Winter ADF	2.05
CURRENT EFFLUENT AMMO	NIA-N: <u>0.5</u> mg/L	X From Report From Model (at AD	OF and load, 15 d MC	RT, 12° C winter conditions)	100
PROPOSED MODIFICATIONS	TO GET AMMONIA <	X No modifications of Raise MCRT/MLS Construct additional Construct additional Use existing anoxional	S in existing tanks (c al aerated volume al clarifiers c volume as aerobic m for BOD removal o	heck clarifier capacity) Flow (mgd): 0. Flow (mgd): 0 (construct separate denit facility) only (construct separate nit/denit	New MLSS N/a - - facility)
PROPOSED MODIFICATIONS	TO GET NITRATE < 1	No modifications re Add downstream D Add downstream N	DeNit filter with methal litrification Biofilter ar xisting BNR process inoxic tank with meth	nd DeNit filter with methanol	oz 75%
CAPITAL COST:	Equipment and Struct Electrical and Instruct Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost per lb. 22	nentation: 1 Work: 1 nstr. Mgmt: 1	\$5,450,000 \$654,000 \$818,000 \$6,920,000 \$1,038,000 \$1,038,000 \$9,000,000 \$2,076,000 \$11,080,000 \$1,41		
OPERATIONS COST:	Sludge Disposal Cos Total Annual O&M C	t 0.05 \$/kW ing Methanol: 0.75 \$/gal nonia Reduction: 6 conc. 0.60 \$/gal nee Cost: e Production w/Methanolit: 400 \$/ton ost: rest Rate after Inflation:	\$134.100 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	S/year mg/L gals/d S/year mg/L gals/d S/year s/year s/year bs/d S/year	
TOTAL 20-YEAR PRESENT W	ORTH COST: Total Cost per lb, 20-	Yr. N removal:	\$18,060,000 \$2.29		

SUMMARY COST SHEETS FOR THE 14 MARYLAND WWTPS

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L USEPA, Chesapeake Ba Virginia Tech with Steam March 19, 2001 Bowie WWTP Bowie, MD 2.2 mgd 3.5 mg/L 3.0 mg/L 10 lbs/d 4 1000 lbs/yr 73 1000 lbs/20-years	ay Office	Nitrogen Limit PE COD: N/a mg/L PE TKN: N/a mg/L	
CURRENT PROCESS (CHECK	X	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Existing Aerated V Existing Anoxic V Current MLSS at	olume (MG): N/a Winter ADF: 4000
CURRENT EFFLUENT AMMO	NIA-N: 0.2 mg/L X	From Report From Model (at ADF and	load, 15 d MCRT, 12° C winter cor	nditions)
PROPOSED MODIFICATIONS	X	No modifications require Raise MCRT/MLSS in e Construct additional aero Construct additional clar Use existing anoxic volu	xisting tanks (check clarifier capacity ated volume Flow (mgd) ifiers Flow (mgd) me as aerobic (construct separate of BOD removal only (construct separate	: 0 : 0 lenit facility)
PROPOSED MODIFICATIONS	X	No modifications require Add downstream DeNit	filter with methanol ation Biofilter and DeNit filter with me BNR process	ethanol
CAPITAL COST:	Equipment and Structure: Electrical and Instruments Yard Piping and Site Work Subtotal. Contractor OH&P: Engineering and Constr. I Subtotal: Contingency: Total Capital Cost: Capital Cost per Ib. 20-Yr	12% 15% 15% 15% 15% 15% 30%	\$250 000 \$30.000 \$38.000 \$320.000 \$48.000 \$48.000 \$420.000 \$96.000 \$7.12	3
OPERATIONS COST:	Additional Horsepower (fr Electrical Power Cost: Nitrate Reduction using M Methanol Required: Methanol Cost: Separate Stage Ammonia Caustic Soda @ 25% cor Caustic Soda Cost: Equipment Maintenance of Denitrification Sludge Pro Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest I 20-Year Present Worth of	0.05 \$/kW Methanol: 0.75 \$/gal a Reduction: 0.60 \$/gal Cost: duction w/Methanol: 400 \$/ton Rate after Inflation:	0 HP \$0 \$/year 0.5 mg/L 0 gals/d \$0 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$4,200 \$/year 10 lbs/d \$700 \$/year \$4,900 \$/year 2,91%	
TOTAL 20-YEAR PRESENT W	ORTH COST: Total Cost per lb, 20-Yr N	l removal	\$590,000 \$8.08	

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L Annual Average To USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 11, 2001 Brunswick WWTP Brunswick, MD 0.7 mgd 8.0 mg/L 3 0 mg/L 3 0 lbs/d 11 1000 lbs/yr	PE COD 280 mg/L PE TKN: 34 mg/L
	219 1000 lbs/20-years	
CURRENT PROCESS (CHE	MLE BEPR (A2/0, VIP, etc Bardenpho Oxidation Ditch Lagoon (Biolac, etc) X Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration Other:	Existing Aerated Volume (MG): 0.234 Existing Anoxic Volume (MG): * Current MLSS at Winter ADF 3500 * Cyclically Aerated
CURRENT EFFLUENT AMM	ONIA-N: <1.0 mg/L X From Report	and load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATION	Construct additional a Construct additional c Use existing anoxic vo	existing tanks (check clarifier capacity) erated volume Flow (mgd): larifiers Flow (mgd): 0 lume as aerobic (construct separate denit facility) or BOD removal only (construct separate nit/denit facility)
PROPOSED MODIFICATION	Add methanol to existi	it filter with methanol ication Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2) Electrical and instrumentation 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$195,000 \$1,650,000
OPERATIONS COST:	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost Effective Annual Interest Rate after Inflation 20-Year Present Worth of O&M Costs:	10 HP \$3,300 S/year 5.0 mg/L 10 gals/d \$2,700 S/year 0.0 mg/L 0 gals/d S0 S/year \$21,500 S/year 40 lbs/d \$2,900 S/year \$30,400 S/year 2,91% \$460,000
OTAL 20-YEAR PRESENT W	ORTH COST: Total Cost per lb. 20-Yr. N removal	\$3,110,000 \$14.20

PROJECT:	Implementing a 3 mg/L Annual Averag	ge Total Nitrogen Limit
PROJECT: PREPARED FOR:	USEPA, Chesapeake Bay Office	As is a serial s
PREPARED BY:	Virginia Tech with Stearns & Wheler, I	II.C
	March 10, 2001	
DATE:	Chestertown WWTP	· ·
FACILITY: LOCATION: .		
RATED FLOW:	Kent County, MD 0.9 mgd	PE COD: N/a mg/L
	 ~	PE TKN: N/a mg/L
CURRENT EFFLUENT TN:	8.0 mg/L	1 C 11(1)
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	40 lbs/d	
1	15 1000 lbs/yr	
77	292 1000 lbs/20-years	
CURRENT PROCESS (CHECK	ALL THAT APPLY):	Existing Aerated Volume (MG): N/a
CURRENT PROCESS (CHECK	BEPR (A2/0, VI	TANKITZ
	Bardenpho	Current MLSS at Winter ADF: N/a
	Oxidation Dilch	
i e	Lagoon (Biolac,	
	X Cyclical Aeratio	
l		011
	SBR .	Filter
	High-Rate Biofil	
	X Effluent Filtratio	Oll
	Other:	
CURRENT EFFLUENT AMMON	IA-N: 3.0 mg/L X From Report	t ADF and load, 15 d MCRT, 12° C winter conditions)
ľ	From Model (at	(ADF and load, 15 d MCR1, 12 C willter conditions)
	50 OST 44440144 4 4 0 11 -	
PROPOSED MODIFICATIONS		ns required New MLSS
	No modification:	MLSS in existing tanks (check clarifier capacity) N/a
	Raise MCR 1/MI	tional aerated volume Flow (mgd) 0
	Construct additi	noxic volume as aerobic (construct separate denit facility)
	Use existing and	ystem for BOD removal only (construct separate or int/denit facility)
l .	Use aerated sys	by equalization tank
	Add influent flov	prove lagoon operation w/flow pattern and diffuser changes.
	X Other: Impr	prove lagoon operation whow pattern and onloser changes.
PROPOSED MODIFICATIONS	No modifications Add downstrear Add downstrear Add methanol to Add downstrear Add effluent filtr	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed tration
	X Other: Mino	or operational changes in lagoon
	-	n: \$50,000
CAPITAL COST:	Equipment and Structures (from Page 2):	,
į.	Electrical and Instrumentation:	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	Yard Piping and Site Work:	15% \$8,000 \$60,000
	Subtotal:	15% \$9,000
520	Contractor OH&P:	15% \$9,000
	Engineering and Constr Mgmt	\$80,000
	Subtotal	30% \$18,000
	Contingency	\$100,000
	Total Capital Cost:	\$0.34
	Capital Cost per lb 20-Yr, N removal:	40.54
L	1.11 Page 2):	0 HP
OPERATIONS COST:	Additional Horsepower (from Page 2):	20.01
	Electrical Power Cost: 0.05 \$/kW	0.0 mg/L
	Nitrate Reduction using Methanol:	0 gals/d
	Methanol Required: Methanol Cost: 0.75 \$/gal	V2 I.
		0.0 mg/L
	Separate Stage Ammonia Reduction:	0 gals/d
	Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal	
Δ 33		\$800 \$/year
	Equipment Maintenance Cost:	
	Denitrification Sludge Production w/Metha Sludge Disposal Cost: 400 \$/ton	on \$0 \$/year
	Oldago Biopodal otto	\$800 \$/year
	Total Annual O&M Cost:	·
	Effective Annual Interest Rate after Inflation	\$10,000
	20-Year Present Worth of O&M Costs:	4 tologo
TOTAL 20-YEAR PRESENT WO	RTH COST	\$110,000
I I I I I I I I I I I I I I I I I I I	Total Cost per lb. 20-Yr. N removal:	\$0.38
	Total boot per los 20° (1) 14 femores.	

PROJECT: PREPARED FOR: PREPARED BY:	Implementing a 3 mg/L Annual Average Total USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC	l Nitrogen Limit
DATE: FACILITY:	March 19, 2001 Crisfield WWTP	
LOCATION:	Crisfield, VA	
RATED FLOW:	1.2 mgd	PE COD 345 mg/L
CURRENT EFFLUENT TN:	8.0 mg/L	PE TKN 25 mg/L
EFFLUENT TN GOAL:	3 0 mg/L	
NITROGEN REDUCTION:	50 lbs/d	
_	18 1000 lbs/yr 365 1000 lbs/20-years	
CURRENT PROCESS (CHEC	K ALL THAT APPLY): MLE	Existing Aerated Volume (MG): 0.349
	X BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Dilch Lagoon (Biolac, etc.)	Existing Anoxic Volume (MG): 0.167 Current MLSS at Winter ADF: 3700
	Cyclical Aeration	
-	High-Rate Biofilter	
	Effluent Filtration	na a sa
	Other	- IS 41
CURRENT EFFLUENT AMMO	NIA-N: 0.5 mg/L X From Report From Model (at ADF at	nd load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L: X No modifications require	ed New MLSS
		existing tanks (check clarifier capacity) N/a
	Construct additional ae	
	Construct additional cla	rifiers Flow (mgd):0
	Use existing anoxic vol	ume as aerobic (construct separate denit facility)
		BOD removal only (construct separate nil/denit facility)
	Add influent flow equal	zation tank
PROPOSED MODIFICATIONS	No modifications requir X Add downstream DeNit Add downstream Nitrific Add methanol to existin	filter with methanol cation Biofilter and DeNit filter with methanol g BNR process c tank with methanol feed
	Other:	A CONTRACT OF THE CONTRACT OF
CAPITAL COST:	Equipment and Structures (from Page 2):	\$1,370,000
	Electrical and Instrumentation: 12%	\$164,000
	Yard Piping and Site Work: 15%	\$206,000
	Subtotal: 15%	\$1,740,000 \$261,000
	Contractor OH&P: 15% Engineering and Constr. Mgmt: 15%	\$261,000
	Subtotal:	\$2,260.000
	Contingency: 30%	\$522,000
	Total Capital Cost:	\$2,780,000
Ÿ.	Capital Cost per lb 20-Yr N removal	\$7.62
ADED 1710110 0005	// Bara 21	20 HP
OPERATIONS COST:	Additional Horsepower (from Page 2) Flectrical Power Cost: 0.05 \$/kW	\$6.500 \$/year
8	Electrical Power Cost: 0 05 \$/kW Nitrate Reduction using Methanol	5.0 mg/L
	Methanol Required:	20 gals/d
	Methanol Cost 0.75 \$/gal	\$5,500 \$/year
	Separate Stage Ammonia Reduction:	0.0 mg/L
	Caustic Soda @ 25% conc	0 gals/d
	Caustic Soda Cost: 0_60 \$/gal	\$0 \$/year
	Equipment Maintenance Cost:	\$22,600 \$/year
	Denitrification Sludge Production w/Methanol	70 lbs/d
	Sludge Disposal Cost: 400 \$/ton	\$5,100 \$/year \$39,700 \$/year
	Total Annual O&M Cost: Effective Annual Interest Rate after Inflation:	2.91%
	20-Year Present Worth of O&M Costs:	\$600,000
FOTAL 20-YEAR PRESENT WO		\$3,380,000 \$9.26

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION: CURRENT PROCESS (CHECK	Implementing a 3 mg/L Annual Av. USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Whele March 19, 2001 Easton WWTP Easton, MD 2.0 mgd 9.1 mg/L 3.0 mg/L 1000 lbs/d 37 1000 lbs/yr 730 1000 lbs/20-years ALL THAT APPLY): MLE BEPR (A2/ Bardenpho Oxidation D	PE COD: 220 PE TKN: 30 Exist O, VIP, etc.) Exist Cur	
	X Lagoon (Bid Cyclical Aet SBR High-Rate I Effluent Filt X Other	olac, etc.) ration Biofilter ration Overland Flow of Lagoon Effluent	
CURRENT EFFLUENT AMMON	IIA-N: 3.4 mg/L X From Repo	rt I (at ADF and load, 15 d MCRT, 12	2° C winter conditions)
PROPOSED MODIFICATIONS	No modification Raise MCR Construct at Construct at Use existing Use aerate Add influen	ations required T/MLSS in existing tanks (check cl dditional aerated volume dditional clarifiers g anoxic volume as aerobic (constr d system for BOD removal only (co t flow equalization tank Nitrification BAF	Flow (mgd): 0 Fl
PROPOSED MODIFICATIONS	No modification Add downs: X Add downs: Add methal	ations required tream DeNit filter with methanol tream Nitrification Biofilter and DeNitrol to existing BNR process tream anoxic tank with methanol fet filtration	
CAPITAL COST:	Equipment and Structures (from Pag Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N remova	12% \$336,000 15% \$420,000 \$3,560,000 15% \$534,000 \$4,630,000 30% \$1,068,000 \$5,700,000	
OPERATIONS COST:	Additional Horsepower (from Page 2 Electrical Power Cost: 0.05 Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 Separate Stage Ammonia Reduction Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 Equipment Maintenance Cost: Denitrification Sludge Production w/N Sludge Disposal Cost: 400 Total Annual O&M Cost: Effective Annual Interest Rate after to 20. Year Present Worth of O&M Cost	\$\frac{\$\\$\text{KV}}{\$\}\$ \begin{array}{cccccccccccccccccccccccccccccccccccc	200 200 200 200 200
TOTAL 20-YEAR PRESENT WO	ORTH COST: Total Cost per lb, 20-Yr N removal	\$7,160,000 \$9.81	A

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L Annual Average Total USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 10, 2001 Elkton WWTP Cecil County, MD 2.7 mgd 8.0 mg/L 3.0 mg/L 110 lbs/d 40 1000 lbs/yr 803 1000 lbs/20-years	PE COD: 344 mg/L PE TKN 28 mg/L
CURRENT PROCESS (CHECK	MLE BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR X High-Rate Biofilter Effluent Filtration Other: NIA-N: <1.0 mg/L X From Report	Existing Aeraled Volume (MG): Existing Anoxic Volume (MG): Current MLSS at Winter ADF: N/a
PROPOSED MODIFICATIONS	From Model (at ADF at TO GET AMMONIA < 1.0 mg/L: X No modifications require Raise MCRT/MLSS in Construct additional ae	existing tanks (check clarifier capacity) rated volume Flow (mgd): 0
	Construct additional cla	arfiers Flow (mgd): 0 ume as aerobic (construct separate denit facility) BOD removal only (construct separate nit/denit facility)
PROPOSED MODIFICATIONS		
-	Add methanol to existin Add downstream anoxi Add effluent filtration	filter with methanol cation Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0
OPERATIONS COST:	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal	0 HP \$0 \$/year
TOTAL 20-YEAR PRESENT WO	Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost Effective Annual Interest Rate after Inflation 20-Year Present Worth of O&M Costs:	0.0 mg/L 0 gals/d \$0 \$/year \$0 \$/year 160 lbs/d \$11,700 \$/year \$25,400 \$/year 2 91% \$380,000 \$380,000 \$0.47

PROJECT: Implementing 3 mg/L Annual Average Total Nitrogen Limit PREPARED BY: Utginist Tech with Steams & Wineler, LLC			
PREPARED FOR: USEPA, Chesapeake Bay Office DATE: Warch 9, 2001 March	BBO IECT:	Implementing a 3 mg/l Annual Average To	tal Nitrogen Limit
PREPARED RY: Virginia Tech with Stearns & Wileder, LLC		HISTOR Channels Bay Office	
DATE: March 9, 201	7.272.39	USEPA, Chesapeake Bay Office	
FACILITY:	PREPARED BY:		
LOCATION: Carroline County, MD PE COO 332 mg/L	DATE:	March 9, 2001	9
LOCATION: Carroline County, MD PE COO 332 mg/L	FACILITY:	Federalsburg WWTP	
RATED FLOW: 0.75 mgd	A SOCIEDAD DESCRIPTION		
CURRENT PROCESS (CHECK ALL THAT APPLY): EFFLUENT TN GOAL: 30 mgL 31000 lbs/y 657 1000 lbs/y20-years CURRENT PROCESS (CHECK ALL THAT APPLY): Baddespho Logon (Bloine, etc.) Cyclicial Aeration Logon (Bloine, etc.) Cyclicial Aeration Sign High-Rate Biofilter Either Hillstofton Logon (Bloine, etc.) Cyclicial Aeration Sign High-Rate Biofilter Either Hillstofton Logon (Bloine, etc.) Cyclicial Aeration Sign High-Rate Biofilter Either Hillstofton Logon (Bloine, etc.) Cyclicial Aeration Sign High-Rate Biofilter Either Hillstofton Logon (Bloine, etc.) Cyclicial Aeration Sign High-Rate Biofilter Either Hillstofton Logon (Bloine, etc.) Cyclicial Aeration Sign High-Rate Biofilter Either Hillstofton Logon (Bloine, etc.) Cyclicial Aeration Logon (Bloine, etc.) Logon (Bloine, etc.) Cyclicial Aeration Logon (Bloine, etc.) Logon (Bloi			PE COD: 332 mg/L
EFFLUENT TN GGAL: 3.0 mpt. NITROGEN REDUCTION: 33 1000 lbs/y 33 1000 lbs/y 33 1000 lbs/y 36 1000 lbs/20-years MLE ERPR (A20, VIP, etc.) Badden/ho Current MLSS at Winter ADF: N/B No modifications required N/B And ender Add winter and Construct separate nitridentify Los earanted system for DOD removal only construct separate nitridentify N/B Current MLSS at Winter ADF: N/B N/B N/B N/B Current MLSS at Winter ADF: N/B N/B N/B N/B N/B N/B N/B N/			
NITROGEN REDUCTION: 90 Inside 3 1000 lbs/y 657 1000 lbs/20-years 2 1000 lbs/20-year 2 10	CURRENT EFFLUENT TN:	<u>18.0</u> mg/L	FE TAN. 20 mg/c
NITROGEN REDUCTION: 90 Ibsid 3 1000 lbs/y 677 1000 lbs/20 years 3 1000 lbs/20 years 4 1000 lbs/20 years 5 1000 lbs/20 years 5 1000 lbs/20 years 6	EFFLUENT TN GOAL:	3.0 mg/L	
Signature Sign	NITROGEN REDUCTION:	-	
CURRENT PROCESS (CHECK ALL THAT APPLY): MLE	MITTO GENT NEEDGO HOM		*(
CURRENT PROCESS (CHECK ALL THAT APPLY): MLE EPPR (A20, VIP, etc.) Existing Aerated Volume (MG); NIa EPPR (A20, VIP, etc.) Existing Anoxic Volume (MG); NIa EPPR (A20, VIP, etc.) Existing Anoxic Volume (MG); NIa			
CURRENT PROCESS (CHECK ALL IMAI APPL!) CIEFR (A20, MP, etc.)		657 1000 lbs/20-years	
CURRENT PROCESS (CHECK ALL IMAI APPL!) CIEFR (A20, MP, etc.)			= 1.0 A
Egisting Anoxic Volume (MG). Na Bardenpho Current MLS3 at Winter ADF: Na Bardenpho Current MLS3 at Winter ADF: Na New MLS3 Na New MLSS Na Na Constituted volume Flow (ing): 0 Constituted volume Flow (ing):	CURRENT PROCESS (CHECK	ALL THAT APPLY): MLE	2
Bardenpho Current MLSS at Winter ADF: N/a Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Fade Biofilter Efficent Filtration CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA 1.0 mg/L: A homodifications required Raise MCRT/MLSS in existing tanks (check clarifier capacity) Construct additional earled volume Flow (right) Construct additional dearlifers Use earled system for BO3 removal only (construct separate init/denit facility) Use aerated system for BO3 removal only (construct separate init/denit facility) Add influent flow equalization tank Other PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: Add oxide material flow equalization tank Other Add divensteam DeNit filter with methanol Add methanol to existing BNR process Add downsteam anoxid tank with methanol feed Add efflow filter filtration Other CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 15% \$146,000 Electrical power Cost: Contractor OHAP: Subtotal:	001111211111100200 (0112011		Existing Anoxic Volume (MG): N/a
CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L			Current MLSS at Winter ADF: N/a
Lagoon (Bloice, etc.) Cyclical Aeration Sigr High-Rate Biofiltor Effluent Filtration CURRENT EFFLUENT AMMONIA-N: O.5 mg/L From Report From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA 1.0 mg/L: Xight Monodifications required Raise MCRT/MLSS in existing tanks (check clarifier capacity) Construct additional aerated volume Flow (mgd): Oconstruct separate antidernit facility) Use aerated system for BCD removal only (construct separate antidernit facility) Was aerated system for BCD removal only (construct separate antidernit facility) No medifications required Add downstream Politified rand Dentified rand Dentif			
CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L	12		
SBR		Lagoon (Biolac, etc.)	
SBR		Cyclical Aeration	
CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L			
Effluent Filtration CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L			
CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L			
CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L	7	Effluent Filtration	
CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L		X Other Trickling	ilter with effluent filtration
PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X No modifications required Raise M/CRT/MLSS in existing tanks (check clarifier capacity) New MLSS N/a		LK Journey	
PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X No modifications required Raise M/CRT/MLSS in existing tanks (check clarifier capacity) New MLSS N/a	6		
PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X No modifications required X No mo	CURRENT EFFLUENT AMMOR	VIA-N: 0.5 mg/L X From Report	1000
PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X No modifications required X No mo		From Model (at ADF	and load, 15 d MCRT, 12° C winter conditions)
No modifications required Raise MCRTNALS. Si existing tanks (check clarifier capacity) New MLSS New ML		, ,	
No modifications required Raise MCRTNALS. Si existing tanks (check clarifier capacity) New MLSS New ML	SPOROSER MORIEIGATIONS	TO CET AMMONIA < 4 5 mall :	
Raise MCRITANLSS in existing tanks (check clarifier capacity) Raise MCRITANLSS in existing tanks (check clarifier capacity) Construct additional aerated volume Flow (mgd): Use existing anoxic volume as aerobic (construct separate denit facility) Use existing anoxic volume as aerobic (construct separate denit facility) Add influent flow equalization tank Other: No modifications required Add downstream DeNit filter with methanol Add downstream Nitification Biofilter and DeNit filter with methanol Add downstream Nitification Biofilter and DeNit filter with methanol Add downstream Nitification Biofilter and DeNit filter with methanol Add downstream Nitification Biofilter and DeNit filter with methanol Add downstream Nitification Biofilter and DeNit filter with methanol Add downstream Nitification Biofilter and DeNit filter with methanol Add downstream anoxic tank with methanol feed Add effluent filtration Other: """ CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$156,000 Year Piping and Site Work: 15% \$195,000 Subtotat: Contractor OH&P: 15% \$248,000 Subtotat: Contractor OH&P: 15% \$248,000 Subtotat: Contingency: Total Capital Cost; Capital Cost per bi. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 %/W Methanol Required: Methanol Required: Methanol Required: Methanol Cost: 0.75 %/gal Separate Stage Ammonia Reduction: Caustic Soda @25% conc. C	PROPOSED MODIFICATIONS	TO GET AMMONIA C 1.0 mg/L:	Now MI SS
Construct additional clarifiers Use existing anoxic volume as aerobic (construct separate denit facility) Use existing anoxic volume as aerobic (construct separate denit facility) Use aerated system for BOD removal only (construct separate init/denit facility) Add influent flow equalization tank Other: No modifications required Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream initrification Biofilter and DeNit filter with methanol feed had effluent filtration Other: Add downstream anoxic tank with methanol feed had effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$156,000 Yard Piping and Site Work: 516,50,000 Yard Piping and Site Work: 516,50,000 Contractor OH&P: Subtotal: Contractor OH&P: Contractor OH&P: Contractor OH&P: Contractor OH&P: Subtotal: Contractor OH&P: Contractor OH&P: Contractor OH&P: Subtotal: Subtotal: Contractor OH&P: Subtotal: Subtotal: Subtotal: Contractor OH&P: Subtotal: Su		X No modifications requ	
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CAPITAL COST: Equipment and Structures (from Page 2): Add diversitem and constructions and downstream anoxic volume as a service (construct separate entit facility) Add influent flow equalization tank No modifications required		Construct additional a	nerated volume Flow (mgd): 0
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Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank Other: No modifications required Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol feed Add effluent filtration Other: Add downstream anoxic tank with methanol feed Add effluent filtration Other: Substate: Contractor OH&P: Substate: Contractor OH&P: Substate: Contractor OH&P: Substate: Contractor OH&P: Substate: Contractor OH&P: Substate: Sub		Construct additional	administration of the second s
PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNit filter with methanol Add downstream DeNit filter with methanol Biofilter and DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream anoxic tank with methanol feed Add downstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$15,000 Yard Piping and Site Work: 15% \$156,000 Yard Piping and Site Work: 15% \$248,000 Subtotat: 51,000,000 Contractor OH&P: 15% \$248,000 Subtotat: 52,150,000 Contingency: 30% \$495,000 Yads Piping Yads		Use existing anoxic v	Olume as aerooic (construct separate denit lacinty)
PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNit filter with methanol Add downstream DeNit filter with methanol Biofilter and DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream anoxic tank with methanol feed Add downstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$15,000 Yard Piping and Site Work: 15% \$156,000 Yard Piping and Site Work: 15% \$248,000 Subtotat: 51,000,000 Contractor OH&P: 15% \$248,000 Subtotat: 52,150,000 Contingency: 30% \$495,000 Yads Piping Yads	11	Use aerated system (for BOD removal only (construct separate nil/denit facility)
Other: O		Add influent flow equ	alization tank
PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required			2.52
Add downstream DeNit filter with methanol Add downstream Nithification Biofilter and DeNit filter with methanol Add downstream Nithification Biofilter and DeNit filter with methanol Add downstream noxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Contingency: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Contingency: Subtotal: Contingency: Subtotal: Contingency: Subtotal: Contingency: Subtotal: Contingency: Subtotal: Contingency: Subtotal: Subtotal: Contingency: Subtotal: Subtotal: Contingency: Subtotal: Subtotal: Contingency: Subtotal:		Other.	
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Add downstream Nitrification Biofilter and Dehit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$156,000 Yard Piping and Site Work: 15% \$1,500,000 Subtotal: Contractor OH&P: 15% \$248,000 Engineering and Constr. Mgmt: 15% \$248,000 Subtotal: Contingency: 30% \$495,000 Capital Cost; Capital Cost per Ib. 20-Yr. N removal: Capital Cost per Ib. 20-Yr. N removal: 44,03 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenanae Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000 \$13,390,000 \$10,000 \$11,000 \$11,000 \$10,000 \$		Y Add downstroom Dob	lit filter with methanol
Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$156,000 Yard Piping and Site Work: 15% \$195,000 Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: 30% \$448,000 Engineering and Constr. Mgmt: 50% \$248,000 Engineering and Constr. Mgmt: Contingency: 30% \$495,000 Total Capital Cost: Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: Methanol Required: Methanol Required: Methanol Required: Methanol Cost: Dentifrication Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$//sar Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000 \$1,000		Add downstream Der	William Charles and Dablit Ellerwith methodel
Add downstream anoxic tank with methanol feed Add effluent filtration Other:		Add downstream Nitr	itication Biotilter and DeNit filter with methanol
Add downstream anoxic tank with methanol feed Add effluent filtration Other:		Add methanol to exis	ting BNR process
Add effluent filtration Other:		Add downstream and	xic tank with methanol feed
Other:			Alo Will Mar Modelin 1999
CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Electrical Power Cost: Nitrate Reduction using Methanol: Methanol Required: Methanol Required: Methanol Cost: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: S1,300,000 \$1,55,000 \$1,650,000 \$2,150,000 \$2,150,000 \$2,150,000 \$2,150,000 \$2,150,000 \$2,650,000 \$2,650,000 \$2,650,000 \$2,650,000 \$2,650,000 \$2,650,000 \$2,650,000 \$4,95,000 \$4,9		100 CA M. C. A.	1.0 2 5 000 1
Electrical and Instrumentation: 12% \$156,000		Other:	
Electrical and Instrumentation: 12% \$156,000		_	
Electrical and Instrumentation: 12% \$156,000	CARITAL COST.	Faviance and Stauduros (from Page 2):	\$1 300 000
Yard Piping and Site Work: 15% \$195,000 \$1,650,000 \$248,000 \$248,000 \$248,000 \$248,000 \$248,000 \$248,000 \$2,150,0	CAPITAL COST:		
Subtotal: \$1,650,000 Contractor OH&P: 15% \$248,000 Engineering and Constr. Mgmt: 15% \$248,000 Subtotal: \$2,150,000 Contingency: 30% \$495,000 Total Capital Cost; \$2,650,000 Capital Cost per lb. 20-Yr. N removal: \$4.03 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: 40 gals/d Methanol Cost: 0.75 \$/gal \$11,000 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 2.91% TOTAL 20-YEAR PRESENT WORTH COST: \$3,330,000		Electrical and months.	
Subtotal:		Yard Piping and Site Work: 159	
Contractor OH&P: 15% \$248,000 Engineering and Constr. Mgmt: 15% \$248,000 Subtotal: \$2,150,000 Contingency: 30% \$495,000 Total Capital Cost: \$2,650,000 Capital Cost per lb. 20-Yr. N removal: \$4.03 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$3,390,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000			\$1,650,000
Engineering and Constr. Mgmt: 15% \$248,000 Subtotal: \$2,150,000 Total Capital Cost: \$2,650,000 Capital Cost per lb. 20-Yr. N removal: \$4,03 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: 40 gals/d Methanol Required: 40 gals/d Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$3,390,000		4.50	
Subtotal: \$2,150,000 Contingency: 30% \$495,000 Total Capital Cost: \$2,650,000 Capital Cost per lb. 20-Yr. N removal: \$4.03 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: 40 gals/d Methanol Required: 40 gals/d Methanol Cost: 0.75 \$/gal \$11,000 \$/year mg/L Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0.60 \$/gal Equipment Maintenance Cost: 9.60 \$/gal Equipment Maintenance Cost: 521,500 \$/year Denitrification Sludge Production w/Methanol: 5ludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: 400 \$/ton Total Annual O&M Cost: 510,200 \$/year \$49,200 \$/year \$49,200 \$/year \$29.1% TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000		CONTRACTOR OF ICE	* * * * * * * * * * * * * * * * * * * *
Subtotal:		Engineering and Constr. Mgmt: 159	
Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: \$4,03			
Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$2,650,000 \$4.03 \$6,500 \$/year 15.0 mg/L 40 gals/d \$11,000 \$/year 0 gals/d \$11,000 \$/year 20-year Production w/Methanol: \$21,500 \$/year \$4,920 \$/year \$4,03 Phermical Cost: \$6,500 \$/year 15.0 mg/L 40 gals/d \$11,000 \$/year 0 gals/d \$11,000 \$/year \$21,500 \$/year \$4,03		000	6 \$495,000
Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$3,390,000		Contingency.	
OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$3,390,000			
OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW \$6,500 \$/year Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal 40 gals/d Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal 51,000 \$/year Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton \$21,500 \$/year 140 lbs/d \$10,200 \$/year \$10,200 \$/year \$29,100 \$740,000 \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000		Capital Cost per lb. 20-Yr. N removal:	\$4.03
Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: 40 gals/d Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: 0.0 mg/L Ogals/d Separ			
Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: 40 gals/d Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: 0.0 mg/L Ogals/d Separ	OPERATIONS COST.	Additional Horsenower (from Page 2)	20 HP
Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: Nitrate Reduction using Methanol: 0.75 \$/gal \$11,000 \$/year 0 gals/d \$0 \$/year \$21,500 \$/year \$10,200 \$/year \$49,200 \$/year \$40,000	OF ERATIONS COST:		
Methanol Required: Methanol Cost: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Value Production w/Methanol: Sludge Disposal Cost: Fifective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: TOTAL 20-YEAR PRESENT WORTH COST: \$11,000 \$/year 0 gals/d \$11,000 \$/year 0 gals/d \$1,000 \$/year \$21,500 \$/year \$21,500 \$/year \$40,200 \$/year \$49,200 \$/year		2.0003 0.10.	
Methanol Cost: 0.75 \$/gal \$11,000 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$21,500 \$/year Denitrification Sludge Production w/Methanol: 140 lbs/d Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: \$10,200 \$/year Total Annual Interest Rate after Inflation: 2.91% \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000		Nitrate Reduction using Methanol:	
Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: 0.0 mg/L Gaustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$740,000 \$11,000 \$/year \$12,500 \$/year \$49,200 \$/year \$49,200 \$/year \$49,200 \$/year \$49,200 \$/year \$49,000 \$/year \$10,000 \$1/year \$10,000 \$1/year \$10,000 \$1/year \$1,000 \$1/year \$1/y		-	40 gals/d
Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$3,390,000 0.0 mg/L 0 gals/d \$0 \$/year \$21,500 \$/year 140 lbs/d \$10,200 \$/year \$49,200 \$/year \$2,91% \$740,000			\$11,000 \$/year
Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$21,500 \$/year Denitrification Sludge Production w/Methanol: 140 lbs/d Sludge Disposal Cost: 400 \$/ton \$10,200 \$/year Total Annual O&M Cost: \$10,200 \$/year Total Annual Interest Rate after Inflation: 2,91% 20-Year Present Worth of O&M Costs: \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000			-
Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$21,500 \$/year Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$740,000 \$740,000			
Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$21,500 \$/year 140 lbs/d \$10,200 \$/year \$49,200 \$/year 2,91% \$740,000			
Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: *291% \$740,000 \$740,000		Caustic Soda Cost: 0.60 \$/gal	
Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 1020 \$/year Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$49,200 \$/year \$49,200 \$/year \$2.91% \$740,000			\$21,500 \$/year
Sludge Disposal Cost: 400 \$/ton \$10,200 \$/year Total Annual O&M Cost: \$49,200 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000			
Total Annual O&M Cost: \$49,200 \$\footnote{y}\text{ear}\$ Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000			
Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000		Sludge Disposal Cost: 400 \$/ton	•
Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: 2.91% \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000			· · · · · · · · · · · · · · · · · · ·
20-Year Present Worth of O&M Costs: \$740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000			2.91%
TOTAL 20-YEAR PRESENT WORTH COST: \$3,390,000			
TOTAL 20 ILLANT RECENT WORTH COOK		20-Year Present Worth of O&M Costs:	Ataclass
TOTAL 20 ILLANT RECENT WORTH COOK			45 000 000
	TOTAL 20-YEAR PRESENT WO	ORTH COST:	
(DIM COSTORID), ZD-11. 14 (CHOVAL)		Total Cost per lb. 20-Yr. N removal:	\$5.16

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L Annual Average To USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 19, 2001 Georges Creek WWTP Alleghany County, MD 0.6 mgd 10.0 mg/L 3 0 mg/L 40 lbs/d 15 1000 lbs/yr 292 1000 lbs/20-years	PE COD: 365 mg/L PE TKN: 22 mg/L
		Existing Aerated Volume (MG) Existing Anoxic Volume (MG) O.2124 Current MLSS at Winter ADF Ditch modified to two step-feed MLE Units
CURRENT EFFLUENT AMMO		and-load, 15 d MCRT, 12° C winter conditions)
PROPOSED MODIFICATIONS PROPOSED MODIFICATIONS	Construct additional a Construct additional a Use existing anoxic v Use aerated system f Add influent flow equal	n existing tanks (check clarifier capacity) lerated volume Flow (mgd): clarifiers Flow (mgd): column as aerobic (construct separate denit facility) or BOD removal only (construct separate nit/denit facility)
FROFOSED MODIFICATIONS	No modifications requ X Add downstream DeN Add downstream Nitri Add methanol to exist	lit filter with methanol fication Biofilter and DeNit filter with methanol
CAPITAL COST:	Equipment and Structures (from Page 2) Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$195,000 \$1,650,000 \$248,000 \$248,000 \$2,150,000
OPERATIONS COST:	Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol:	10 HP \$3,300 \$/year
	Methanol Required: Methanol Cost: 0 75 \$/gal Separate Stage Ammonia Reduction Caustic Soda @ 25% conc Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation 20-Year Present Worth of O&M Costs	20 gals/d \$5,500 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$21,500 \$/year 50 ibs/d \$3,700 \$/year \$34,000 \$/year 2,91% \$510,000
TOTAL 20-YEAR PRESENT WO	ORTH COST: Total Cost per lb. 20-Yr. N removal	\$3,160,000 \$10.82

	Total Total	Nitropon Limit
PROJECT:	Implementing a 3 mg/L Annual Average Tota	Nitrogen Limit
PREPARED FOR:	USEPA, Chesapeake Bay Office	
1	Virginia Tech with Steams & Wheler, LLC	
PREPARED BY:		
DATE:	March 19, 2001	
FACILITY:	Havre de Grace WWTP	
LOCATION:	Havre de Grace, MD	
		PE COD: N/a mg/L
RATED FLOW:	<u>1,9</u> mgd	
CURRENT EFFLUENT TN:	8.0 mg/L	PE TKN: N/a mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	80 lbs/d	
1	29 1000 lbs/yr	
1	584 1000 lbs/20-years	
	364 1000 ibs/20-years	
1	146	5 : 6 A stad Male and MACA. Mile
CURRENT PROCESS (CHECK	ALL THAT APPLY): X MLE	Existing Aerated Volume (MG): N/a
10011112111111100200 (0112011	BEPR (A2/0, VIP, etc.)	Existing Anoxic Volume (MG): N/a
ł		Current MLSS at Winter ADF: N/a
1	Bardenpho	Culterit MESS at Writter ADI . 1474
	Oxidation Ditch	
	Lagoon (Biolac, etc.)	
1		
	Cyclical Aeration	
	SBR	
	High-Rate Biofilter	
	Effluent Filtration	** ***
	70.10 (CO) (CO)	ecycle from RBCs in Series before Clarifier
į.	X Other: MLE with R	Corpie Hom (Cook Conco deloic Cidellie)
ľ		
CURRENT ESSI HENT AMMON	NA-N: <1.0 mg/L X From Report	
COURTH I ELLEGENT WINNOW	ing/L A From Report	nd load, 15 d MCRT, 12° C winter conditions)
1	From Model (at ADF ar	iu ioau, 15 g MCN1, 12 C Willer conditions)
I		5 11
PROPOSES MODIFICATIONS	TO CET ABBROAUS 4.0 mig/l :	
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	red New MLSS
	X No modifications requir	
l	Paice MCRT/MLSS in	existing tanks (check clarifier capacity) N/a
	Raise Work Invitor in	grated volume Flow (mgd): 0
	Construct additional ae	
	Construct additional cla	arifiers Flow (mgd): 0
1	Humanisting apovio vol	ume as aerobic (construct separate denit facility)
[Use existing anoxic voi	unite as aerobic (construct separate dent tuomy)
1	Use aerated system for	BOD removal only (construct separate nil/denit facility)
	Add influent flow equal	ization tank
1		zation tarix
1	Other:	
	Add methanol to existing	cation Biofilter and DeNit filter with methanol
1	Other:	
A CONTRACTOR OF THE PARTY OF TH		£4 C20 000
CAPITAL COST:	Equipment and Structures (from Page 2):	\$1,620,000
16.0	Electrical and Instrumentation: 12%	\$194,000
	Electrical and motivation	\$243,000
1	Yard Piping and Site Work: 15%	
I	Subtotal:	\$2,060,000
1	Contractor OH&P: 15%	\$309,000
	Contractor Orion .	\$309,000
7.20	Engineering and Constr Mgmt 15%	
I .	Subtotal:	\$2,680,000
	200/	\$618,000
	Contingency	At the state of th
	Total Capital Cost:	\$3,300,000
1	Capital Cost per lb. 20-Yr. N removal	\$5.65
I		1
AND		AN HD
OPERATIONS COST:	Additional Horsepower (from Page 2)	40 HP
	Electrical Power Cost: 0.05 \$/kW	\$13,100 \$/year
1	Electrical Court Court	5.0 mg/L
1	Nitrate Reduction using Methanol:	
I	Methanol Required:	40 gals/d
I	Methanol Cost: 0.75 \$/gal	\$11,000 \$/year
1	methanor cook.	0.0 mg/L
1	Separate Stage Ammonia Reduction:	
1	Caustic Soda @ 25% conc	0 gals/d
1	Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
1	-	\$26,800 \$/year
	Equipment Maintenance Cost:	
I	Denitrification Sludge Production w/Methanol:	110 lbs/d
1		\$8,000 \$/year
I .	Cladge Diopotal Com	
I	Total Annual O&M Cost:	\$58,900 \$/year
I	Effective Annual Interest Rate after Inflation:	2.91%
1		\$880,000
I -	20-Year Present Worth of O&M Costs:	Aggalage
I .		
TOTAL 20-YEAR PRESENT W	ORTH COST:	\$4,180,000
TO THE 20-1 CAR FREDERIT W		\$7.16
1	Total Cost per lb. 20-Yr N removal	1 111

PROJECT:	Implementing a 3	mg/L Annual Average Tot	al Nitrogen Llmit		
PREPARED FOR:	USEPA, Chesape				
PREPARED BY:		Stearns & Wheler, LLC			
DATE:	March 19, 2001				
FACILITY:	Indian Head WW7	P			
LOCATION:	Indian Head,, MD				
RATED FLOW:	0.5 mgd		PE COD:	430 mg/L	
CURRENT EFFLUENT TN:	10.5 mg/L		PE TKN:	29 mg/L	
EFFLUENT TN GOAL:	3.0 mg/L		_		
NITROGEN REDUCTION:	30 lbs/d				
	11 1000 lbs/yr				
	219 1000 lbs/20	vears			
	CT-70-50				
CURRENT PROCESS (CHEC	K ALL THAT APPLY)			Existing Aerated Volum	
		BEPR (A2/0_VIP_etc)	Existing Anoxic Volum	
		Bardenpho		Current MLSS at Win	er ADF
		Oxidation Ditch			
		Lagoon (Biolac, etc.)			
		Cyclical Aeration			
		SBR			
N.		High-Rate Biofilter			
		Effluent Filtration			i i
		Other			
CURRENT EFFLUENT AMMO	NIA-N: 0.5 mg/L	X From Report			
		From Model (at ADF a	ind load, 15 d MCF	RT, 12° C winter conditio	ns)
##0B005B #405					
PROPOSED MODIFICATIONS	TO GET AMMONIA				
		X No modifications requi			New MLSS
		Raise MCRT/MLSS in			N/a
		Construct additional ad		Flow (mgd):	0
		Construct additional cl		Flow (mgd):	0
				onstruct separate denit	
				ly (construct separate ni	t/denit facility)
		Add influent flow equa	lization tank		
21		Other:			
BEODOSE MODIES		1 2			
PROPOSED MODIFICATIONS	TO GET NITRATE <				
		No modifications requi			1
		Add downstream DeNi			
		The second secon		DeNit filter with methan	01
	g 3	X Add methanol to existing			
		Add downstream anox	ic tank with methar	nol feed	
		Add effluent filtration			
	9	Other:			

CAPITAL COST:		ctures (from Page 2)	\$250,000		
	Electrical and Instru				
	Yard Piping and Site	e Work: 15%			
	Subtotal:		\$320, 0 00		
	Contractor OH&P:	15%	\$48,000		
	Engineering and Co	nstr. Mgmt: 15%	\$48,000		i i
	Subtotal:		\$420,000		1
	Contingency:	30%	\$96,000		
	Total Capital Cost:		\$520,000		1
			4020,000		100
		20-Yr. N removal:	\$2.37		
	Capital Cost per lb	20-Yr. N removal:			*
OPERATIONS COST:	Capital Cost per lb			,	*
OPERATIONS COST:	Capital Cost per lb.: Additional Horsepow	ver (from Page 2):	\$2.37 0 HF		
OPERATIONS COST:	Capital Cost per lb. Additional Horsepow Electrical Power Cos	ver (from Page 2): st: 0.05 \$/kW	\$2.37 0 HF \$0 \$/y	rear	*
OPERATIONS COST:	Capital Cost per lb. Additional Horsepow Electrical Power Cos Nitrate Reduction us	ver (from Page 2): st: 0.05 \$/kW	\$2.37 0 HF \$0 \$/y 	rear J/L	-
OPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required:	ver (from Page 2): st: 0.05 \$/kW ing Methanol:	\$2.37 0 HF \$0 \$/y	rear n/L s/d	
OPERATIONS COST:	Capital Cost per lb. Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost:	ver (from Page 2): st: 0.05 \$/kW ing Methanol: ,	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y	rear n/L s/d ear	
OPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr	ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gat monia Reduction	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg	ear y/L Is/d ear y/L	
OPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25%	ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0.75 \$/gat monia Reduction	\$2.37 0 HF \$0 \$/y 7.5 mc 10 gal \$2,700 \$/y 0.0 mg	rear y/L Is/d ear y/L s/d	*
OPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost	ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gat monia Reduction 6 conc 0.60 \$/gat	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$0 \$/y	ear y/L s/d ear y/L s/d ear	
DPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost Equipment Maintena	ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gat monia Reduction 6 conc 0.60 \$/gat ince Cost:	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$0 \$/y \$4,200 \$/y	ear y/L s/d ear s/d ear ear	
DPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost Equipment Maintena Denitrification Sludge	ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gat monia Reduction 6 conc 0.60 \$/gat ince Cost: e Production w/Methanol	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$50 \$/y \$4,200 \$/y 50 (bs	ear y/L s/d ear y/L s/d ear ear	
OPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost Equipment Maintena Dentrification Sludge Sludge Disposal Cos	ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0.75 \$/gat monia Reduction 6 conc 0.60 \$/gat since Cost: e Production w/Methanol st: 400 \$/ton	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$4,200 \$/y 50 lbs \$3,700 \$/y	ear y/L s/d ear y/L s/d ear ear y/d	
OPERATIONS COST:	Capital Cost per lb. Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost Equipment Maintena Denitrification Sludge Sludge Disposal Cost Total Annual O&M C	ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction % conc 0.60 \$/gal ince Cost: e Production w/Methanol st: 400 \$/ton oost:	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$5 \$/y \$4,200 \$/y 50 [bs \$3,700 \$/y \$10,600 \$/y	ear y/L s/d ear y/L s/d ear ear y/d	
OPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost Equipment Maintena Denitrification Sludge Sludge Disposal Cos Total Annual O&M C Effective Annual Inte	ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction // conc 0.60 \$/gal ince Cost: e Production w/Methanol st: 400 \$/ton iost: crest Rate after Inflation:	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$0 \$/y \$4,200 \$/y 50 bbs \$3,700 \$/y \$10,600 \$/y 2,91%	ear y/L s/d ear y/L s/d ear ear y/d	
OPERATIONS COST:	Capital Cost per lb. Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost Equipment Maintena Denitrification Sludge Sludge Disposal Cost Total Annual O&M C	ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction // conc 0.60 \$/gal ince Cost: e Production w/Methanol st: 400 \$/ton iost: crest Rate after Inflation:	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$5 \$/y \$4,200 \$/y 50 [bs \$3,700 \$/y \$10,600 \$/y	ear y/L s/d ear y/L s/d ear ear y/d	
25	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost Equipment Maintena Denitrification Sludge Sludge Disposal Cos Total Annual O&M C Effective Annual Inte 20-Year Present Wo	ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction // conc 0.60 \$/gal ince Cost: e Production w/Methanol st: 400 \$/ton iost: crest Rate after Inflation:	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$0 \$/y \$4,200 \$/y 50 lbs \$3,700 \$/y \$10,600 \$/y 2.91%	ear y/L s/d ear y/L s/d ear ear y/d	·
OPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost Equipment Maintena Denitrification Sludge Sludge Disposal Cos Total Annual O&M C Effective Annual Inte 20-Year Present Wo	ver (from Page 2): st: 0.05 \$/kW sing Methanol: 0.75 \$/gal monia Reduction // conc 0.60 \$/gal since Cost: e Production w/Methanol st: 400 \$/ton stost: erest Rate after Inflation: rth of O&M Costs:	\$2.37 0 HF \$0 \$/y 7.5 mg 10 gal \$2,700 \$/y 0.0 mg 0 gal \$0 \$/y \$4,200 \$/y 50 bbs \$3,700 \$/y \$10,600 \$/y 2,91%	ear y/L s/d ear y/L s/d ear ear y/d	÷

		- Tatal Mitsagan Limit
PROJECT:	Implementing a 3 mg/L Annual Average	e Total Nitrogen Limit
PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, Li	LC .
DATE:	March 9, 2001	75
FACILITY:	Mattawoman WTTP	
LOCATION:	Charles County. MD	
I	The state of the s	PE COD: 104 _ mg/L
RATED FLOW:	<u>15.0</u> mgd	PE TKN: <u>28</u> mg/L
CURRENT EFFLUENT TN:	3.0 mg/L *	The plant is currently being upgraded
EFFLUENT TN GOAL:	3.0 mg/L	• The plant is currently being upgraded
NITROGEN REDUCTION:	- 0 lbs/d	to a Bardenpho with the ability to add
111111111111111111111111111111111111111	0 1000 lbs/yr	methanol so 3 TN will be achievable
1	0 1000 lbs/20-years	
	0 1000 108/20-308/3	
	CALL THAT APPLIAN THE	Existing Aerated Volume (MG): N/a
CURRENT PROCESS (CHECK	(ALL THAT APPLY): MLE	E to de a suite Malayera (MCN) Num
	BEPR (A2/0, VIF	Current MLSS at Winter ADF: N/a
(Under Design - March 2001)	X Bardenpho	Corrent MESS at White MST
	Oxidation Dilch	
	Lagoon (Biolac, o	etc.)
	Cyclical Aeration	
	SBR	
		tor
	High-Rate Biofilte	
	Effluent Filtration	n
	Other:	
CURRENT EFFLUENT AMMO	NIA-N: 0.5 mg/L X From Report	
	From Model (at A	ADF and load, 15 d MCRT, 12° C winter conditions)
	34.4257	
BROBOSED MODIEICATIONS	TO GET AMMONIA < 1.0 mg/L:	
PROPOSED MODIFICATIONS	X No modifications	s required New MLSS
	A NO MODIFICATIONS	LSS in existing tanks (check clarifier capacity) N/a
	Raise MCR1/ML	onal aerated volume Flow (mgd):0
	Construct addition	
l.	Construct addition	onal clarifiers Flow (mgd): 0
*	Use existing ano	oxic volume as aerobic (construct separate denit facility)
, y = -	Use aerated syst	stem for BOD removal only (construct separate nit/denit facility)
	Add influent flow	v equalization tank
	Other:	. 04.00
l	Other.	
	*	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	
	L X INo modifications	s required
l.	Add downstream	n DeNit filter with methanol
	Add downstream	n Nitrification Biofilter and DeNit filter with methanol
	Add methanol to	existing BNR process
	Add downstream	n anoxic tank with methanol feed
	Add effluent filtra	
		auon
1	Other:	
		. \$0
CAPITAL COST:	Equipment and Structures (from Page 2):	·
	Electrical and Instrumentation:	12% \$0
	Yard Piping and Site Work:	15% \$0
	Subtotal:	\$ 0
1		15% \$0
	Contractor OH&P:	15% \$0
	Engineering and Constr. Mgmt:	
	Subtotal:	\$0
	Contingency:	30% \$0
	Total Capital Cost:	\$0
	Capital Cost per lb. 20-Yr. N removal:	#DIV/01
	Capital Cost per lo. 20-11. 14 formation	**
	A LIM ALLES AND Grown Flore 21:	O HP
OPERATIONS COST:	Additional Horsepower (from Page 2):	
	Electrical Power Cost: 0.05 \$/kW	•
I	Nitrate Reduction using Methanol:	0.0 mg/L
I	Methanol Required:	0 gals/d
	Methanol Cost: 0.75 \$/gal	
1	Separate Stage Ammonia Reduction:	<u>0.0</u> _mg/L
		0 gals/d
	Caustic Soda @ 25% conc.	0.01
1		\$0 \$/year
	Equipment Maintenance Cost:	
- ×	Denitrification Sludge Production w/Metha	anol: 0 lbs/d
1	Sludge Disposal Cost: 400 \$/ton	a avyear
	Total Annual O&M Cost:	\$0 \$/year
I .	Effective Annual Interest Rate after Inflation	ion: 2.91%
	20 Vest Deceat Mode of O.M. Code:	\$0
L	20-Year Present Worth of O&M Costs:	
	IODTI COOT	\$ 0
TOTAL 20-YEAR PRESENT W	ORTH COST:	#DIV/0I
1	Total Cost per lb. 20-Yr. N removal:	101111
	14	

PROJECT:	Implementing a 3 mg/L Annual Average To	tal Nitrogen Limit
PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 11, 2001	
FACILITY:	Princess Anne WWTP	
LOCATION:	Somerset County, MD	
RATED FLOW:	1.3 mgd	PE COD 260 mg/L
1000000		
CURRENT EFFLUENT TN:	<u>18.0</u> mg/L	PE TKN26mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	160 lbs/d	
THE SELECTION OF THE SE	58 1000 lbs/yr	8
	•	
	1168 1000 lbs/20-years	
25		
CURRENT PROCESS (CHECK	(ALL THAT APPLY): MLE	Existing Aerated Volume (MG)N/a
1	BEPR (A2/0, VIP, et	Existing Anoxic Volume (MG) N/a
	Bardenpho .	Current MLSS at Winter ADF: 3000
		Odifere friedd at William F. E
E .	Oxidation Ditch	
E .	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
	SBR	
12		
	High-Rate Biofilter	
	Effluent Filtration	
	X Other: Currently	Conventional Activated Sludge
l .	_ Notice:	Contraction of Fourth Contractor Change
I		
CURRENT EFFLUENT AMMOI	VIA-N: <1.0 mg/L X From Report	
	From Model (at ADF	and load, 15 d MCRT, 12° C winter conditions)
DEPORTORED MARIETO ATTENT	TO OFT 444404H4 < 4.0 # :	
PROPOSED MODIFICATIONS		
	X No modifications req	
	Raise MCRT/MLSS	n existing tanks (check clarifier capacity) N/a
	Construct additional	serated volume Flow (mgd): 0
	Construct additional	
	Use existing anoxic v	olume as aerobic (construct separate denit facility)
	Use aerated system	for BOD removal only (construct separate nit/denit facility)
	Add influent flow equ	alization tank
14	Other:	
	Other.	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	
	No modifications req	tired
		Nit filter with methanol
		ification Biofilter and DeNit filter with methanol
	Add methanol to exis	ting BNR process
	Add downstream and	xic tank with methanol feed
		Alo Will Mill Modelotto 1000
	Add effluent filtration	CO. 1 - 128
2	X Other: 5-Stage B	ardenpho has been bid, will be constructed
*		
CAPITAL COST:	Equipment and Structures (from Page 2):	\$1,309,230
GALTIAL GOOT.		
	Ercotrioar arra monare	· ·
	-Yard Piping and Site Work: 159	6 \$196,000
	Subtotal:	\$1,662,722
00	Contractor OH&P: 159	6 \$249,000
	Contractor Crisci	- ,
	Engineering and Constr. Mgmt: 159	
	Subtotal:	\$2,161,538
	Contingency: 30%	6 \$843,000
		\$2,810,000
	Total Capital Cost:	
	Capital Cost per lb 20-Yr N removal:	\$2.41
OPERATIONS COST:	Additional Horsepower (from Page 2)	0 HP
	Electrical Power Cost 0.05 \$/kW	\$0 \$/year
2.0	Electrical College	0.0 mg/L
	Nitrate Reduction using Methanol	
	Methanol Required	0 gals/d
	Methanol Cost 0 75 \$/gal	\$0 \$/year
	Separate Stage Ammonia Reduction:	0.0 mg/L
		0 gals/d
	Caustic Soda @ 25% conc	
	Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
	Equipment Maintenance Cost:	\$21,600 \$/year
	Denitrification Sludge Production w/Methanol	0 lbs/d
		\$0 \$/year
	Gladge Bioposa, even	
	Total Annual O&M Cost:	\$21,600 \$/year
	Effective Annual Interest Rate after Inflation:	2.91%
	20-Year Present Worth of O&M Costs:	\$320,000
	20-1001 Fiederic Front Of Own Cools.	
TOTAL 00 1/202		£2.420.000
TOTAL 20-YEAR PRESENT WO		\$3,130,000
	Total Cost per lb. 20-Yr. N removal:	\$2.68
	The second secon	. I

PROJECT:	Implementing a 3	mg/L Annual Average Tota	l Nitrogen Limit		-
PREPARED FOR:			i maogen emin		
PREPARED BY:	USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC				
DATE:					
FACILITY:	March 19, 2001 Western Branch WWTP				
LOCATION:	Western Branch	ban Sanitary Commission, M	n		
RATED FLOW:		Dali Salikary Commission III	PE COD:	N/a mg/L	
CURRENT EFFLUENT TN:	16.6 mgd		PE TKN:	N/a mg/L	
	8.0 mg/L		1 L 11011.	Tiva mg/L	
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	690 lbs/d		-		
	252 1000 lbs/yr 5037 1000 lbs/20	wars			
	5037 1000 lbs/20	-years			
CURRENT PROCESS (CHECK	ALL THAT APPLY	YMIE		- Existing Aerated Volume (N	IG): N/a
CORRENT FROCESS (CHECK	ALL IIIAI ALLEI	BEPR (A2/0, VIP, etc.)		Existing Anoxic Volume (M	
		Bardenpho	·	Current MLSS at Winter A	
		Oxidation Ditch			
		Lagoon (Biolac, etc.)			
l	5),	Cyclical Aeration			
		SBR			
		High-Rate Biofilter			
		X Effluent Filtration			
		X Other Denite Filte	ore		
		Nother Define Fine	13		
CURRENT SEEL USAIT ANNOU	MIA NI: 24 0	Y From Report			
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/	From Keport	od lood 15 d #405	T 120 C winter conditions	
84		From Model (at ADF a	na ioaa, 15 a MCR	T, 12° C winter conditions)	
THE STATE OF THE S		Terror Countries	**		
PROPOSED MODIFICATIONS	TO GET AMMONIA		**		
		X No modifications requi		an areas and the second	New MLSS
		Raise MCRT/MLSS in			N/a
		Construct additional ac	erated volume	Flow (mgd): 0	
		Construct additional cla		Flow (mgd): 0	
ł .		Use existing anoxic vol	lume as aerobic (co	onstruct separate denit facili	ty)
	1.2	Use aerated system fo	r BOD removal only	y (construct separate nit/der	nit facility)
		Add influent flow equal			
a		Other:	CALL DEFE	10世 - 100 - 200 海线水色设计	CONTRACTOR
L		14 87			
PROPOSED MODIFICATIONS	TO GET NITRATE		1.0		
		No modifications require		14	
AV		Add downstream DeNi			
				DeNit filter with methanol	
		Add methanol to existing			
18		Add downstream anoxi	ic tank with methan	ol feed	
	14	Add effluent filtration	and the form of the action of the second	*	
		X Other: Add additor	nal methanol to exis	sting denite filter	
	13			•	
CAPITAL COST:	Equipment and Str	ructures (from Page 2):	\$0	£	
	Electrical and Instr	umentation: 12%	\$ 0		
	Yard Piping and Si	te Work: 15%	\$0		
	Subtotal:	, .	\$0		
	Contractor OH&P:	15%	\$0		
	Engineering and C	onstr. Mamt: 15%	\$0		2
71	Subtotal:		\$0		
6.	Contingency:	30%	\$0	in a	
	Total Capital Cost:		\$0		
1,5		. 20-Yr. N removal:	\$0.00		
	Capital Cost per lo	. 20-11-14 10:110-41.	******		
OPERATIONS COST:	Additional Horson	ower (from Page 2):	0 HP		
OPERATIONS COST.		- · · · · · · · · · · · · · · · · · · ·	\$0 \$/y		
.e. 54	Electrical Power C		5.0 mg		
	Nitrate Reduction		320 gal		
180	Methanol Required		_		
~~	Methanol Cost:	0.75 \$/gal	\$87,600 \$/y		15
		nmonia Reduction:		•	
	Caustic Soda @ 2		0 gal		
	Caustic Soda Cost		\$0 \$/y		
<u> </u>	Equipment Mainter		\$0 \$/y		
	Denitrification Sluc	ge Production w/Methanol	1000 lbs		
	Sludge Disposal C	ost: 400 \$/ton	\$73,000 \$/y		
	Total Annual O&M	Cost:	\$160,600 \$/y	ear -	
	Effective Annual In	terest Rate after Inflation:	2.91%		
		orth of O&M Costs:	\$2,410,000	. 2	
					16
TOTAL 20-YEAR PRESENT W	ORTH COST:		\$2,410,000	19	-
VAC-11	Total Cost per lb 2	20-Yr N removal	\$0.48		
N	. 0.0. 000, po. 10 1		*		

PROJECT: PREPARED FOR: PREPARED BY:	Implementing a 3 mg/L An USEPA, Chesapeake Bay (Office	Nitrogen Limit		
DATE:	Virginia Tech with Stearns & Wheler, LLC				
FACILITY:	March 19, 2001 Winebrenner WWTP				
LOCATION:	Washington County, MD				
RATED FLOW:	0.6 mgd		PE COD: 365 mg/L		
CURRENT EFFLUENT TN:	16.5 mg/L		PE TKN: 22 mg/L		
EFFLUENT TN GOAL:	3.0 mg/L	*			
NITROGEN REDUCTION:	70 lbs/d				
	26 1000 lbs/yr				
	511 1000 lbs/20-years				
CURRENT PROCESS (OUT					
CURRENT PROCESS (CHEC			Existing Aerated Volume		
		PR (A2/0, VIP, etc.)	Existing Anoxic Volume	7.37.45	
	-	denpho dation Ditch	Current MLSS at Winter	ADF: N/a	
		oon (Biolac, etc.)			
		lical Aeration			
	SBF				
		n-Rate Biofilter			
N =		uent Filtration			
	X Othe		ed by Denite Filters		
	L104	. 110001011011	CO DY COME LINES		
CURRENT EFFLUENT AMMO			d load, 15 d MCRT, 12° C winter conditions)	
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/l				
TO TON		nodifications require	ad.	Marriag 00	
*			xisting tanks (check clarifier capacity)	New MLSS	
		struct additional aer		N/a	
		struct additional cla			
			me as aerobic (construct separate denit fac		
	Use	aerated system for	BOD removal only (construct separate nit/de	anty) Anit facility)	
		influent flow equaliz		still facility)	
	Othe				
	Add Add Add Add	methanol to existing downstream anoxic effluent filtration	ilter with methanol ation Biofilter and DeNit filter with methanol BNR process tank with methanol feed	S. White of the other	
	X Othe	r: Add addition	I methanol to existing Denite Filter	CALL PROPERTY	
CAPITAL COST:	Equipment and Structures (fro	m Page 2):	\$0		
3	Electrical and Instrumentation:		\$0		
	Yard Piping and Site Work:	15%	\$0		
	Subtotal:	1370	\$0		
	Contractor OH&P:	15%	\$0		
	Engineering and Constr. Mgmt		\$0		
	Subtotal:	. 1070	\$0		
	Contingency:	30%	\$0		
	Total Capital Cost:	• • • • • • • • • • • • • • • • • • • •	\$0		
	Capital Cost per lb. 20-Yr. N re	emoval:	\$0.00		
OPERATIONS COST:	Additional Horsepower (from P	age 2)	0 HP		
	Electrical Power Cost:	0.05 \$/kW	\$0 \$/year		
	Nitrate Reduction using Metha	nol:	13.5 mg/L		
	Methanol Required:		30 gals/d		
3	Methanol Cost:	0.75 \$/gal	\$8,200 \$/year		
4	Separate Stage Ammonia Red	uction:	0.0 mg/L		
	Caustic Soda @ 25% conc.		0 gals/d	L	
	Caustic Soda Cost:	0.60 \$/gal	\$0 \$/year		
	Equipment Maintenance Cost:		\$0 \$/year		
~	Denitrification Sludge Production		100 lbs/d		
	Śludge Disposał Cost:	400 \$/ton	\$7,300 \$/year		
	Total Annual O&M Cost:		\$15,500 \$/year		
	Effective Annual Interest Rate a		2.91%		
	20-Year Present Worth of O&M	l Costs:	\$230,000	9	
OTAL 20 VEAR STEER	X 25				
OTAL 20-YEAR PRESENT WO			\$230,000		
	Total Cost per lb. 20-Yr. N remo	oval:	\$0.45		

SUMMARY COST SHEETS FOR THE 2 NEW YORK WWTPS

PROJECT:	Implementing a 3	mg/L Annual Average Total	al Nitrogen Limit	11	~~·
PREPARED FOR:	USEPA, Chesape		(1020126-14-11-000 - 01-2015-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-		
PREPARED BY:	Virginia Tech with	n Stearns & Wheler, LLC			
DATE:	March 11, 2001				
FACILITY:	Binghamton-John	son City WWTP			
LOCATION:	Binghamton, NY				
RATED FLOW:	25.0 mgd	,	PE COD: _		
CURRENT EFFLUENT TN:	8.0 mg/L		PE TKN:_	18mg/L	
EFFLUENT TN GOAL:	3,0 mg/L				
NITROGEN REDUCTION:	1040 lbs/d				
	380 1000 lbs/yr				
	7592 1000 lbs/20	-years			
CURRENT PROCESS (CHECK	(ALL THAT APPLY)	XMLE		Existing Aerated Volun	ne (MG): 1.82
00	.,,== .,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	BEPR (A2/0, VIP, etc.	.)	Existing Anoxic Volum	
-		Bardenpho		Current MLSS at Win	ter ADF: 2700
		Oxidation Ditch			
100		Lagoon (Biolac, etc.)			
		Cyclical Aeration			
		SBR		92	
		High-Rate Biofilter			
		Effluent Filtration			
			BAFs for 12.5 mgd		-17
400		TWIS D. A.			
CURRENT EFFLUENT AMMO	NIA-N: 0.5 mg/L	From Report	and load, 15 d MCI	RT, 12° C winter condition	ne)
		From Wodel (at ADF a	and load, 15 d Wici	VI, 12 C WINTER CONDITION	nis)
PROPOSED MODIFICATIONS	TO GET AMMONIA	< 1.0 mg/L:			
		X No modifications requ	ired		New MLSS
		Raise MCRT/MLSS in	existing tanks (ch	eck clarifier capacity)	N/a
		Construct additional a	erated volume	Flow (mgd):	0
		Construct additional c	larifiers	Flow (mgd):	0 1
		Use existing anoxic vo	olume as aerobic (construct separate denit	facility)
		Use aerated system for	or BOD removal or	nly (construct separate n	it/denit facility)
		Add influent flow equa			
		Other:	· · · · · · · · · · · · · · · · · · ·		the state of the s
					
PROPOSED MODIFICATIONS	TO GET NITRATE <	1.0 mg/L:			~
		No modifications requi	ired		
i		X Add downstream DeN			
		Add downstream Nitrif	fication Biofilter an	d DeNit filter with metha	nol
		Add methanol to exist	ing BNR process		
X0		Add downstream anox	dic tank with metha	nol feed	
	(8)	Add effluent filtration			
		Other:			
CAPITAL COST:	, ,	uctures (from Page 2):	\$9,700,000		
	Electrical and Instru				5 5
	Yard Piping and Sit	e Work: 15%			4.
H _ C	Subtotal:		\$12,320,000		
	Contractor OH&P:	15%		381	
	Engineering and Co	onstr. Mgmt: 15%	\$1,848,000		
	Subtotal:		\$16,020,000		
	Castianoppe	30%			
	Contingency:	0070	\$3,696,000		
27	Total Capital Cost:	307	\$3,696,000 \$19,720,000		^
20					786 286
ODED ATIONS SOCT	Total Capital Cost: Capital Cost per lb.	20-Yr. N removal:	\$19,720,000 \$2.60	p	240
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo	20-Yr. N removal: wer (from Page 2):	\$19,720,000 \$2.60 500 H		340
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW	\$19,720,000 \$2.60 500 H \$163,400 \$	/year	240
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol:	\$19,720,000 \$2.60 500 H \$163,400 \$ 5.0 m	/year ng/L	380 ⁽⁷⁾
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required	20-Yr, N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol:	\$19,720,000 \$2.60 500 H \$163,400 \$ 	/year ng/L als/d	39C
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost:	20-Yr. N removal: wer (from Page 2): bst: 0.05 \$/kW sing Methanol: 0.75 \$/gal	\$19,720,000 \$2.60 \$500 H \$163,400 \$ 5.0 m 470 g \$128,700 \$.	/year ng/L als/d /year	1000 m
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Stage Am	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol: : 0.75 \$/gal	\$19,720,000 \$2.60 500 H \$163,400 \$ 5.0 m 470 g \$128,700 \$	/year ng/L als/d /year ng/L	980 *
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Stage Arr Caustic Soda @ 25	20-Yr, N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol: : 0.75 \$/gal monia Reduction:	\$19,720,000 \$2.60 500 H \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m	/year ng/L als/d /year ng/L als/d	380
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Stage Arr Caustic Soda @ 25 Caustic Soda Cost:	20-Yr, N removal: wer (from Page 2): sst: 0.05 \$/kW sing Methanol: 0.75 \$/gal monia Reduction: % conc. 0.60 \$/gal	\$19,720,000 \$2.60 500 H \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m 0 g \$0 \$0	/year ng/L als/d /year ng/L als/d /year	280
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Stage Arr Caustic Soda @ 25: Equipment Mainten	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol: 0.75 \$/gal mnonia Reduction: % conc. 0.60 \$/gal ance Cost:	\$19,720,000 \$2.60 500 H \$163,400 \$ 5.0 m 470 g \$128,700 \$. 0.0 m 0 g \$0 \$.	/year ng/L als/d /year ng/L als/d /year /year	390
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Slage Am Caustic Soda @ 25 Caustic Soda Cost: Equipment Mainten Denitrification Sludge	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol: : 0.75 \$/gal mnonia Reduction: 0/6 conc. 0.60 \$/gal ance Cost: ge Production w/Methanol	\$19,720,000 \$2.60 \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m 0 g \$160,200 \$ \$160,200 \$	/year ng/L als/d r/year ng/L als/d /year /year	38C
OPERATIONS COST:	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Stage Arr Caustic Soda @ 25 Caustic Soda Cost: Equipment Mainten Dentrification Study Studge Disposal Cost	wer (from Page 2): ost: 0.05 \$/kW sing Methanol: : 0.75 \$/gal amonia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanol ost: 400 \$/ton	\$19,720,000 \$2.60 500 H \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m 0 g \$0 \$ \$160,200 \$ \$160,200 \$ \$1500 lb	/year ng/L als/d ryear ng/L dals/d ryear ryear ryear ryear	28C
OPERATIONS COST:	Total Capital Cost: Capital Cost per Ib. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Stage Am Caustic Soda @ 25 Caustic Soda Cost: Equipment Mainten Denitrification Sludg Sludge Disposal Co Total Annual O&M	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol: : 0.75 \$/gal amonia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanol ost: 400 \$/ton Cost:	\$19,720,000 \$2.60 \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m 0 g \$ 0 \$ \$160,200 \$ 1500 lb \$109,500 \$	/year ng/L als/d ryear ng/L dals/d ryear ryear ryear ryear	220
OPERATIONS COST:	Total Capital Cost: Capital Cost per Ib. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Stage Am Caustic Soda @ 25 Caustic Soda Cost: Equipment Mainten Denitrification Sludg Sludge Disposal Co Total Annual O&M Effective Annual Int	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol: : 0.75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanol ost: 400 \$/ton Cost: erest Rate after Inflation:	\$19,720,000 \$2.60 \$163,400 \$ \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m 0 g \$0 \$ \$160,200 \$ 1500 lb \$109,500 \$ \$561,800 \$ 2.91%	/year ng/L als/d ryear ng/L dals/d ryear ryear ryear ryear	280
OPERATIONS COST:	Total Capital Cost: Capital Cost per Ib. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Stage Am Caustic Soda @ 25 Caustic Soda Cost: Equipment Mainten Denitrification Sludg Sludge Disposal Co Total Annual O&M	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol: : 0.75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanol ost: 400 \$/ton Cost: erest Rate after Inflation:	\$19,720,000 \$2.60 \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m 0 g \$ 0 \$ \$160,200 \$ 1500 lb \$109,500 \$	/year ng/L als/d ryear ng/L dals/d ryear ryear ryear ryear	787
	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Slage Am Caustic Soda @ 25 Caustic Soda Cost: Equipment Mainten Denitrification Sludge Sludge Disposal Co Total Annual O&M Effective Annual Int 20-Year Present W	20-Yr. N removal: wer (from Page 2): ost: 0.05 \$/kW sing Methanol: : 0.75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanol ost: 400 \$/ton Cost: erest Rate after Inflation:	\$19,720,000 \$2.60 500 H \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m 0 g \$0 \$ \$1500 lb \$109,500 \$ \$561,800 \$ 2.91% \$8,430,000	/year ng/L als/d ryear ng/L dals/d ryear ryear ryear ryear	780
OPERATIONS COST: TOTAL 20-YEAR PRESENT W	Total Capital Cost: Capital Cost per lb. Additional Horsepo Electrical Power Co Nitrate Reduction u Methanol Required Methanol Cost: Separate Slage Am Caustic Soda @ 25 Caustic Soda Cost: Equipment Mainten Denitrification Sludge Sludge Disposal Co Total Annual O&M Effective Annual Int 20-Year Present W	wer (from Page 2): ost: 0.05 \$/kW sing Methanol: 0.75 \$/gal mnonia Reduction: % conc. 0.60 \$/gal ance Cost: ge Production w/Methanol ost 400 \$/ton Cost: erest Rate after Inflation: orth of O&M Costs:	\$19,720,000 \$2.60 \$163,400 \$ \$163,400 \$ 5.0 m 470 g \$128,700 \$ 0.0 m 0 g \$0 \$ \$160,200 \$ 1500 lb \$109,500 \$ \$561,800 \$ 2.91%	/year ng/L als/d ryear ng/L dals/d ryear ryear ryear ryear	

PROJECT:	Implementing a 3 mg . Annual Average Total	il Nitrogen Limit
	USEPA, Chesapeake Bay Office	William Carlos C
PREPARED FOR:	USEPA, Chesapeake Day Office	70
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
E-0:5576	March 11, 2001	12
DATE:		
FACILITY:	Endicott WWTP	
LOCATION:	Endicott, NY	
RATED FLOW:	8.0 mgd	PE COD: 100 mg/L
CURRENT EFFLUENT TN:	8.0 mg/L	PE TKN:26mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
	330 lbs/d	
NITROGEN REDUCTION:		
	120 1000 lbs/yr	
	2409 1000 lbs/20-years	
		Friedian Annotad Valuma (MCV)
CURRENT PROCESS (CHECK	ALL THAT APPLY): MLE	Existing Aerated Volume (MG):1.82
	BEPR (A2/0, VIP, etc.)) Existing Anoxic Volume (MG): 0.78
	Bardenpho	Current MLSS at Winter ADF: 2700
	1	Ourient Wedd at Winter 7.51 . 22.00
75	Oxidation Ditch	
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
	SBR	
	W High Rate Biofilter with	n Solids Contact Activated Sludge
		. apilip adilitati, intrata diadga
I	Effluent Filtration	and the second s
ľ	X Other: Denite Filte	ers
1	2000	
NORTH CONTROL		
CURRENT EFFLUENT AMMON	IA-N: <1.0 mg/L From Report	
	. I From Model (at ADE a	nd load, 15 d MCRT, 12° C winter conditions)
I	F. J. Iour Moder (at Yor a	
		9
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	9 2
The state of the s	X No modifications requi	red New MLSS
5000	A No modifications requi	
	Raise MCRT/MLSS in	existing tanks (check clarifier capacity)
	Construct additional ad	erated volume Flow (mgd): 0
	Construct additional cl	
1	Construct additional ci	
	Use existing anoxic vo	lume as aerobic (construct separate denit facility)
	Use aerated system for	r BOD removal only (construct separate nit/denit facility)
1	Add influent flow equa	lization tank
ł	Other:	
Construent construence	The Control Control of the Control o	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	
	No modifications requi	red *
	Add downstream DeNi	
1	Add downstream Deni	it likel with methanor
	Add downstream Nitrif	ication Biofilter and DeNit filter with methanol
	Add methanol to existi	ng BNR process
121		
l .		ic tank with methanol feed
1 .	Add effluent filtration	and the second s
R	X Other: Add Addition	onal Methanol to Denite Filters
	A Other Add Addition	That Medianolia Define 1 maio
CAPITAL COST:	Equipment and Structures (from Page 2):	\$0
	Electrical and Instrumentation: 12%	1
I	Electrical and instrumentation. 1276	
8	Yard Piping and Site Work: 15%	
1	Subtotal:	\$0
- 12		\$0
I	COMMISSION CONTRACT :	
I	Engineering and Constr. Mgmt: 15%	\$0
I		\$0
I	Subtotal:	
I	Contingency: 30%	
j .	Total Capital Cost:	\$0
l	Capital Cost per lb. 20-Yr. N removal:	\$0.00
	Capital Cost per lo, 20-11. N Tellioval.	70.00
OPERATIONS COST:	Additional Horsepower (from Page 2):	0 HP
or Environd Coot.	Flectrical Power Cost: 0.05 \$/kW	\$0 \$/year
1		
ł .	Nitrate Reduction using Methanol:	5.0 mg/L
	Methanol Required:	150 gals/d
1		-
I	Methanol Cost: 0.75 \$/gal	\$41,100 \$/year
	Separate Stage Ammonia Reduction:	0.0_mg/L
į.	Caustic Soda @ 25% conc.	0 gals/d
1		
1	Caustic Soda Cost 0.60 \$/gal	\$0 \$/year
	Equipment Maintenance Cost:	\$0 \$/year
	Denitrification Sludge Production w/Methanol	480 lbs/d
L		
K	Sludge Disposal Cost: 400 \$/ton	\$35,000 \$/year
I	Total Annual O&M Cost:	\$76,100 \$/year
	Effective Annual Interest Rate after Inflation:	2,91%
I .		
1	20-Year Present Worth of O&M Costs:	\$1,140,000
1		
TOTAL 20 VEAR DRESENTING	NETH COST:	\$1,140,000
TOTAL 20-YEAR PRESENT WO		
I	Total Cost per lb. 20-Yr. N removal:	\$0.47
I		

SUMMARY COST SHEETS FOR THE 26 VIRGINIA WWTPS

			1 1 1 1 1 1 1 1 1 1 1	
PROJECT:		L Annual Average Tota	il Nitrogen Limit	
PREPARED FOR:	USEPA, Chesapeake	Bay Office		
PREPARED BY:	Virginia Tech with St	earns & Wheler, LLC		
DATE:	March 16, 2001 ,			F.C.
FACILITY:	Arlington WWTP	_		
LOCATION:	Adington, VA			
RATED FLOW:	30.0 mgd		PE COD: 30	0 mg/L
DATE OF THE PROPERTY OF THE PR			PE TKN: 2	 =
CURRENT EFFLUENT TN:	8.0 mg/L		PE INNZ	rmg/L
EFFLUENT TN GOAL:	3.0 mg/L			
NITROGEN REDUCTION:	1250 lbs/d			
	456 1000 lbs/yr			
		22		
	9125 1000 lbs/20-yea	rs		
	- 1			
CURRENT PROCESS (CHECK	ALL THAT APPLY):	MLE	Exis	sting Aerated Volume (MG):1.82
		BEPR (A2/0, VIP, etc.) Ex	isting Anoxic Volume (MG): 0.78
	-	Bardenpho		rrent MLSS at Winter ADF: 3000
	_		Cu	TELL WILOO BY WHITE ADT . 3000
		Oxidation Ditch		
		Lagoon (Biolac, etc.)		
and the second second	_	Cyclical Aeration		
		SBR		
	-			
		High-Rate Biofilter		
		Effluent Filtration		
U.	5		MLE, no nitrate recycle	Deen Bed Filters
U.	L	Collect. Otep-1 eed	man no moute recycle	1.5.7
L		Tie n		
CURRENT EFFLUENT AMMON	NA-N: <1.0 mg/L)	∐+rom Report		
		From Model (at ADF a	ind load, 15 d MCRT, 1	2° C winter conditions)
	_			•
PROPOSED MORISIONS	TO CET AMMONIA HA	0 ma/l ·		
PROPOSED MODIFICATIONS			Card N	M AM 00
	. [)	No modifications requi		New MLSS
		Raise MCRT/MLSS in	existing tanks (check of	clarifier capacity) N/a
ik.		Construct additional a	erated volume	Flow (mgd): 0
	-	Construct additional cl		Flow (mgd):
	<u> </u>			
		Use existing anoxic vo	lume as aerobic (const	ruct separate denit facility)
	3	Use aerated system for	or BOD removal only (co	onstruct separate nit/denit facility)
- 24	-	Add influent flow equa		
	1	Other:	PERMITTEN TO THE PERMIT	THE PERSON NAMED IN COLUMN TWO IN COLUMN TO SERVICE AND ADDRESS OF THE PERSON NAMED A
<u> </u>	1	Jourer.	ALTERNATION OF THE PROPERTY OF	
	5			2
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0	mg/L:		
INSTACTATI		No modifications requi	ired	*
	7.4	Add downstream DeN		
				Nit filter with methanol
	2.0		ication Biofilter and Del	Nit filter with methanol
)	Add methanol to existi	ing BNR process	V4
	7 7	Add downstream anox	ic tank with methanol for	ee d
	1	Add effluent filtration		
	<u> </u>		The second second second second	CORP. A. M. SECRETARION STREET, SEC.
in the second se	. [2	Other: Convert ex	isting deep bed effluen	filters to denite filters
				22
CAPITAL COST:	Equipment and Structu	res (from Page 2):	\$2,950,000	
SAITTAL 0001.				
-	Electrical and Instrume			
	Yard Piping and Site V	/ork: 15%		
	Subtotal:		\$3,750,000	
	Contractor OH&P:	15%	\$563,000	
	Engineering and Const	www.		
xx	Subtotal:		\$4,880,000	19
	Contingency:	30%	\$1,125,000	
	Total Capital Cost:	9	\$6,010,000	
		Vr. N. romovol:	\$0.66	
	Capital Cost per lb. 20-	TI N TEINOVAL	₽0.00	
OPERATIONS COST:	Additional Horsepower	(from Page 2):	0 HP	
00000 TANAVOV	Electrical Power Cost:	0.05 \$/kW	\$0 \$/year	
			5.0 mg/L	
	Nitrate Reduction using	I MELITATION		
II w	Methanol Required:		570 gals/d	
	Methanol Cost:	0.75 \$/gal	\$156,000 \$/year	
l.	Separate Stage Ammo	_	0.0 mg/L	
l '			0 gals/d	
	Caustic Soda @ 25% o		-	
	Caustic Soda Cost:	0.60 \$/gal	\$0 \$/year	
	Equipment Maintenand	e Cost:	\$48,800 \$/year	
		Production w/Methanol:	1800 lbs/d	
K	Sludge Disposal Cost:	400 \$/ton	\$131,400 \$/year	
	Total Annual O&M Cos	t: `	\$336,200 \$/year	
	Effective Annual Intere		2.91%	
•	20-Year Present Worth	OI UMM COSTS:	\$5,040,000	
and the same of th				
TOTAL 20-YEAR PRESENT W	ORTH COST:		\$11,050,000	
	Total Cost per lb. 20-Y	. N removal:	\$1.21	
	. Oldi Codi poi lo Eo-11	9	• /	

PROJECT:	Implementing a 3 mg/L Annual Average	Total Nitrogen Limit		
PREPARED FOR:	USEPA, Chesapeake Bay Office	97,839		
PREPARED BY:	Virginia Tech with Stearns & Wheler, LL	С		72.1
DATE:	March 19, 2001			
FACILITY:	Colonial Beach WWTP			
LOCATION:	Colonial Beach, VA	•		
RATED FLOW:	2.0 mgd	PE COD:	N/a mg/L	
CURRENT EFFLUENT TN:	7.0 mg/L	PE TKN:	N/a mg/L	
EFFLUENT TN GOAL:	3.0 mg/L		1197E	
NITROGEN REDUCTION:	70 lbs/d			
MIROGEN REDUCTION.				
	26 1000 lbs/yr			
	511 1000 lbs/20-years			
CURRENT PROCESS (CHEC	WALL THAT ADDI VI. THE	5	Existing Apratod Volume (MC	
CORRENT PROCESS (CHEC		-1-1	Existing Aerated Volume (MG	
	BEPR (A2/0, VIP,	etc.)	Existing Anoxic Volume (MG	
	Bardenpho		Current MLSS at Winter ADI	N/a
l	Oxidation Ditch			
	Lagoon (Biolac, et	c.)		
	X Cyclical Aeration			
	SBR			
	High-Rate Biofilter			
	Effluent Filtration			
	Other		135	+47.74
	outer.			
CURRENT EFFLUENT AMMO	NIA-N: 0.5 mg/L X From Report			
(227.102.000 N)		E and load 15 d MCR	T, 12° C winter conditions)	
		and load, to a more	1, 12 0 Willer Collegeoris)	
PROPOSED MODIFICATION	S TO GET AMMONIA < 1.0 mg/L:			
I TO OULD MODIFICATION	X No modifications re	aguired		Nous MI CC
			-1120	New MLSS
5" . V		S in existing tanks (che		N/a
	Construct additional		Flow (mgd):0	_
	. Construct additional	al clarifiers	Flow (mgd):0"	_
			onstruct separate denit facility)	
	Use aerated system	n for BOD removal only	y (construct separate nit/denit	facility)
			· ·	
	Add influent flow ed	qualization tank		11
PROPOSED MODIFICATIONS	Other: TO GET NITRATE < 1.0 mg/L:	A THE		1 5019
PROPOSED MODIFICATIONS	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re X Add downstream D Add downstream N Add methanol to ex	equired leNit filter with methand litrification Biofilter and kisting BNR process noxic tank with methan	DeNit filter with methanot	
PROPOSED MODIFICATIONS	Other: Other: No modifications re X Add downstream D Add downstream N Add methanol to ex Add downstream a	equired leNit filter with methand litrification Biofilter and kisting BNR process noxic tank with methan	DeNit filter with methanot	
PROPOSED MODIFICATIONS	Other: TO GET NITRATE < 1.0 mg/L: No modifications re Add downstream N Add downstream N Add methanol to ex Add downstream at Add effluent filtratio	equired leNit filter with methand litrification Biofilter and kisting BNR process noxic tank with methan	DeNit filter with methanot	
	Other: TO GET NITRATE < 1.0 mg/L: No modifications re Add downstream N Add downstream N Add methanol to ex Add downstream at Add effluent filtratio	equired leNit filter with methand litrification Biofilter and kisting BNR process noxic tank with methan	DeNit filter with methanot	
	Other: TO GET NITRATE < 1.0 mg/L: No modifications re Add downstream N Add methanol to ex Add downstream al Add downstream al Add effluent filtratio Other: Equipment and Structures (from Page 2):	equired eNit filter with methano kisting BNR process noxic tank with methanon \$1,650,000	DeNit filter with methanot	
PROPOSED MODIFICATIONS CAPITAL COST:	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re X Add downstream D Add downstream N Add methanol to ex Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation:	equired lenit filter with methanolitrification Biofilter and kisting BNR process noxic tank with methanon \$1,650,000 2% \$198,000	DeNit filter with methanot	
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re Add downstream D Add methanol to ex Add downstream al Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work:	equired leNit filter with methano itrification Biofilter and kisting BNR process noxic tank with methanon \$1,650,000 2% \$198,000 5% \$248,000	DeNit filter with methanot	
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re X Add downstream D Add methanol to ex Add downstream ai Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 1: Yard Piping and Site Work: 1: Subtotal:	equired lenit filter with methano litrification Biofilter and disting BNR process moxic tank with methano strict tank wit	DeNit filter with methanot	
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re Add downstream D Add methanol to ex Add downstream ai Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: 1.0 mg/L: No modifications re Add downstream ai Add effluent filtratio Other: 1.1 Subtotal: Contractor OH&P: 1.2 Subtotal: Contractor OH&P: 1.3 Subtotal: Contractor OH&P: 1.4 Subtotal: Contractor OH&P: 1.5 Subtotal: Contractor OH&P: 1.5 Subtotal: Contractor OH&P: Contractor	equired litrification Biofilter and disting BNR process noxic tank with methanon \$1,650,000 2% \$198,000 5% \$248,000 \$2,100,000 5% \$315,000	DeNit filter with methanot	
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re Add downstream N Add downstream N Add downstream N Add downstream all Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 1: Yard Piping and Site Work: 1: Subtotal: Contractor OH&P: 1: Engineering and Constr. Mgmt: 1:	equired denit filter with methanolitrification Biofilter and disting BNR process noxic tank with methanol \$1,650,000 \$1,650,000 \$2,100,000 \$2,100,000 \$3,15,000 \$3,15,000	DeNit filter with methanot	
	Other: No modifications re Add downstream N Add methanol to ex Add downstream al Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal:	equired lenit filter with methanolitirification Biofilter and kisting BNR process noxic tank with methanolitirification BNR process noxic tank with methanolitirification by \$1,650,000 \$1,98,000 \$2,100,000 \$2,100,000 \$315,000 \$2,730,000	DeNit filter with methanot	
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re X Add downstream D Add downstream N Add methanol to ex Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: 36	equired eleNit filter with methanolitrification Biofilter and kisting BNR process noxic tank with methanon \$1,650,000 \$2,100,000 \$2,100,000 \$2,100,000 \$2,730,000 \$2,730,000 \$630,000	DeNit filter with methanot	
	Other: No modifications re Add downstream N Add methanol to ex Add downstream al Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal:	equired lenit filter with methanolitirification Biofilter and kisting BNR process noxic tank with methanolitirification BNR process noxic tank with methanolitirification by \$1,650,000 \$1,98,000 \$2,100,000 \$2,100,000 \$315,000 \$2,730,000	DeNit filter with methanot	
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re X Add downstream D Add downstream N Add methanol to ex Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: 36	equired eleNit filter with methanolitrification Biofilter and kisting BNR process noxic tank with methanon \$1,650,000 \$2,100,000 \$2,100,000 \$2,100,000 \$2,730,000 \$2,730,000 \$630,000	DeNit filter with methanot	
	Other: S TO GET NITRATE < 1.0 mg/L: No modifications re Add downstream D Add downstream N Add methanol to ex Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency Total Capital Cost:	squired leNit filter with methanolitrification Biofilter and disting BNR process noxic tank with methanolitrification Biofilter and sisting BNR process noxic tank with methanolitrification (1,000 % 1,650,000 % \$1,650,000 % \$315,000 % \$2,730,000 % \$630,000 % \$3,360,000	DeNit filter with methanot	
CAPITAL COST:	Other: No modifications re Add downstream D Add downstream N Add downstream N Add downstream at Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency Total Capital Cost:	squired leNit filter with methanolitrification Biofilter and disting BNR process noxic tank with methanolitrification Biofilter and sisting BNR process noxic tank with methanolitrification (1,000 % 1,650,000 % \$1,650,000 % \$315,000 % \$2,730,000 % \$630,000 % \$3,360,000	DeNit filter with methanot of feed	
CAPITAL COST:	Other: STO GET NITRATE < 1.0 mg/L: No modifications re Add downstream N Add downstream N Add downstream N Add downstream al Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 20-Yr. N removal:	sequired lenit filter with methano litrification Biofilter and disting BNR process moxic tank with methano \$1,650,000 \$1,650,000 \$1,98,000 \$2,100,000 \$2,100,000 \$3,315,000 \$2,730,000 \$2,730,000 \$3,360,000 \$3,360,000 \$6.58	DeNit filter with methanot of feed	
	Contractor OH&P: Engineering and Constr, Mgmt: Subtotal: Contractor OH&P: Engineering and Constr, Mgmt: Subtotal: Contingency Total Capital Cost: Capital Cost per lb 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: Other: No modifications re Add downstream N Add methanol to ex Add downstream N Add downstream N Add downstream N Add methanol to ex Add downstream N Ad	sequired lenit filter with methanolitrification Biofilter and disting BNR process noxic tank with methanol \$1,650,000 \$1,650,000 \$1,650,000 \$1,850,000 \$2,100,000 \$2,100,000 \$3,350,000 \$3,360,000 \$6,58 40 HP \$13,100 \$/ye	DeNit filter with methanol ol feed	
CAPITAL COST:	Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Contractor OH&P	sequired leNit filter with methanolitrification Biofilter and kisting BNR process noxic tank with methanon \$1,650,000 2% \$198,000 5% \$248,000 \$2,100,000 \$5,15,000 \$2,730,000 \$3,360,000 \$3,360,000 \$6,58 40 FP \$13,100 \$/ye 4.0 mg	DeNit filter with methanol ol feed	
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CAPITAL COST:	Other: No modifications re Add downstream D Add downstream No Add downstream No Add downstream No Add downstream No Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 1: Yard Piping and Site Work: 1: Subtotal: Contractor OH&P: 1: Engineering and Constr. Mgmt: 1: Subtotal: Contingency 3: Total Capital Cost: Capital Cost per lb 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal	sequired lenit filter with methanolitrification Biofilter and disting BNR process noxic tank with methanolitrification Biofilter and disting BNR process noxic tank with methanolitrification by the sequence of the sequence	DeNit filter with methanot of feed ear /L s/d ear	
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CAPITAL COST:	Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency Total Capital Cost: Capital Cost per lb. 20-Yr N removal: Additional Horsepower (from Page 2): Electrical Power Cost: O.05 \$/kW Nitrate Reduction using Methanol: Methanol Cost: Methanol Cost: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: O.60 \$/gal	\$1,650,000 \$1,650,000 \$1,650,000 \$2,48,000 \$2,100,000 \$2,100,000 \$3,15,000 \$2,730,000 \$3,360,000 \$3,360,000 \$6,58 40 FP \$13,100 \$/ye 4.0 mg 30 gale \$8,200 \$/ye \$27,300 \$/ye \$27,300 \$/ye	ear /L s/d ear /L s/d ear ear	
CAPITAL COST:	Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Contractor	\$1,650,000 \$1,650,000 \$1,650,000 \$2,48,000 \$2,100,000 \$2,100,000 \$3,15,000 \$2,730,000 \$3,360,000 \$3,360,000 \$6,58 40 FP \$13,100 \$/ye 4.0 mg 30 gale \$8,200 \$/ye \$27,300 \$/ye \$27,300 \$/ye	ear /L s/d ear /L s/d ear /L s/d ear	
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CAPITAL COST:	Other: STO GET NITRATE < 1.0 mg/L: No modifications re Add downstream D Add downstream N Add downstream N Add downstream I Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: O.05 \$/kW Nitrate Reduction using Methanol: Methanol Cost: Methanol Cost: O.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: U.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost:	\$1,650,000 \$1,650,000 \$1,650,000 \$1,650,000 \$1,98,000 \$2,100,000 \$2,100,000 \$2,100,000 \$3,350,000 \$2,730,000 \$630,000 \$6,58 40 HP \$13,100 \$/ye 4.0 mg 30 gals \$8,200 \$/ye 0.0 mg/c \$27,300 \$/ye \$55,900 \$/ye \$55,900 \$/ye	ear /L s/d ear /L s/d ear /L s/d ear ear	
CAPITAL COST:	Other: STO GET NITRATE < 1.0 mg/L: No modifications re Add downstream D Add downstream N Add methanol to ex Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 1: Yard Piping and Site Work: 1: Subtotal: Contractor OH&P: 1: Engineering and Constr. Mgmt: 1: Subtotal: Contingency 3: Contingency 3: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	\$1,650,000 \$1,650,000 \$1,650,000 \$2,48,000 \$2,100,000 \$2,100,000 \$3,15,000 \$2,730,000 \$3,360,000 \$3,360,000 \$6,58 40 HP \$13,100 \$/ye 4.0 mg 30 gals \$8,200 \$/ye \$27,300 \$/ye \$55,900 \$/ye \$29,91% \$840,000	ear /L s/d ear /L s/d ear /L s/d ear ear	
CAPITAL COST:	Other: STO GET NITRATE < 1.0 mg/L: No modifications re Add downstream D Add downstream N Add methanol to ex Add downstream at Add effluent filtratio Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 1: Yard Piping and Site Work: 1: Subtotal: Contractor OH&P: 1: Engineering and Constr. Mgmt: 1: Subtotal: Contingency 3: Contingency 3: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	sequired servith methanoc litrification Biofilter and disting BNR process noxic tank with methanom \$1,650,000 \$1,650,000 \$2,100,000 \$2,100,000 \$2,100,000 \$3,360,000 \$2,730,000 \$6,58 \$40 HP \$13,100 \$/y/4.0 mg/30 gals \$8,200 \$/y/6 \$27,300 \$/y/6 \$27,300 \$/y/6 \$55,900 \$/y/6 \$55,900 \$/y/6 \$2,91%	ear /L s/d ear /L s/d ear /L s/d ear ear	

PROJECT:	Implementing a 3 mg/L Annual Average Total	Nitrogen Limit
PREPARED FOR:	USEPA, Chesapeake Bay Office	
PREPARED BY:	Virginia Tech with Steams & Wheler, LLC	
DATE:	March 19, 2001	
	Dahlgren WWTP	
FACILITY:		
LOCATION:	Dahlgren, VA	PE COD: N/a mg/L
RATED FLOW:	<u>0.3</u> mgd	
CURRENT EFFLUENT TN:	6.0 mg/L	PE TKN N/a mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
	10 lbs/d	
NITROGEN REDUCTION:		* 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	4 1000 lbs/yr	
	73 1000 lbs/20-years	
		5 1-5 - A 4 1/- Lines (140). W/-
CURRENT PROCESS (CHECK	ALL THAT APPLY): MLE	Existing Aerated Volume (MG): N/a
	BEPR (A2/0, VIP, etc.)	Existing Anoxic Volume (MG): N/a
	Bardenpho	Current MLSS at Winter ADF: 2700
81	X Oxidation Ditch	
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
	SBR	
~	High-Rate Biofilter	· C
i e	Effluent Filtration	Data Street See a Se
ii ii	X Other: Orbal, 3 cor	ncentric rings
CURRENT EFFI LIENT AMMON	NIA-N: <1.0 mg/L X From Report	
Total Elit Edelit Allinot	From Model (at ADF ar	nd load, 15 d MCRT, 12° C winter conditions)
Į.	LI TOTT MODEL (at AD) at	·- ····
	\$ ₆₅₀ - 240	
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
	X No modifications requir	red New MLSS
i e	Raise MCRT/MLSS in	existing tanks (check clarifier capacity) N/a
	Construct additional ae	rated volume Flow (mgd): 0
	Construct additional cla	
	Use existing anoxic vol	ume as aerobic (construct separate denit facility)
	Use aerated system for	BOD removal only (construct separate nit/denit facility)
	Add influent flow equali	
l .	Other:	
		39
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	
	No modifications requir	red
į.	Add downstream DeNit	
	Add down stream Alikeife	cation Biofilter and DeNit filter with methanol
1 N	Add downstream Nilling	Callott Diotitlet and Detail titlet with Inclination
	X Add methanol to existing	
	Add downstream anoxi	c tank with methanol feed
	Add effluent filtration	
	Other:	AND THE PROPERTY OF THE PROPER
	Oulei.	W. TRUM BEAUGINGS.
CAPITAL COST:	Equipment and Structures (from Page 2):	\$250,000
	Electrical and Instrumentation: 12%	\$30,000
l		\$38,000
1	rata riping and one trem	\$320,000
	Subtotal:	
	Contractor OH&P: 15%	\$48,000
l .	Engineering and Constr. Mgmt: 15%	\$48,000
	Subtotal:	\$420,000
1	2001	\$96,000
	Contingency.	
- 11	Total Capital Cost:	\$520,000
1	Capital Cost per lb 20-Yr N removal:	\$7.12
i		
ODEDATIONS SOST	Additional Horsepower (from Page 2):	0 HP
OPERATIONS COST:		\$0 \$/year
1	Electrical Power Cost: 0.05 \$/kW	77.
-:	Nitrate Reduction using Methanol:	3.0 · mg/L
	Methanol Required:	0 gals/d
1	Methanol Cost: 0.75 \$/gal	\$0 \$/year
1		0.0 mg/L
	Separate Stage Ammonia Reduction:	
1	Caustic Soda @ 25% conc.	0 gals/d
1	Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
1	Equipment Maintenance Cost:	\$4,200 \$/year
	Denitrification Sludge Production w/Methanol:	10 lbs/d
12		\$700 \$/year
× .	Sludge Disposal Cost: 400 \$/ton	·
- X	Total Annual O&M Cost:	\$4,900 \$/year
1	Effective Annual Interest Rate after Inflation:	2.91%
I	20-Year Present Worth of O&M Costs:	\$70,000
-	ZU-TEST FIESCHE WORM OF OUR COSTS.	
I		CE00 000
TOTAL 20-YEAR PRESENT W	ORTH COST:	\$590,000
	Total Cost per lb, 20-Yr. N removal:	\$8.08
I		E1

PROJECT:	According to the second for the second second			
	implementing a 3 mg	L Annual Average Tota	I Nitrogen Limit	
PREPARED FOR:	USEPA, Chesapeake			
PREPARED BY:	Virginia Tech with St			
		earlis & Wilelei, LLO		
DATE:	March 16, 2001			
FACILITY:	Dale Services #1 WW	TP		1.89
LOCATION:	Dale City, VA			
RATED FLOW:	3.0 mgd		PE COD:	N/a mg/L
Luman a transfer and the state of the state	_			100000000000000000000000000000000000000
CURRENT EFFLUENT TN:	6.0 mg/L		PE TKN:	N/a mg/L
EFFLUENT TN GOAL:	3.0 mg/L			
NITROGEN REDUCTION:	80 lbs/d			
THE TOTAL TEDOOTION.				
	29 1000 lbs/yr			
	584 1000 lbs/20-yea	rs		
	S			
CURRENT PROCESS (CHECK	CALL THAT APPLYS	IMLE		Existing Aerated Volume (MG): N/a
COLUMN THEOLOG (OTILOT		BEPR (A2/0, VIP, etc.)		Existing Anoxic Volume (MG): N/a
	<u>-</u>	and the second control of the second control		
	150	Bardenpho		Current MLSS at Winter ADF: 5300
	. I (i)	Oxidation Ditch		
		Lagoon (Biolac, etc.)		8
	1	Cyclical Aeration		
	-			
		SBR .		
		High-Rate Biofilter		
	- I	Effluent Filtration		
	1-		inoronea elt est-	
	LX	Other: pH adjust to	increase nit rate	
CURRENT EFFLUENT AMMO	NIA-N: <1.0 ma/L 🗀	From Report		
		From Model (at ADE at	ad load 15 d MCE	RT, 12° C winter conditions)
		Terrorii Moder (at ADE ar	iu ioau, 15 d MCF	VI, IZ O WITHER COHUMONS)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.	0 mg/L:		
7.		No modifications requir	ed	New MLS
	1			THE ROOM STORY OF THE PERSON O
8	1.8	Raise MCRT/MLSS in		
" =	1%	Construct additional ae	rated volume	Flow (mgd):
	1 102	Construct additional cla	arifiers	Flow (mgd): 0
	H-9			construct separate denit facility)
	-3	Use existing anoxic voi	une as aerobic (c	construct separate defin facility)
Or Control of the Con	2	Use aerated system for	r BOD removal on	ly (construct separate nit/denit facility)
	720	Add influent flow equal	ization tank	
	- 02	Other:		THE STATE OF THE PARTY OF THE PARTY.
6	1263	Outer.	1.44-6	
		-5-86-6		
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0	mg/L:		
	177	No modifications requir	ed ·	
-	= 1768	Add downstream DeNit		ol
	1 1			
	- 1114	TAGG downstream Nitrition		
	The second secon			DeNit filter with methanol
0.50	X	Add methanol to existing	g BNR process	
	X	Add methanol to existing	g BNR process	
	X	Add methanol to existing Add downstream anoxides	g BNR process	
	- 2	Add methanol to existing Add downstream anoxice Add effluent filtration	ng BNR process c tank with metha	nol feed
	- 2	Add methanol to existing Add downstream anoxice Add effluent filtration	g BNR process	nol feed
4 2	- 2	Add methanol to existing Add downstream anoxic Add effluent filtration	ng BNR process c tank with metha	nol feed
CAPITAL COST:	I X	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep	ng BNR process c tank with metha	nol feed
CAPITAL COST:	Equipment and Structure	Add methanol to existing Add downstream anoxing Add effluent filtration Other: Modify deep res (from Page 2):	ng BNR process to tank with methan to bed filters to den \$520,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer	Add methanol to existing Add downstream anoxing Add effluent filtration Other: Modify deep res (from Page 2): Intation: 12%	ng BNR process to tank with metha bed filters to den \$520,000 \$62,000	nol feed
CAPITAL COST:	Equipment and Structure	Add methanol to existing Add downstream anoxing Add effluent filtration Other: Modify deep res (from Page 2): Intation: 12%	ng BNR process to tank with metha bed filters to den \$520,000 \$62,000 \$78,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer	Add methanol to existing Add downstream anoxing Add effluent filtration Other: Modify deep res (from Page 2): Intation: 12%	ng BNR process to tank with metha bed filters to den \$520,000 \$62,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): Intation: 12% ork: 15%	ng BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): ntation: 12% fork: 15%	ng BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Construction	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): ntation: 12% fork: 15%	g BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): 12% ork: 15% 15% 15% 15% 15%	g BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$860,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Construction	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): ntation: 12% fork: 15%	g BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): 12% ork: 15% 15% 15% 15% 15%	\$520,000 \$62,000 \$62,000 \$78,000 \$660,000 \$99,000 \$860,000 \$198,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): Intation: 12% ork: 15% 15% 15% 15% 30%	\$520,000 \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$198,000 \$1,060,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): Intation: 12% ork: 15% 15% 15% 15% 30%	\$520,000 \$62,000 \$62,000 \$78,000 \$660,000 \$99,000 \$860,000 \$198,000	nol feed
CAPITAL COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): Intation: 12% ork: 15% 15% 15% 15% 30%	\$520,000 \$62,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$198,000 \$1,060,000 \$1.82	nol feed ite fitters
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): ntation: 12% ork: 15% r. Mgmt: 15% 30% Yr. N removal:	\$520,000 \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$198,000 \$1,060,000	nol feed ite fitters
CAPITAL COST: OPERATIONS COST:	Equipment and Structur Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constr Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): 15% ork: 15% 15% 30% Yr. N removal: (from Page 2):	\$520,000 \$52,000 \$62,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000	nol feed ite fitters
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): 15% ork: 15% 15% 30% Add effluent filtration: 12% 15% 15% 15% 15% 15% 15% 15% 15% 15% 15	\$520,000 \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$860,000 \$198,000 \$1,060,000 \$1.82	nol feed ite fitters
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): 15% ork: 15% 15% 30% Add effluent filtration: 12% 15% 15% 15% 15% 15% 15% 15% 15% 15% 15	\$520,000 \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1,32	nol feed ite fitters P year g/L
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost:	Add methanol to existing Add downstream anoxice. Add effluent filtration. Other: Modify deep res (from Page 2): 15% ork: 15% 15% 30% Add effluent filtration: 12% 15% 15% 15% 15% 15% 15% 15% 15% 15% 15	\$520,000 \$62,000 \$62,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1,82	p year g/L
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required:	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% 15% 30% 15% 15% 30% 15% 15% 15% 15% 15% 15% 15% 15% 15% 15	\$520,000 \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1,32	p year g/L
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost:	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal	sg BNR process c tank with methal bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1.82	p year g/L als/d
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammon	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): 15% ork: 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction:	sg BNR process c tank with methal bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$198,000 \$1,060,000 \$1.82 0 H \$0 \$7 \$7 \$7 \$7 \$7 \$7 \$7 \$7 \$7 \$7 \$7 \$7 \$7	p year g/L als/d year g/L
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Construction Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: onc.	9 BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1.82 \$0 \$7.82	p year g/L sis/d year g/L
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammon	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): 15% ork: 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction:	9 BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$860,000 \$198,000 \$1,060,000 \$1.82 \$1.82 \$0 H \$0 \$/ 3.0 m 30 gg \$8,200 \$/ 0.0 \$0 gg \$0 \$/ 5.0 \$/ 0	P year g/L als/d year g/L als/d year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% C	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: 0.60 \$/gal	9 BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1.82 \$0 \$7.82	P year g/L als/d year g/L als/d year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c Caustic Soda Cost: Equipment Maintenance	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: onc. 0.60 \$/gal e Cost:	9 BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,00	P year g/L als/d year g/L bls/d year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenance Denitrification Sludge P	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): ntation: 12% 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: onc. 0.60 \$/gal e Cost: roduction w/Methanol:	9 BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1,82 \$1.82 \$0 \$60,000 \$1,060,0	P year g/L sis/d year g/L sis/d year g/L sis/d year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c Caustic Soda Cost: Equipment Maintenance Denitrification Sludge P Sludge Disposal Cost:	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): ntation: 12% ork: 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: onc. 0.60 \$/gal e Cost: roduction w/Methanol: 400 \$/ton	9 BNR process c tank with methal bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1.82 \$0.5 \$1.82 \$0	peyear g/L als/d year g/L als/d year g/L als/d year year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenance Denitrification Sludge P	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): ntation: 12% ork: 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: onc. 0.60 \$/gal e Cost: roduction w/Methanol: 400 \$/ton	9 BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1,82 \$1.82 \$0 \$60,000 \$1,060,0	peyear g/L als/d year g/L als/d year g/L als/d year year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c Caustic Soda Cost: Equipment Maintenance Denitrification Sludge P Sludge Disposal Cost: Total Annual O&M Cost	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): ntation: 12% ork: 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: onc. 0.60 \$/gal e Cost: roduction w/Methanol: 400 \$/ton	9 BNR process c tank with methal bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$860,000 \$1,060,000 \$1,060,000 \$1,82 \$0 \$7 \$8,200 \$7 \$8,200 \$7 \$8,600 \$7 \$8,600 \$7 \$8,600 \$7 \$24,800 \$7 \$24,800 \$7	peyear g/L als/d year g/L als/d year g/L als/d year year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c Caustic Soda Cost: Equipment Maintenanco Denitrification Sludge Plugge Disposal Cost: Total Annual O&M Cost Effective Annual Interes	Add methanol to existin Add downstream anoxic Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: 0.60 \$/gal e Cost: roduction w/Methanol: 400 \$/ton is tractal Rate after Inflation: distribution of the cost of the co	g BNR process c tank with methal bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1.82 0 H \$0 \$/ 3.0 m \$0 \$/ \$86,000 \$/ \$1,000	peyear g/L als/d year g/L als/d year g/L als/d year year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c Caustic Soda Cost: Equipment Maintenance Denitrification Sludge P Sludge Disposal Cost: Total Annual O&M Cost	Add methanol to existin Add downstream anoxic Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: 0.60 \$/gal e Cost: roduction w/Methanol: 400 \$/ton is tractal Rate after Inflation: distribution of the cost of the co	9 BNR process c tank with methal bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$860,000 \$1,060,000 \$1,060,000 \$1,82 \$0 \$7 \$8,200 \$7 \$8,200 \$7 \$8,600 \$7 \$8,600 \$7 \$8,600 \$7 \$24,800 \$7 \$24,800 \$7	peyear g/L als/d year g/L als/d year g/L als/d year year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal; Contingency: Total Capital Cost: Capital Cost per lb. 20-Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c Caustic Soda Cost: Equipment Maintenanco Denitrification Sludge Plugge Disposal Cost: Total Annual O&M Cost Effective Annual Interes	Add methanol to existin Add downstream anoxic Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: 0.60 \$/gal e Cost: roduction w/Methanol: 400 \$/ton is tractal Rate after Inflation: distribution of the cost of the co	g BNR process c tank with methal bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1.82 0 H \$0 \$/ 3.0 m \$0 \$/ \$86,000 \$/ \$1,000	peyear g/L als/d year g/L als/d year g/L als/d year year
OPERATIONS COST:	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c Caustic Soda Cost: Equipment Maintenance Denitrification Sludge P Sludge Disposal Cost: Total Annual O&M Cost Effective Annual Interes 20-Year Present Worth	Add methanol to existin Add downstream anoxic Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 30% Yr. N removal: (from Page 2): 0.05 \$/kW Methanol: 0.75 \$/gal nia Reduction: 0.60 \$/gal e Cost: roduction w/Methanol: 400 \$/ton is tractal Rate after Inflation: distribution of the cost of the co	g BNR process c tank with methal bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,000 \$1,060,000 \$1.82 0 H \$0 \$/ 3.0 m \$0 \$/ \$86,000 \$/ \$1,000	peyear g/L als/d year g/L als/d year g/L als/d year year
	Equipment and Structure Electrical and Instrumer Yard Piping and Site W Subtotal: Contractor OH&P: Engineering and Constructure Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20- Additional Horsepower Electrical Power Cost: Nitrate Reduction using Methanol Required: Methanol Required: Methanol Cost: Separate Stage Ammor Caustic Soda @ 25% c Caustic Soda Cost: Equipment Maintenance Denitrification Sludge P Sludge Disposal Cost: Total Annual O&M Cost Effective Annual Interes 20-Year Present Worth	Add methanol to existin Add downstream anoxi Add effluent filtration Other: Modify deep res (from Page 2): 15% 15% 15% 15% 30% 15% 30% 15% 30% 15% 15% 30% 15% 15% 15% 15% 15% 15% 15% 15% 15% 15	9 BNR process c tank with metha bed filters to den \$520,000 \$62,000 \$78,000 \$660,000 \$99,000 \$99,000 \$1,060,00	peyear g/L als/d year g/L als/d year g/L als/d year year

PROJECT:	Implementing a 3 r	mg/L Annual Average	Total Nitrogen Li	mit	-
PREPARED FOR:	USEPA, Chesapea	ke Bay Office			
PREPARED BY:		Stearns & Wheler, LI	LC =		
DATE:	March 16, 2001	2.			
FACILITY:	Dale Services #8 V	WTP			
LOCATION:	Dale City, VA				
RATED FLOW:	3.0 mgd		PE CO		
CURRENT EFFLUENT TN:	6.0 mg/L		PE TK	(N: N/a mg/L	
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	80 lbs/d				
M.M.OOLM	29 1000 lbs/yr				
	584 1000 lbs/20-y	years			
		[V]us		Existing Aerated	Volume (MG): N/a
CURRENT PROCESS (CHECK	ALL THAT APPLY):	BEPR (A2/0, VIP	eta \	Existing Anoxic	Volume (MG): N/a
			·, e(c.)		at Winter ADF: 5300
*:		Bardenpho		Culterit Micoo	St Willter ADI
		Oxidation Ditch	-4.4		
	5	Lagoon (Biolac,			
		Cyclical Aeration	ı		
		SBR			
		High-Rate Biofilt	ег		
		Effluent Filtration	1		
			djustment to increase	se nitrification rate	1 0 2 000
eponoAcone	ŝ.	- Invitation			
CURRENT EFFLUENT AMMON	VIA-N: <1.0 mg/L	X From Report		MART 400 0 : 1	(*** \
		From Model (at A	ADF and load, 15 d	MCRT, 12° C winter of	onditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA	c 1 0 mg/l *			
FROFOSED MODIFICATIONS	TO OLI AIIIIIOTTIA	X No modifications	required		New MLSS
				s (check clarifier capac	4 2 2 4
		-1000-000-000-000-000-000-000-000-000-0	onal aerated volume		· ———
		Construct addition	onal clarifiers	Flow (mg	
		Use existing ano	xic volume as aero	bic (construct separate	e denit facility)
		Use aerated syst	tem for BOD remov	al only (construct sepa	arate nit/denit facility)
			equalization tank		
		Other:	61		and the second
ě	, ,	Add downstream	existing BNR proce anoxic tank with m	er and DeNit filter with ess	methanol
-	(A)		fy deep bed filters to	o denite filters	A CONTRACT OF STREET
100 April 100					
CAPITAL COST:	Equipment and Stru	ctures (from Page 2):	\$520,0		
	Electrical and Instru	imentation: .	12% \$62,0	00	
3"	Yard Piping and Site	e Work:	15% \$78,0	00	
, a	Subtotal:	•	\$660,0	00	
	Contractor OH&P:		15% \$99,0		
	Engineering and Co	instr. Might:			W
	Subtotal:	22	\$860,0		
	Contingency:		30% 🐁 \$198,0		
	Total Capital Cost:		\$1,060,0	00	
	Capital Cost per lb.	20-Yr. N removal:	\$1.8	32	
	9	5 0		O LID	
OPERATIONS COST:	Additional Horsepov			0 HP	8
	Electrical Power Co	st: 0.05 \$/kW		\$0 \$/year	
1.20	Nitrate Reduction us	sing Methanol:	3	<u>.0</u> mg/L	
-22	Methanol Required:			30 gals/d	
	Methanol Cost:	. 0.75 \$/gal	\$8.2	00 \$/year	
	Separate Stage Am			.0 mg/L	
(4)				0 gals/d	
341	Caustic Soda @ 25			_	
	Caustic Soda Cost:			\$0 \$/year	
	Equipment Mainten	ance Cost:		00 \$/year	
	Denitrification Sludg	ge Production w/Metha	inol: 1	10 lbs/d	
				100 \$/year	
	Sludge Disposal Co	ost: 400 \$/ton	₽ 0,0		
	Sludge Disposal Co			•	
Λ 2	Total Annual O&M	Cost:	\$24,8	100 \$ /year	
190	Total Annual O&M (Effective Annual Int	Cost: erest Rate after Inflation	\$24,8 on: 2.91	100 \$ /year 1%	
1991	Total Annual O&M	Cost: erest Rate after Inflation	\$24,8	100 \$ /year 1%	
TOTAL 20 VEAD DESEAT WA	Total Annual O&M (Effective Annual Int 20-Year Present W	Cost: erest Rate after Inflation	\$24,8 on: 2.91 \$370,0	000 \$ /year 1% 000	3.
TOTAL 20-YEAR PRESENT W	Total Annual O&M (Effective Annual Int 20-Year Present W	Cost: lerest Rate after Inflatio orth of O&M Costs:	\$24,8 on: 2.91	000 \$ /year 1% 1000	a

PROJECT: PREPARED FOR: PREPARED BY:	USEPA, Chesape	mg/L Annual Average To ake Bay Office n Stearns & Wheler, LLC	otal Nitrogen Limit	9
DATE: FACILITY:	March 19, 2001 DuPont	Toteams a vineter, LLO		
LOCATION:	Waynesboro, VA			
RATED FLOW:	0.5 mgd		PE COD: 487	mg/L
CURRENT EFFLUENT TN:	49.0 mg/L		PE TKN: 63	mg/L
EFFLUENT TN GOAL:	3.0 mg/L	8:		1119/2
NITROGEN REDUCTION:	190 lbs/d			
TANAMED SANS	69 1000 lbs/yr			9
	1387 1000 lbs/20-	years		
CURRENT PROCESS (CHEC	K ALL THAT APPLY)		Existing /	Aerated Volume (MG): 0.76
		BEPR (A2/0, VIP, et		Anoxic Volume (MG): N/a
1	3.5	X Bardenpho	Current	MLSS at Winter ADF: 7140
ł.		Oxidation Ditch		
		Lagoon (Biolac, etc.)		
, e		X Cyclical Aeration		
		SBR		s (* *)
		High-Rate Biofilter		
		Effluent Filtration		
1 -		Other:		A
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L		and load, 15 d MCRT, 12° C v	vinter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA	: 1.0 mg/l ·		
N .		X No modifications requ	uired	Now MI CC
		Paice MCPTMI SS in	n existing tanks (check clarifie	New MLSS
1		Construct additional a		
1		**************************************		ow (mgd):0
		Construct additional of		ow (mgd):
φ,		Use existing anoxic v	olume as aerobic (construct se	eparate denit facility)
		Use aerated system f	or BOD removal only (constru	ct separate nit/denit facility)
		Add influent flow equa	alization tank	
		Other:	1901	
PROPOSED MODIFICATIONS	TO GET NITRATE <	1.0 mg/L:		
340		No modifications requ	ired	[14]
1		Add downstream DeN		
			fication Biofilter and DeNit filte	c with methanol
		X Add methanol to exist		1 WILLI THE ITATION
			kic tank with methanol feed	
			kic tank with methanor feed	
l .		Add effluent filtration		
	,	Other:		
CAPITAL COST:	Equipment and Struc	durae (from Page 2):	\$250,000	
974 TAL 0001.			\$250,000	
	Electrical and Instrur			
li de la companya de	Yard Piping and Site	Work: 15%		
l	Subtotal:		\$320,000	2.00
i	Contractor OH&P:	15%	\$48,000	_ i
	Engineering and Cor	str. Mgmt: 15%	\$48,000	1
= -	Subtotal:		\$420,000	
	Contingency:	30%		1
	Total Capital Cost:		\$520,000	1
	Capital Cost per lb. 2	0-Yr N removal:	\$0.37	1
	oopilal oost per lo. 2	o-11. 11 temoval.	\$0.3 1	1
OPERATIONS COST:	Additional Horsepow	er (from Page 2):	0 HP	= 1
	Electrical Power Cos	`	\$0 \$/year	. 1
	Nitrate Reduction usi			
		ng methanol.	46.0 mg/L	I.
	Methanol Required:	0.75 641	90 gals/d	
	Methanol Cost:	0.75 \$/gal	\$24.600 \$/year	I
	Separate Stage Amm		0.0_mg/L	
_	Caustic Soda @ 25%		0 gals/d	
	Caustic Soda Cost:	0.60 \$/gal	\$0 <i>\$1</i> year	= 8
	Equipment Maintenar	ice Cost:	\$4.200 \$/year	<
lu.	Denitrification Sludge	Production w/Methanol:	280 lbs/d	
	Sludge Disposal Cost		\$20.400 \$/year	-
A	Total Annual O&M Co		S49 200 S/year	(1)
*		est Rate after Inflation:	2.91%	
	20-Year Present Wor		\$740,000	1
22	17	and Calvi Costs.	₹1 ₹0, 000	
TOTAL 20-YEAR PRESENT WO	ORTH COST		\$1,260,000	11
	Total Cost per lb 20-	/r N removal	\$0.91	
			*****	_ 1

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	USEPA, Chesapeal	Stearns & Wheler, LLC	Al Nitrogen Limit PE COD: _ PE TKN: _	N/a mg/L N/a mg/L	
CURRENT PROCESS (CHECK		X BEPR (A2/0, VIP, etc Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Can be or	perated as either A2	Existing Aerated Volume (N Existing Anoxic Volume (N Current MLSS at Winter A	мG): N/a
CURRENT EFFLUENT AMMON	lIA-N: <u><1.0 m</u> mg/L	X From Report From Model (at ADF	and load, 15 d MCF	RT, 12° C winter conditions)	
PROPOSED MODIFICATIONS	TO GET AMMONIA <	X No modifications requ Raise MCRT/MLSS in Construct additional a Construct additional of Use existing anoxic v	n existing tanks (cho perated volume clarifiers olume as aerobic (c or BOD removal on	Flow (mgd): 0	New MLSS N/a Nitty nit facility)
PROPOSED MODIFICATIONS	TO GET NITRATE <	No modifications requ X Add downstream Del	Nit filter with methan ification Biofilter and ting BNR process	DeNit filter with methanol	i .
CAPITAL COST:	Equipment and Structure Electrical and Instrury Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2	159 159 nstr. Mgmt: 159 309	\$248,000 \$2,100,000 \$315,000 \$315,000 \$2,730,000		
OPERATIONS COST:	Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena Denitrification Sludge Studge Disposal Cost	st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: % conc. 0.60 \$/gal ance Cost: e Production w/Methanol:	40 H \$13,100 \$/ 4.0 m 30 gs \$8,200 \$/ 0,0 m 0 gs \$27,300 \$/ 100 lb \$7,300 \$/	year g/L als/d year g/L als/d year year year	io io
	Total Annual O&M C	cost erest Rate after Inflation:	\$55,900 \$/ 2,91% \$840,000		
TOTAL 20-YEAR PRESENT WO	ORTH COST: Total Cost per lb. 20	-Yr. N removal:	\$4,200,000 \$8.22		. *

PROJECT: PREPARED FOR:		mg/L Annual Average Tot	ai Mitrogen Liniit			
	USEPA, Chesapea					
PREPARED BY:	_	Steams & Wheler, LLC				
DATE:	March 9, 2001					
FACILITY:	Front Royal					
LOCATION:	Front Royal, VA					
RATED FLOW:	4.0 mgd		PE COD:	286mg/L		
CURRENT EFFLUENT TN:	8.0 mg/L		PE TKN:	21 mg/L		
EFFLUENT TN GOAL:	3,0 mg/L	4.				
NITROGEN REDUCTION:	170 lbs/d					
Ti .	62 1000 lbs/yr					
7	1241 1000 lbs/20-y	ware				(4)
	1241 1000 103/20-9	rears				
CURRENT PROCESS (CHE	CK ALL THAT APPLY):	MLE		Existing Aerated	Volume (MG):1	.728*
		BEPR (A2/0, VIP, etc.)	Existing Anoxic	Volume (MG):C	yclical
		Bardenpho		Current MLSS a	at Winter ADF:	N/a
· ·		Oxidation Ditch				
		Lagoon (Biolac, etc.)	*N	ote: Existing plan	nt has 4 aeration ta	nks.
	1	X Cyclical Aeration			commend 2 addition	
		SBR		nks @ 0,288 mg		
12	1		vai	11/3 @ 0.200 mg	Cacii	
	9	High-Rate Biofilter				
	.p. *1 ∀	Effluent Filtration	9715	-7-2		
	3	Other:				_
CURRENT EFFLUENT AMN	MONIA-N: 0.5 mg/l	X From Report				
THE RESERVE THE PARTY OF THE PA		From Model (at ADF a	nd load, 15 d MCR	T, 12° C winter c	onditions)	
				,	,	
PROPOSED MODIFICATION	NS TO GET AMMONIA <					
		X No modifications requi				MLSS
		Raise MCRT/MLSS in	existing tanks (che	ck clarifier capac	city)	N/a
		Construct additional ac		Flow (mg		
		Construct additional cl		Flow (mg		
		Use existing anoxic vo				
		Use aerated system to				۸
		N707871 Sections 1	Patronectic acts	y (construct sepa	rrate invoernt racinty	()
		Add influent flow equal	lization tank	Allesson of	1,013	
PROPOSED MODIFICATION	NS TO GET NITRATE < 1	Other:	red	ol .		
PROPOSED MODIFICATION	NS TO GET NITRATE < 1	Other: .0 mg/L: No modifications requi	red t filter with methand cation Biofilter and ng BNR process ic tank with methan	DeNit filter with i	methanol	
PROPOSED MODIFICATION	NS TO GET NITRATE < 1	Other: No mg/L: No modifications required to existing the company of the company	red t filter with methanc cation Biofilter and ng BNR process	DeNit filter with i	methanol	.4.80
	, a	Other: No modifications required Add downstream DeNired Add methanol to existing Add downstream anoxion Add effluent filtration Other:	red t filter with methanc cation Biofilter and ng BNR process ic tank with methan	DeNit filter with i	methanol	.4.8
PROPOSED MODIFICATION	Equipment and Struc	Other: .0 mg/L: No modifications requi X Add downstream DeNi Add downstream Nitrifi Add methanol to existin Add downstream anoxi Add effluent filtration Other: ctures (from Page 2):	red t filter with methanc cation Biofilter and ng BNR process ic tank with methan \$2,350,000	DeNit filter with i	methanol	.4.8
	Equipment and Struc Electrical and Instrum	Other: No modifications required to the state of the sta	red t filter with methanc cation Biofilter and ng BNR process ic tank with methan \$2,350,000	DeNit filter with i	methanol	.4.2
	Equipment and Struc	Other: No modifications required to the state of the sta	red t filter with methanc cation Biofilter and ng BNR process ic tank with methan \$2,350,000	DeNit filter with i	methanol	
	Equipment and Struc Electrical and Instrum	Other: No modifications required to the state of the sta	red t filter with methanc cation Biofilter and ng BNR process ic tank with methan \$2,350,000 \$282,000	DeNit filter with i	methanol	
	Equipment and Struc Electrical and Instrun Yard Piping and Site Subtotal:	Other: No modifications required to make the control of the contr	red t filter with methanc cation Biofilter and to BNR process to tank with methan \$2,350,000 \$282,000 \$353,000	DeNit filter with i	methanol	
	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P:	Other: No modifications required to the control of	red t filter with methanc action Biofilter and ng BNR process to tank with methan \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000	DeNit filter with i	methanol	
	Equipment and Struc Electrical and Instrun Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor	Other: No modifications required to the control of	red t filter with methano cation Biofilter and ng BNR process to tank with methan \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000 \$449,000	DeNit filter with i	methanol	
	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Con Subtotal:	Other: .0 mg/L: No modifications required to the state of the state o	red t filter with methanic cation Biofilter and ng BNR process is tank with methanic series and series are series and series and series and series and series are series and series and series and series are series and series and series are series and series and series are series and series are series and series and series are ser	DeNit filter with i	methanol	
	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Con Subtotal: Contingency:	Other: No modifications required and downstream DeNir Add downstream Nitrification and downstream Nitrification and deffluent filtration other: Cutures (from Page 2): mentation: 12% Work: 15%	red t filter with methanc cation Biofilter and ng BNR process ic tank with methan \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000 \$449,000 \$3,890,000 \$3,890,000 \$897,000	DeNit filter with i	methanol	
	Equipment and Struc Electrical and Instrun Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost:	Other: No mg/L: No modifications required to the control of the c	red t filter with methanc cation Biofilter and ng BNR process ic tank with methan \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000 \$449,000 \$3,890,000 \$3,890,000 \$4,790,000	DeNit filter with i	methanol	
CAPITAL COST:	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2	Other: No modifications required to make the control of the contr	red t filter with methanc cation Biofilter and g BNR process ic tank with methan \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000 \$3,890,000 \$3,890,000 \$49,000 \$3,890,000 \$3,890,000 \$3,890,000 \$3,890,000 \$3,890,000 \$3,890,000 \$3,890,000	DeNit filter with a		
CAPITAL COST:	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to impleme	Other: .0 mg/L: No modifications required in the provided in	red t filter with methanic cation Biofilter and ag BNR process is tank with methanic series with the series of tank with methanic series with the series of tank with methanic series with the series of tank with methanic series of series of tank with methanic series of tank wit	DeNit filter with a		poort
CAPITAL COST:	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add'l aeration	Other: .0 mg/L: No modifications required in provein basins, SE PE flow modifications required in provein basins, SE PE flow distributions.	red t filter with methanic cation Biofilter and ng BNR process in tank with methanic tank with methanic satisfactors and satisfactors are satisfactors are satisfactors are satisfactors and satisfactors are satisfactors are satisfactors.	DeNit filter with a		port
CAPITAL COST:	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to impleme	Other: .0 mg/L: No modifications required in provein basins, SE PE flow modifications required in provein basins, SE PE flow distributions.	red t filter with methanic cation Biofilter and ag BNR process is tank with methanic series with the series of tank with methanic series with the series of tank with methanic series with the series of tank with methanic series of series of tank with methanic series of tank wit	DeNit filter with a		poort
	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add'l aeration	Other: .0 mg/L: No modifications required in prove in basins, SE PE flow distribler (from Page 2): .0 mg/L: No modifications required in prove in basins, SE PE flow distrible in prove in page 2): .0 mentation: .0 mg/L: .0 mg/L: .0 mg/L: .0 mg/L: .0 modifications required in prove in basins, SE PE flow distrible in prove in page 2): .0 mentation: .0 mg/L: .0 m	red t filter with methanic cation Biofilter and ng BNR process in tank with methanic tank with methanic satisfactors and satisfactors are satisfactors are satisfactors are satisfactors and satisfactors are satisfactors are satisfactors.	DeNit filter with i		port
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add't aeration Additional Horsepower)	Other: No modifications required to the state of the sta	red t filter with methanic cation Biofilter and ng BNR process ic tank with methanic series in the series of tank with methanic series in the series of tank with methanic series of tank with	DeNit filter with it of feed		port
CAPITAL COST:	Equipment and Struc Electrical and Instrun Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add'l aeration Additional Horsepowe Electrical Power Cos Nitrate Reduction usi	Other: No modifications required to the state of the sta	red t filter with methanic cation Biofilter and ng BNR process ic tank with methanic section \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000 \$3,890,000 \$4,790,000 \$4,790,000 \$3,860 ments for BNR at diution) 80 HP \$26,100 \$/ye	DeNit filter with a color feed		port
CAPITAL COST:	Equipment and Structure Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to impleme Cost (2 Add't aeration Additional Horsepow Electrical Power Cost Nitrate Reduction usi Methanol Required:	Other: No mg/L: No modifications required in the process of the	\$2,350,000 \$2,350,000 \$3,353,000 \$449,000 \$3,890,000 \$4,790,000 \$3,890,000 \$4,790,000 \$4,790,000 \$4,790,000 \$3,800,000 \$4,790,000 \$4	DeNit filter with a col feed esign flow found the color flow found the color flow found the color flow flow flow flow flow flow flow flow		hoc
CAPITAL COST:	Equipment and Structelectrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add't aeration Additional Horsepowe Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Cost:	Other: No modifications required by the control of	sed to filter with methanic cation Biofilter and an BNR process in tank with methanic section \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000 \$3,890,000 \$449,000 \$3,890,000 \$4,790,000 \$3,86 ments for BNR at distribution) 80 HP \$26,100 \$/ye \$0 gals \$21,900 \$/ye \$0 \$21,900 \$/ye \$/ye \$0 \$21,900 \$/ye \$/ye \$0 \$21,900 \$/ye \$/ye \$/ye \$/ye \$/ye \$/ye \$/ye \$/ye	DeNit filter with a col feed esign flow found ear // // // // // // // // // // // // /		port
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add't aeration Additional Horsepowe Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Cost: Separate Stage Amm	Other: No modifications required by the control of	red t filter with methanic cation Biofilter and ng BNR process ic tank with methanic section \$2,350,000 \$2,82,000 \$353,000 \$2,990,000 \$449,000 \$3,890,000 \$4,790,000 \$3,860 for BNR at diution) 80 HP \$26,100 \$/ye 5.0 mg/s 80 gals \$21,900 \$/ye 0.0 mg/s	DeNit filter with a col feed esign flow found ear L L L L L L L L L L L L L		port
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add'i aeration Additional Horsepown Electrical Power Cost Nitrate Reduction using Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25%	Other: No modifications required by the concept of	sed to filter with methanic cation Biofilter and an BNR process is tank with methanic set ank with methanic set and	DeNit filter with a col feed esign flow found ear L sid ear L		poort
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add'i aeration Additional Horsepown Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost:	Other: No modifications required by the state of the sta	red t filter with methanic cation Biofilter and ng BNR process ic tank with methanic section Biofilter and section Biofilter and section BNR process ic tank with methanic section sec	esign flow found ear fL s/d ear fL s/d ear		noc
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to impleme Cost (2 Add't aeratior Additional Horsepow Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenan	Other: .0 mg/L: No modifications required in the province of	\$2,350,000 \$2,350,000 \$3,353,000 \$2,990,000 \$449,000 \$3,890,000 \$4,790,000 \$3,890,000 \$4,790,000 \$3,890,000 \$4,790,000 \$3,890,000 \$4,790,000 \$3,890 \$0,00 \$0	esign flow found ear L s/d ear ear		port
CAPITAL COST:	Equipment and Structelectrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Corsubtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implemed Cost (2 Add't aeration Additional Horsepower Cost (12 Add't aeration Additional Horsepower Cost (13 Add't aeration Additional Required: Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenan Denitrification Sludge	Other: No mod/L: No modifications required and downstream DeNir Add downstream Nitrification and the state of the state o	sed tilter with methanic cation Biofilter and ag BNR process is tank with methanic set and set	esign flow found		noc
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to impleme Cost (2 Add't aeratior Additional Horsepow Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenan	Other: No mod/L: No modifications required and downstream DeNir Add downstream Nitrification and the state of the state o	red t filter with methanic cation Biofilter and ng BNR process ic tank with methanic \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000 \$3,890,000 \$449,000 \$3,890,000 \$4,790,000 \$3,896,000 \$4,790,000 \$1,790,000	esign flow found ear // // // // // // // // // // // // //		noc
CAPITAL COST:	Equipment and Structelectrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Corsubtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implemed Cost (2 Add't aeration Additional Horsepower Cost (12 Add't aeration Additional Horsepower Cost (13 Add't aeration Additional Required: Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenan Denitrification Sludge	Other: No modifications required by the control of	sed tilter with methanic cation Biofilter and ag BNR process is tank with methanic set and set	esign flow found ear // // // // // // // // // // // // //		port
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add'l aeration Additional Horsepown Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenau Denitrification Sludge Sludge Disposal Cost Total Annual O&M Co	Other: No modifications required by the control of	red t filter with methanic cation Biofilter and ng BNR process ic tank with methanic \$2,350,000 \$282,000 \$353,000 \$2,990,000 \$449,000 \$3,890,000 \$449,000 \$3,890,000 \$4,790,000 \$3,896,000 \$4,790,000 \$1,790,000	esign flow found ear // // // // // // // // // // // // //		oort
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add'l aeration Additional Horsepown Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenau Denitrification Sludge Sludge Disposal Cost Total Annual O&M Co	Other: No modifications required by the control of	red t filter with methanic cation Biofilter and ng BNR process ic tank with methanic section Biofilter and ng BNR process ic tank with methanic section sectio	esign flow found ear // // // // // // // // // // // // //		port
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to implement Cost (2 Add't aeration Additional Horsepown Electrical Power Cos Nitrate Reduction usi Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenan Denitrification Sludge Sludge Disposal Cos Total Annual O&M Ceffective Annual Inter	Other: No modifications required by the control of	red t filter with methanic cation Biofilter and ing BNR process ic tank with methanic section \$2,350,000 \$282,000 \$353,000 \$282,000 \$353,000 \$449,000 \$3,890,000 \$449,000 \$3,890,000 \$4,790,000 \$4,790,000 \$1,86 for BNR at diution) 80 HP \$26,100 \$/ye 5.0 mg/s \$21,900 \$/ye \$38,900 \$/ye \$38,900 \$/ye \$17,500 \$/ye \$104,400 \$/ye \$104,400 \$/ye	esign flow found ear // // // // // // // // // // // // //		noc
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P: Engineering and Corsubtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Also need to impleme Cost (2 Add't aeration Additional Horsepow Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenal Denitrification Sludge Sludge Disposal Cost Total Annual O&M Co Effective Annual Inter 20-Year Present Wor	Other: No modifications required by the control of	red t filter with methanic cation Biofilter and ng BNR process ic tank with methanic section Biofilter and ng BNR process ic tank with methanic section sectio	DeNit filter with it of feed esign flow found ear // // // // // // // // //		hoc

PROJECT:	Implementing a 3 r	ng/L Annual Average To	tal Nitrogen Limit		
PREPARED FOR:	USEPA, Chesapea		776		
PREPARED BY:		Stearns & Wheler, LLC			
DATE:	March 19, 2001				
FACILITY:	Harrisonburg WW	TP			
■ h 1000 k 3 Year (20 C k) a c				1	
LOCATION:	Harrisonburg, VA		DE 00D	240 "	
RATED FLOW:	16.0 mgd		PE COD _	<u>340</u> mg/L	
CURRENT EFFLUENT TN:	6.0 mg/L		PE TKN.	34 mg/L	
A CANADA A SANDA A SAN					
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	400 lbs/d				
The Paris Court	146 1000 lbs/yr				
	2920 1000 lbs/20-y	0276	J .	0	
	2920 1000 103/20-1	Cars			
		9			
CURRENT PROCESS (CHECK	ALL THAT APPLY):	MLE		Existing Aerated Volume (MG): N/a
001111111111111111111111111111111111111		X BEPR (A2/0, VIP, et	(c.)	Existing Anoxic Volume (MG	
			,		
		Bardenpho		Current MLSS at Winter AD	3600
		Oxidation Ditch			
		Lagoon (Biolac, etc.)	١		
			,		
		Cyclical Aeration			
		SBR			
		High-Rate Biofilter			
		X Effluent Filtration			
		Other:			
		-			
I		Fig. 8			
CURRENT EFFLUENT AMMON	IIA-N: <u>0.</u> 5 mg/L	X From Report			
		From Model (at ADE	and load, 15 d MCF	RT, 12° C winter conditions)	
ł.		Total Wodel (at ADI	U		
	×c				
PROPOSED MODIFICATIONS	TO GET AMMONIA <	1.0 mg/L:			
8		No modifications req	uired		New MLSS
A A				ant placifies appeals.)	
		X Raise MCRT/MLSS.	_		N/a
5.0		Construct additional	aerated volume	Flow (mgd): 0	
		Construct additional		Flow (mgd): 0	_
		Construct additional			_
		Use existing anoxic v	volume as aerobic (d	construct separate denit facility)
		Use aerated system	for BOD removal on	ly (construct separate nit/denit	facility)
1		Add influent flow equ		11.	
	(0)	1.0000	Janzanon tank	* 'n * '	4 6
		Other:	11/03/4		
li Plant and any major appropriation					
PROPOSED MODIFICATIONS	TO GET NITRATE <	1.0 mg/L:	*		
THE COLD MEDITION	.0 02:	No modifications req	uirod		
Note: Existing Eff Filters only 3	30" deep,	X Add downstream De	Nit filter with methar	101	
Replace with denite filters		 Add downstream Niti 	rification Biofilter and	d DeNit filter with methanol	
3		Add methanol to exis	ting BNR process		
					10
		Add downstream and	oxic tank with metha	noi reea	
		Add effluent filtration	la l		
	•:	Other:	The state of the s	The state of the s	71.533
		Other.	C 208 TO BOK V. STATE OF		
CAPITAL COST:	Equipment and Slru	ctures (from Page 2):	\$6,550,000		
CALLIAE COOL.					
	Electrical and Instru	nentation. 12			
	Yard Piping and Site				
			% \$983,000		+
	Subtotal:	: Work: 15	% \$983,000 \$8,320,000		
-	Subtotal: Contractor OH&P:	Work: 15	% \$983,000 \$8,320,000 % \$1,248,000		
-	Subtotal:	Work: 15	% \$983,000 \$8,320,000 % \$1,248,000 % \$1,248,000		
	Subtotal: Contractor OH&P: Engineering and Co	Work: 15	% \$983,000 \$8,320,000 % \$1,248,000		
	Subtotal: Contractor OH&P: Engineering and Col Subtotal:	15' 15' 15' 15' 15' 15' 15' 15' 15' 15'	% \$983,000 \$8,320,000 % \$1,248,000 \$1,248,000 \$10,820,000		
	Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency:	Work: 15	% \$983,000 \$8,320,000 \$1,248,000 \$10,820,000 \$2,496,000		
	Subtotal: Contractor OH&P: Engineering and Col Subtotal:	15' 15' 15' 15' 15' 15' 15' 15' 15' 15'	% \$983,000 \$8,320,000 % \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000		
	Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost:	15' nstr Mgmt: 15' 30'	% \$983,000 \$8,320,000 \$1,248,000 \$10,820,000 \$2,496,000		
	Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency:	15' nstr Mgmt: 15' 30'	% \$983,000 \$8,320,000 % \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000		
	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 3	15' 15' 15' 15' 15' 15' 15' 15' 15' 15'	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$4.56	0	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Cor Subtotal: Contingency: Total Capital Cost:	15' 15' 15' 15' 15' 15' 15' 15' 15' 15'	% \$983,000 \$8,320,000 % \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$4.56		
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 3 Additional Horsepow	15' 15' 15' 15' 15' 15' 15' 15' 15' 15'	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$4.56		
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Cot Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 2 Additional Horsepow Electrical Power Cost	15' nstr. Mgmt: 15' 15' 15' 15' 15' 15' 15' 15' 15' 15'	% \$983,000 \$8,320,000 % \$1,248,000 \$10,820,000 \$10,820,000 \$2,496,000 \$13,320,000 \$4.56 320 H \$104,600 \$/	year	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Cot Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 2 Additional Horsepow Electrical Power Cos Nitrate Reduction us	15' nstr. Mgmt: 15' 15' 15' 15' 15' 15' 15' 15' 15' 15'	% \$983,000 \$8,320,000 % \$1,248,000 \$10,820,000 \$10,820,000 \$2,496,000 \$4.56 320 H \$104,600 \$/ 3.0 m	year g/L	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Cot Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 2 Additional Horsepow Electrical Power Cost	15' nstr. Mgmt: 15' 15' 15' 15' 15' 15' 15' 15' 15' 15'	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$1,248,000 \$1,3320,000 \$13,320,000 \$44.56 \$3.0 m \$180 gs	year g/L als/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Cot Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required:	e Work: 15' nstr. Mgmt: 15' 30' 20-Yr. N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol:	% \$983,000 \$8,320,000 % \$1,248,000 \$10,820,000 \$10,820,000 \$2,496,000 \$4.56 320 H \$104,600 \$/ 3.0 m	year g/L als/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost:	15' nstr Mgmt: 15' 30' 20-Yr N removal ver (from Page 2): 5t: 0.05 \$/kW ing Methanol: 0.75 \$/gal	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44.56 320 H \$104,600 \$/ 3.0 m 180 gi	year g/L als/d year	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Ami	e Work: 15' nstr. Mgmt: 15' 30' 20-Yr. N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction:	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$4.56 320 H \$104,600 \$/ 3.0 m 180 gs \$49,300 \$/	year g/L als/d year g/L	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost:	e Work: 15' nstr. Mgmt: 15' 30' 20-Yr. N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction:	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$4.56 320 H \$104,600 \$/ 3.0 m 180 gs \$49,300 \$/ 0.0 m	year g/L als/d year g/L als/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb : Additional Horsepower Electrical Power Cost Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25%	e Work: 15' nstr. Mgmt: 15' 30' 20-Yr. N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction:	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$4.56 320 H \$104,600 \$/ 3.0 m 180 gs \$49,300 \$/	year g/L als/d year g/L als/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 3 Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost:	swork: 15' nstr Mgmt: 15' nstr Mgmt: 15' 30' 20-Yr N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$4,56 320 H \$104,600 \$\frac{3}{3},000 m 180 9\frac{3}{2},49,300 \$\frac{3}{2},49,300 \$\frac{3}{2},49	year g/L als/d year g/L als/d year	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Cot Subtotal: Contingency: Total Capital Cost: Capital Cost per lb 3 Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena	15' nstr Mgmt: 15' 30' 20-Yr N removal ser (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal ance Cost:	% \$983,000 \$8,320,000 % \$1,248,000 \$10,820,000 \$2,496,000 \$4,56 320 H \$104,600 \$/ 3.0 m 180 g; \$49,300 \$/ 0.0 g; \$0 \$/ \$108,200 \$/	year g/L als/d year g/L als/d year year	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintena Denitrification Sludgi	e Work: 15 th nstr. Mgmt: 15 th 30 th 20-Yr N removal: ser (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal ince Cost: e Production w/Methanol;	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44,56 3.0 m 180 gs \$49,300 \$/ 0.0 m 0 gs \$108,200 \$/ \$108,200 \$/	year g/L als/d year g/L als/d year year year	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintena Denitrification Sludgi	e Work: 15 th nstr. Mgmt: 15 th 30 th 20-Yr N removal: ser (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal ince Cost: e Production w/Methanol;	% \$983,000 \$8,320,000 % \$1,248,000 \$10,820,000 \$2,496,000 \$4,56 320 H \$104,600 \$/ 3.0 m 180 g; \$49,300 \$/ 0.0 g; \$0 \$/ \$108,200 \$/	year g/L als/d year g/L als/d year year year	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena Denitrification Sludg Sludge Disposal Cost	# Work: 15" ### 150 ### 150 ### 150 ### 300 ### 20-Yr N removal: ### 150 ### 300 ### 20-Yr N removal: ### 150 ### 300 ### 150 ### 300 ### 150 ### 300 ### 150 ### 300 ### 150 ### 150 ### 300 ### 150	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44.56 320 H \$104,600 \$/ 3.0 m 180 gi \$49,300 \$/ 0.0 m 0 gi \$108,200 \$/ 580 lb \$42,300 \$/	year g/L als/d year g/L als/d year year year s/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cost Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena Denitrification Sludg Sludge Disposal Cost Total Annual O&M Co	e Work: 15' nstr Mgmt: 15' 20-Yr N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal ince Cost: e Production w/Methanol: st: 400 \$/ton lost:	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44.56 320 H \$104,600 \$/ 3.0 m 180 gi \$49,300 \$/ 0.0 m 0 gi \$108,200 \$/ 580 bl \$42,300 \$/ \$304,400 \$/	year g/L als/d year g/L als/d year year year s/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cost Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena Denitrification Sludg Sludge Disposal Cost Total Annual O&M Co	# Work: 15" ### 150 ### 150 ### 150 ### 300 ### 20-Yr N removal: ### 150 ### 300 ### 20-Yr N removal: ### 150 ### 300 ### 150 ### 300 ### 150 ### 300 ### 150 ### 300 ### 150 ### 150 ### 300 ### 150	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44.56 320 H \$104,600 \$/ 3.0 m 0 gg \$49,300 \$/ \$108,200 \$/ \$108,200 \$/ \$304,400 \$/ \$304,400 \$/ \$2,91%	year g/L als/d year g/L als/d year year year s/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb: Additional Horsepow Electrical Power Cost Nitrate Reduction us Methanot Required: Methanot Required: Methanot Cost: Separate Stage Amr Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintena Denitrification Sludg Sludge Disposal Cost Total Annual O&M C Effective Annual Inter	e Work: 15° nstr. Mgmt: 15° 20-Yr. N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal ince Cost: e Production w/Methanol: st: 400 \$/ton oost: vest Rate after Inflation:	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44.56 320 H \$104,600 \$/ 3.0 m 0 gg \$49,300 \$/ \$108,200 \$/ \$108,200 \$/ \$304,400 \$/ \$304,400 \$/ \$2,91%	year g/L als/d year g/L als/d year year year s/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb Additional Horsepow Electrical Power Cost Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena Denitrification Sludg Sludge Disposal Cost Total Annual O&M Co	e Work: 15° nstr. Mgmt: 15° 20-Yr. N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal ince Cost: e Production w/Methanol: st: 400 \$/ton oost: vest Rate after Inflation:	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44.56 320 H \$104,600 \$/ 3.0 m 180 gi \$49,300 \$/ 0.0 m 0 gi \$108,200 \$/ 580 bl \$42,300 \$/ \$304,400 \$/	year g/L als/d year g/L als/d year year year s/d	
	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb : Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena Denitrification Sludge Sludge Disposal Cost Total Annual O&M C Effective Annual Inte 20-Year Present Wo	e Work: 15° nstr. Mgmt: 15° 20-Yr. N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal ince Cost: e Production w/Methanol: st: 400 \$/ton oost: vest Rate after Inflation:	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44,56 320 H \$104,600 \$/ 3.0 m 180 g/ \$49,300 \$/ \$0 \$/ \$108,200 \$/ \$108,200 \$/ \$304,400 \$/ \$304,400 \$/ \$304,400 \$/ \$44,570,000	year g/L als/d year g/L als/d year year year s/d	
OPERATIONS COST:	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb : Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena Denitrification Sludge Sludge Disposal Cost Total Annual O&M C Effective Annual Inte 20-Year Present Wo	e Work: 15° nstr. Mgmt: 15° 20-Yr. N removal ver (from Page 2): st: 0.05 \$/kW ing Methanol: 0.75 \$/gal monia Reduction: 6 conc. 0.60 \$/gal ince Cost: e Production w/Methanol: st: 400 \$/ton oost: vest Rate after Inflation:	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44.56 320 H \$104,600 \$/ 3.0 m 0 gg \$49,300 \$/ \$108,200 \$/ \$108,200 \$/ \$304,400 \$/ \$304,400 \$/ \$2,91%	year g/L als/d year g/L als/d year year year s/d	
	Subtotal: Contractor OH&P: Engineering and Col Subtotal: Contingency: Total Capital Cost: Capital Cost per lb : Additional Horsepow Electrical Power Cos Nitrate Reduction us Methanol Required: Methanol Cost: Separate Stage Amr Caustic Soda @ 259 Caustic Soda Cost: Equipment Maintena Denitrification Sludge Sludge Disposal Cost Total Annual O&M C Effective Annual Inte 20-Year Present Wo	work: 15 th 16 th 17 th 18	% \$983,000 \$8,320,000 \$1,248,000 \$1,248,000 \$10,820,000 \$2,496,000 \$13,320,000 \$44,56 320 H \$104,600 \$/ 3.0 m 180 g/ \$49,300 \$/ \$0 \$/ \$108,200 \$/ \$108,200 \$/ \$304,400 \$/ \$304,400 \$/ \$304,400 \$/ \$44,570,000	year g/L als/d year g/L als/d year year year s/d	

PREPARED FOR: USEPA, Chesapeake Bay Office PREPARED BY: Virginia Tech with Stearns & Wheler, LLC DATE: March 16, 2001 FACILITY: H. L. Mooney WWTP LOCATION: Price William County, VA RATED FLOW: 18.0 mg/L PE COD: 176 mg/L CURRENT EFFLUENT TN: 8.0 mg/L PE TKN: 26 mg/L EFFLUENT TN GOAL: 3.0 mg/L PE TKN: 26 mg/L NITROGEN REDUCTION: 750 lbs/d 274 1000 lbs/yr 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE Existing Aerated Volume (MG): 1.82 BEPR (A2/0, VIP, etc.) Existing Anoxic Volume (MG): 0.78	-		
PREPARED FOR: PREPARED TO: PREPARED TO: DATE: PREPARED TO: DATE: PREPARED TO: DATE: PREPARED TO: DATE: PROCLITY: FACILITY: FAC	PROJECT:	Implementing a 3 mg/L Annual Average Tota	l Nitrogen Limit
PREPARED PY: Output Scarms & Wheler, LLC	DDEDADED FOR		
DATE: FACILITY: FLACILITY: FLACIL	The same of the sa		
FACILITY: L. Mooney WWTP	PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
FACILITY: L. Mooney WWTF L. Mooney WWTF MATER FLOW: 18.0 mg/L PE TKN: 26	DATE:	March 16, 2001	
LOCATION:	EACH ITY		
RATED FLOW: 18.0 mg/L EFFLUENT TN GOAL: 3.0 mg/L NTROGEN REDUCTION: 3.0 mg/L NTROGEN REDUCTION: 3.0 mg/L PETKN. 26 mg/L REFRUENT TN GOAL: 3.0 mg/L 272 1000 bs/y 573 1000 bs/y 573 1000 bs/y 573 1000 bs/y 574 1000 bs/y 575 1000 bs/y 575 1000 bs/y 575 1000 bs/y 576 1000 bs/y 577	B 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
CURRENT PFILIENT TN: 8.0 mg/L PE TKN: 28 mg/L	Decree 20 ACC DC	Prince William County, VA	
CURRENT PFILUENT TIN: 8.0 mg/L PE TKN: 26 mg/L	RATED FLOW:	18.0 mgd	PE COD: 176 mg/L
EFFLUENT TN GOAL: NTROGEN REDUCTION: 750 blood 274 1000 blay/07 5475 1000 blay/07	CURRENT EFFICIENT TN:		PE TKN: 26 mg/l
NITROGEN REDUCTION: 750 los/d 274 1000 los/d 754 10	Britain Control Control	=	TE TIME. 20 INGIE,
CURRENT PROCESS (CHECK ALL THAT APPLY):	A Part of the part	3.0 mg/L	
CURRENT PROCESS (CHECK ALL THAT APPLY):	NITROGEN REDUCTION:	750 lbs/d	
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE			
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE BERR (AZO, VIP, etc.) Berdenpho Oxidation Ditch Lagoon (Boilace, etc.) Cyclical Aeration SBR High-Rate Biolitier Effluent Filtration X Other. Silep Feed MLE, no nitrate recycle CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L X From Rodel (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X In modifications required Construct additional alerated volume Construct additional clarifiers V Use existing anoack volume as aerobic (construct separate dentification) Use aerated system for BOD removal only (construct separate intil/dentif facility) Add influent flow equalization tank Other: PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNt filter with methanol Add downstream DeNt filter with methanol X Add methanol to existing BNR process Add downstream Polit filter with methanol X Add methanol to existing BNR process Add downstream DeNt filter with methanol feed Add settlevent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$224,000 Yard Piping and Site Work: 15% \$281,000 Subtotal: Contractor OHAP: Engineering and Constr. Mgmt: 15% \$357,000 Subtotal: Contractor OHAP: Engineering and Constr. Mgmt: 15% \$357,000 Subtotal: Contractor OHAP: Electrical Prower Cost: 0.05 \$NW Nitrate Reduction using Methanol Cost: Capital Cost per lb. 2-DY. N removal: 0.00 \$10 \$30,000 Verar Treatment Maintenance Cost: Dentrification Subge Production withdehanol Sludge Disposal Cost: 400 \$30,000 10 al Annual OMC cost: Effective Annual interest Rate after Inflation: 2.0 424 Poping Production withdehanol Sludge Disposal Cost: 400 \$30,000 10 al Annual OMC cost: Effective Annual interest Rate after Inflation: 2.0 428 Present Worth of O&M Costs: 56,840,000			
BEFR (AZIO, VIP, etc.) Existing Anoxic Volume (MC) 0.78		5475 1000 lbs/20-years	
BEFR (AZIO, VIP, etc.) Existing Anoxic Volume (MC) 0.78			
BEFR (A2/0, VIP, etc.) Existing Anoxic Volume (MC) 0.78	CURRENT PROCESS (CHECK	ALL THAT APPLY). X MIF	Existing Aerated Volume (MG): 1.82
Bardenpho Current MLSS at Winter ADF 2700 Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Ageration SBR High-Rate Biofilter Effluent Filtration SIR High-Rate Biofilter Effluent Filtration Sign Agent Micro Modifications required Current MCRT. 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: Sign MCRTMLSS in existing tanks (check clarifier capacity) Construct additional clarifors Construct additional clarifors Construct additional clarifors Flow (mgd): Use existing anoate volume Flow (mgd): Use existing anoate volume as aerobic (construct separate entit floation) Use existing anoate volume as aerobic (construct separate entit floation) Add downstream Ninfication Biofilter and DeNit filter with methanol and downstream Ninfication Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Add downstream nointification Biofilter and DeNit filter with methanol Revolution Biofilter and DeNit filter wit	TOOKKENT I KOOLOO (CIILCK		
Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SIRP High-Rate Biofiliter Effluent Filtration SIRP High-Rate Biofiliter Effluent Filtration X Other: Step Feed MLE, no nitrate recycle			
Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SIRP High-Rate Biofiliter Effluent Filtration SIRP High-Rate Biofiliter Effluent Filtration X Other: Step Feed MLE, no nitrate recycle		Bardenpho	Current MLSS at Winter ADF 2700
Lagoon (Biolac, etc.) Cyclical Aeration SBR		Ovidation Ditch	
CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L From Report Effluent Filtration X Other: Step Feed MLE, no nitrate recycle CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: No modifications required New (mg/d) New MLS No modifications required New (mg/d)	1		
SBR High-Rate Biofiliter Effluent Filtration X Other: Step Feed MLE, no nitrate recycle CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L X from Report From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L: X No modifications required Raise MCRTMLS5 in existing tanks (check clarifier capacity) N/a: X No modifications required Raise MCRTMLS5 in existing tanks (check clarifier capacity) N/a: Construct additional clarifiers Flow (mg/d): 0 Flow (mg/d): 0 Construct additional clarifiers Flow (mg/d): 0 Construct additional caracted volume Flow (mg/d): 0 Construct additional caracter volume Flow (mg/d): 0 Construct separate entit facility) Lise acrated system for BOD removal only (construct separate entit facility) Lise acrated system for BOD removal only (construct separate intit/denit facility) Add intellement flow equalization tank Other: PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: Add officiant flow equalization tank Other: No modifications required Add downstream North cank with methanol Add downstream Denlit filter with methanol Add downstream North cank with methanol feed Add effluent filters to denite filters with methanol feed Add effluent filters to denite filters with methanol feed Add effluent filters to denite filters with methanol feed Add effluent filters to denite filters with methanol feed Add effluent filters to denite filters with methanol feed Add effluent filters to denit	f .	Lagoon (Biolac, etc.)	
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CAPITAL COST:		Add effluent filtration	
CAPITAL COST:		X Other Modify exist	ing deep bed effluent filters to denite filters.
Electrical and Instrumentation: 12% \$224,000 Yard Piping and Site Work: 15% \$281,000 Subtotal: 52,380,000 Contractor OH&P: 15% \$357,000 Engineering and Constr. Mgmt: 15% \$357,000 Subtotal: 53,090,000 Contingency: 30% \$714,000 Total Capital Cost: 53,800,000 Contingency: 30% \$714,000 Total Capital Cost per lb. 20-Yr. N removal: 50,69 OPERATIONS COST: Additional Horsepower (from Page 2): 50,69 OPERATIONS COST: 0,05 \$/kW \$0,800,000 OPERATIONS COST: 0,05 \$/kW \$0,800,000 OPERATIONS COST: 0,05 \$/kW \$0,800,000 OPERATIONS COST: 0,00 \$/k/vear OPERATIONS		LA Outer	The state of the s
Electrical and Instrumentation: 12% \$224,000 Yard Piping and Site Work: 15% \$281,000 Subtotal: \$2,380,000 Contractor OH&P: 15% \$357,000 Engineering and Constr. Mgmt: 15% \$357,000 Subtotal: \$3,090,000 Contingency: 30% \$714,000 Total Capital Cost: \$3,800,000 Contingency: 30% \$714,000 Total Capital Cost per lb. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): \$0.69 OPERATIONS COST: 0.69 OPERATIONS COST: 0.60 OPERATIONS COST: 0.69 OPERATIONS COST: 0.60 OPERATIONS COST: 0.69 OPERATIONS COST: 0.60 OPERATIONS COST	MAN CONTRACTOR OF THE PARTY OF		
Yard Piping and Site Work: 15% \$281,000 \$2,380,000 Contractor OH&P: 15% \$357,000 Engineering and Constr. Mgmt: 15% \$357,000 Subtotal: \$3,090,000 Contingency: 30% \$714,000 Total Capital Cost: \$3,800,000 Capital Cost per lb. 20-Yr. N removal: \$3,800,000 Capital Cost per lb. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW \$0 \$/year Nitrate Reduction using Methanol: 5.0 mg/L Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d S0 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda Cost: 0.60 \$/gal \$0 \$/year S0 \$/year Sudge Disposal Cost: 400 \$/ton \$78,800 \$/year S78,800	CAPITAL COST:	Equipment and Structures (from Page 2):	\$1,870,000
Yard Piping and Site Work: 15% \$281,000	AND SERVE TO SERVE	Electrical and Instrumentation: 12%	\$224,000
Subtotal: \$2,380,000			
Contractor OH&P: 15% \$357,000 Engineering and Constr. Mgmt: 15% \$357,000 Subtotal: \$3,000,000 Contingency: 30% \$714,000 Total Capital Cost: \$3,800,000 Capital Cost per lb. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): \$0 HP Electrical Power Cost: 0.05 \$/kW \$0 \$/year Nitrate Reduction using Methanol: \$5.0 mg/L Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: 1080 lbs/d Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000		Yard Piping and Site Work: 15%	\$281,000
Contractor OH&P: 15% \$357,000 Engineering and Constr. Mgmt: 15% \$357,000 Subtotal: \$3,000,000 Contingency: 30% \$714,000 Total Capital Cost: \$3,800,000 Capital Cost per lb. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): \$0 HP Electrical Power Cost: 0.05 \$/kW \$0 \$/year Nitrate Reduction using Methanol: \$5.0 mg/L Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: 1080 lbs/d Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000		Subtotal:	\$2,380,000
Engineering and Constr. Mgmt: 15% \$357,000 Subtotal: \$3,090,000 Contingency: 30% \$714,000 Total Capital Cost: \$3,800,000 Capital Cost per lb. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP Electrical Power Cost: 0.05 \$/kW \$0 \$/year Nitrate Reduction using Methanol: 5.0 mg/L Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc 0 gals/d Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: \$1080 lbs/d Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000			
Subtotal:	i		·
Subtotal:		Engineering and Constr. Mgmt: 15%	\$357,000
Contingency: 30% \$714,000 \$3,800,000 Capital Cost per lb. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: 5.0 mg/L Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year \$202,800 \$/year \$202,800 \$/year \$202,800 \$/year \$202,800 \$/year \$30,900 \$/			\$3,090,000
Total Capital Cost: \$3,800,000 Capital Cost per Ib. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP Electrical Power Cost: 0.05 \$/kW \$0 \$/year Nitrate Reduction using Methanol: 5.0 mg/L Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$20,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000			
Capital Cost per Ib. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP	7.5	Contingency: 30%	
Capital Cost per Ib. 20-Yr. N removal: \$0.69 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP		Total Capital Cost:	\$3,800,000
OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP Electrical Power Cost: 0.05 \$/kW \$0 \$/year Nitrate Reduction using Methanol: 5.0 mg/L Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: 1080 lbs/d Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year *701al Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000			
Electrical Power Cost:		Capital Cost per lb. 20-11. N Terrioval.	\$0.03
Electrical Power Cost:			
Electrical Power Cost:	OPERATIONS COST:	Additional Horsenower (from Page 2):	0 HP
Nitrate Reduction using Methanol:	or EKATIONO OOOT.		
Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: 1080 lbs/d Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$20,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000		Electrical Power Cost: 0.05 \$/KVV	\$U \$/year
Methanol Required: 340 gals/d Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: 1080 lbs/d Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$20,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000		Nitrate Reduction using Methanol:	5.0 mg/L
Methanol Cost: 0.75 \$/gal \$93,100 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$30,900 \$/year Denitrification Sludge Production w/Methanol: 1080 lbs/d Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000	*: " · · · · · · · · · · · · · · · · · ·		
Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Sa0,900 Sylvear Solade Disposal Cost: A00 \$/ton S78,800 S/year Solade Disposal Cost: S10,900 Sylvear S78,800 Sylvear S202,800 Sylvear			•
Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: Caustic Sod		Methanol Cost: 0.75 \$/gal	\$93,100 \$/year
Caustic Soda @ 25% conc. Caustic Soda Cost: C		_	
Caustic Soda Cost: 0.60 \$/gal \$0 \$/year. Equipment Maintenance Cost: \$30,900 \$/year Dentrification Sludge Production w/Methanol: 1080 lbs/d Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000			
Equipment Maintenance Cost: \$30,900 \$/year Dentrification Sludge Production w/Methanol: \$1080 lbs/d \$78,800 \$/year Total Annual O&M Cost: \$20,800 \$/year Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000		_	•
Equipment Maintenance Cost: \$30,900 \$/year Dentrification Sludge Production w/Methanol: \$1080 lbs/d \$78,800 \$/year Total Annual O&M Cost: \$20,800 \$/year Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000		Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year
Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$202,800 \$/year \$202,800 \$/year \$2,91% \$3,040,000 **TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000			
Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000			·
Sludge Disposal Cost: 400 \$/ton \$78,800 \$/year Total Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000		Denitrification Sludge Production w/Methanol:	1080 lbs/d
Total Annual O&M Cost: \$202,800 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000			\$78,800 \$/year
Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000	20	3	·
20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000			
20-Year Present Worth of O&M Costs: \$3,040,000 TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000		Effective Annual Interest Rate after Inflation:	2.91%
TOTAL 20-YEAR PRESENT WORTH COST: \$6,840,000			
· · ·	n=	20- Leaf 1 Teacht Aforth of Odial Coats.	Antonia in the same of the sam
· · ·	M5		
· · ·	TOTAL 20-YEAR PRESENT WO	RTH COST:	\$6,840,000
TOTAL COST DEL TO LETTE TOTAL			· · ·
		rotal boot per lot 20-11, it removal.	· · · · · ·

		T-1	Allian man I Imale		
PROJECT:		/L Annual Average Total	Nitrogen Limit		
PREPARED FOR:	USEPA, Chesapeake				
PREPARED BY:	Virginia Tech with St	earns & Wheler, LLC			
DATE:	March 19, 2001				
FACILITY:	Leesburg WWTP	- `			
LOCATION:	Leesburg, VA	_	05.000	A11 4	
RATED FLOW:	4.9 mgd		PE COD:		
CURRENT EFFLUENT TN:	7.0 mg/L		PE TKN:	N/a mg/L	
EFFLUENT TN GOAL:	3.0 mg/L				
	•	•			
NITROGEN REDUCTION:	160 lbs/d =				
	58 1000 lbs/yr				
	1168 1000 lbs/20-yea	ars			
CURRENT PROCESS (CHECK	ALL THAT APPLYI-	VIME		Existing Aerated Volume (M	(G): N/a
CURRENT PROCESS (CHECK				Existing Anoxic Volume (M	
		X BEPR (A2/0, VIP, etc.)			
		Bardenpho		Current MLSS at Winter A	DF: 3500
		Oxidation Ditch			
		Lagoon (Biolac, etc.)			
	H	Cyclical Aeration			
4	L				
		SBR			
		High-Rate Biofilter			
		Effluent Filtration			
		# 1 / CO 0 (CO CO C	t can also be ope	rated as an MI E	
I		X Other: An A2/O tha	L can also be upe	resets as all MILL	
	200				
CURRENT EFFLUENT AMMON	IIA-N: <1.0 mg/L 🗆	X From Report			
		From Model (at ADF ar	d load, 15 d MCR	T, 12° C winter conditions)	
s u		all model (at Apr al	10 0 111011	,	3.
naverse		1041			
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1	<u>.0</u> mg/L:			
		X No modifications requir	ed		New MLSS
		Raise MCRT/MLSS in	existing tanks (che	eck clarifier capacity)	N/a
	-	Construct additional ae		Flow (mgd): 0	-
	_				
		Construct additional cla		Flow (mgd):0	
		Use existing anoxic vol	ume as aerobic (c	onstruct separate denit facili	ty)
		Use aerated system for	BOD removal onl	ly (construct separate nit/der	nit facility)
	- 1	Add influent flow equali			
	1		Editor tariit		
	_	Other:	='/- 1)		
	= 1	Add methanol to existing Add downstream anoxion Add effluent filtration	filter with methan- cation Biofilter and g BNR process c tank with methan	DeNit filter with methanol not feed	200
	E.	Other:	CONTRACTOR OF STREET	Charles in the Second	Section Court -
	-				
CAPITAL COST:	Equipment and Struct	ures (from Page 2):	\$2,650,000		
CAPITAL COST.			\$318,000		
	Electrical and Instrum				
	"Yard Piping and Site \	Nork: 15%	\$398,000		
	Subtotal:		\$3,370,000		
	Contractor OH&P:	15%	\$506,000		
	Engineering and Cons		\$506,000		
		1070	\$4,380,000		
	Subtotal:			+8	
	Contingency:	30%	\$1,011,000		
l	Total Capital Cost:		\$5,390,000		
2	Capital Cost per lb. 20	-Yr N removal	\$4.61		
9.5					
ODERATIONS SOST	A Hadabara - 1 1 4 a	r Hrom Dago Oli	100 HI	D	
OPERATIONS COST:	Additional Horsepowe				
	Electrical Power Cost	0.05 \$/kW	\$32,700 \$/		
I	Nitrate Reduction usin	g Methanol:	4.0 m	g/L	
1	Methanol Required:	-	70 ga		
I	· ·	0.75 \$/201	\$19,200 \$/		5
19	Methanol Cost:	0.75 \$/gal			
	Separate Stage Amm	onia Reduction:	0,0 ₋ m		
I	Caustic Soda @ 25%	conc.	0 ga	ils/d	20
5 2	Caustic Soda Cost:	0.60 \$/gal	\$0 \$/	year	
×	Equipment Maintenan	•	\$43,800 \$/	-	096
- +-	Caritain attack	Draduation w/Mathanal		=	
- ~		Production w/Methanol:	230 lbs		
- 25	Sludge Disposal Cost	400 \$/ton	\$16,800 \$/	•	
I	Total Annual O&M Co		\$112,500 \$/	year	
		est Rate after Inflation:	2.91%		
			\$1,690,000		
I	20-Year Present Worl	II UI UAIVI CUSIS.	# 1,050,000		
500,clip					
TOTAL 20-YEAR PRESENT WO	ORTH COST:		\$7,080,000		
	Total Cost per lb. 20-1	r. N removal:	\$6.06		
İ					

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY: LOCATION: RATED FLOW: CURRENT EFFLUENT TN: EFFLUENT TN GOAL: NITROGEN REDUCTION:	Implementing a 3 mg/L Annual Average Total USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Wheler, LLC March 16, 2001 Noman M. Cole WWTP(formerly Lower Potom Fairfax County, VA 67.0 mgd 8.0 mg/L 3.0 mg/L 2790 lbs/d 1018 1000 lbs/yr 20367 1000 lbs/y20-years	
		Existing Aerated Volume (MG): 18.65
CURRENT PROCESS (CHEC	X ALL THAT APPLY): X MLE BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration	Existing Anoxic Volume (MG): 7.3 Current MLSS at Winter ADF: 2700
*	SBR High-Rate Biofilter	2.
	Effluent Filtration X Other: Step Feed 6	ILE, no nitrate recycle
	e - 2 * -	The state of the s
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L X From Report	id load, 15 d MCRT, 12° C winter conditions)
0		
PROPOSED MODIFICATIONS	S TO GET AMMONIA < 1.0 mg/L: X No modifications requir	ed New MLSS
	Raise MCRT/MLSS in	existing tanks (check clarifier capacity) N/a
	Construct additional ae	rated volume Flow (mgd):0
	Construct additional cla	ume as aerobic (construct separate denit facility)
4	. Use aerated system for	BOD removal only (construct separate nit/denit facility)
	Add influent flow equali	zation tank
	Other:	
PROPOSED MODIFICATION	X Add methanol to existing Add downstream anoxi	I filter with methanol cation Biofilter and DeNit filter with methanol
	N===	
CAPITAL COST:	Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal:	\$7,980,000 \$1,197,000 \$1,197,000 \$10,370,000 \$2,394,000 \$12,760,000 \$0.63
OPERATIONS COST:	Additional Horsepower (from Page 2): Flectrical Power Cost: 0.05 \$/kW	0 HP \$0 \$/year
	Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol:	5.0 _ mg/L
×	Methanol Required:	1270 gals/d \$347,700 \$/year
	Methanol Cost: 0.75 S/gal Separate Stage Ammonia Reduction:	0.0 mg/L
	Caustic Soda @ 25% conc	0 gals/d
	Caustic Soda Cost: 0 60 \$/gal	\$0 \$/year \$103,700 \$/year
	Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol:	4020 lbs/d
	Sludge Disposal Cost: 400 \$/ton	\$293,500 \$/year
1	Total Annual O&M Cost:	\$744,900 \$/year
	Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	2.91% \$11,170,000
TOTAL 20-YEAR PRESENT	WORTH COST: Total Cost per lb. 20-Yr. N removal:	\$23,930,000 \$1.17

PROJECT: PREPARED FOR: PREPARED BY:	USEPA, Chesapea	ng/L Annual Average Total ke Bay Office Stearns & Wheler, LLC	Nitrogen Limit		
DATE:	March 19, 2001				25
FACILITY:	Luray WWTP			2 x	
LOCATION:	Luray, PA				
RATED FLOW:	2.0 mgd	100	PE COD: _		
CURRENT EFFLUENT TN:	7.0 mg/L		PE TKN: -	N/a mg/L	
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	70 lbs/d				
M. W. S.	26 1000 lbs/yr				
	511 1000 lbs/20-y	vears .			
	- Continued			1.0	
CURRENT PROCESS (CHECI	K ALL THAT APPLY):	MLE		Existing Aerated Volum	
		BEPR (A2/0, VIP, etc.)		Existing Anoxic Volum	
		Bardenpho		Current MLSS at Wir	nter ADF 5,500
		X Oxidation Ditch			A-
		Lagoon (Biolac, etc.)			
		X Cyclical Aeration			
		SBR			
		High-Rate Biofilter			
		Effluent Filtration			
	54	Other:			
		permitty			
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L	X From Report			
		From Model (at ADF and	d load, 15 d MCF	RT, 12° C winter conditi	ons)
=					
PROPOSED MODIFICATIONS	TO GET AMMONIA	< 1.0 mg/L:			
THOI GOLD MICE.	, 10 02	X No modifications require	ed		New MLSS
		Raise MCRT/MLSS in e		eck clarifier capacity)	N/a
		Construct additional aer		Flow (mgd):	0 1 000
		Construct additional clar		Flow (mgd):	0
		Use existing anoxic volu	Ime as aerooic (c	Construct separate uem	t facility)
		Use aerated system for		ily (construct separate i	hil/denit raciiity)
		Add influent flow equaliz	zation tank		
		Other:			
9		No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration	filter with methar ation Biofilter and g BNR process tank with metha	d DeNit filter with metha	anol
_	V X	Other:			
			£4 650 000		
CAPITAL COST:		ictures (from Page 2):	\$1,650,000		
	Electrical and Instru		\$198,000		
an	Yard Piping and Sile	e Work: 15%	\$248,000		
*.0	Subtotal:		\$2,100,000		
	Contractor OH&P:	15%	\$315,000		
	Engineering and Co	nstr. Mamt: 15%	\$315,000		
	Subtotal:	115tt. ingine.	\$2,730,000		
		30%			
	Contingency:	••	\$3,360,000		
¥.1	Total Capital Cost:	and the Manager of			
	Capital Cost per lb.	20-Yr, N removal.	\$6.58		
OPERATIONS COST:	Additional Horsepov		40 H		
	Electrical Power Co	st: 0.05 \$/kW	\$13,100 \$	/year	
	Nitrate Reduction us		4.0 m	ıg/L	
	Methanol Required:	-	30 g	-	
	Methanol Cost:	0.75 \$/gal	\$8,200 \$		
			0.0 m	•	
	Separate Stage Am			als/d	
	Caustic Soda @ 25		-		
	Caustic Soda Cost:		\$0.5	**	
	Equipment Maintena	ance Cost:	\$27,300 \$	•	
50	Denitrification Sludg	ge Production w/Methanol:	100 lb		
S 0	Sludge Disposal Co		\$7,300 \$		
	Total Annual O&M (\$55,900 \$	/year	
= = =		erest Rate after Inflation:	2.91%		
297	20-Year Present Wo		\$840,000		
/*	ZU-1001 1 1000111 111				
TOTAL OF VE DECENT WO	DTH COCT		\$4 200,000		
TOTAL 20-YR PRESENT WO	RTH COST Total Cost per lb. 20		\$4,200,000 \$8.22		

DOO HOT					
PROJECT:	Implementing a 3 mg/L A		al Nitrogen Limit		
PREPARED FOR:	USEPA, Chesapeake Bay	Office			
PREPARED BY:	Virginia Tech with Stearn	s & Wheler, LLC			
DATE:	_				
	March 19, 2001				
FACILITY:	Merck, Inc. VA				2
LOCATION:	Elkton, VA				
RATED FLOW:	1.2 mgd		PE COD:	5077 mg/L	
CURRENT EFFLUENT TN:					
The state of the property of the state of th	41.7 mg/L		PE TKN:	98 mg/L	
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	390 lbs/d				
	142 1000 lbs/yr				
1					
	2847 1000 lbs/20-years				
45					
CURRENT PROCESS (CHECK	(ALL THAT APPLY): MI	F	1	Existing Aerated Volume (MG	4.0715
		PR (A2/0, VIP, etc.)			The second second second
)	Existing Anoxic Volume (MG	
	X Ba	ardenpho		Current MLSS at Winter ADI	F N/a
	0>	adation Ditch		0	
	TI.a	goon (Biolac, etc.)			
1		clical Aeration			
* 100	SE	3R			
	Hic	gh-Rate Biofilter			
		fluent Filtration			
1					
PS .		her:		E41 1 100 100	41
CURRENT EFFLUENT AMMOR	JIA-N: <10 moll Y Fre	om Report			+
The state of the s				- 100 0	
	Fro	om Model (at ADF ar	na ioad, 15 d MCRT	f, 12° C winter conditions)	
I				10	
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg	ı/I ·		9	
THOI COLD MODIL ICATIONS					
7		modifications requir			New MLSS
	≞€ Ra	ise MCRT/MLSS in	existing tanks (chec	ck clarifier capacity)	N/a
		nstruct additional ae		Flow (mgd): 0	2
		nstruct additional cla		Flow (mgd): 0	
				. 3	-
				nstruct separate denit facility)	
	Us	e aerated system for	r BOD removal only	(construct separate nit/denit	facility)
	Add	d influent flow equal:	ization tank		
		ner:	iconon torm	C - 179 - 1	
		ter.	1000	200	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/l	23		7	
ANTHER SHICKSON		modifications requir	ha:		
				i	1
		d downstream DeNit			1
	Add	d downstream Nitrific	cation Biofilter and I	DeNit filter with methanol	
2	Add	d methanol to existin	g BNR process		1
2		d downstream anoxid		ol feed	
		d effluent filtration	o toriit mari motrario	7 1000	- 1
	X Oth	ner: Add more m	nethanol		
CAPITAL COST:	Equipment and Structures (fi	rom Page 2):	\$0		- 1
OFFICE COOT.	• •				
	Electrical and Instrumentatio		\$0		
	Yard Piping and Site Work;	15%	\$0		
	Subtotal:		\$0		
	Contractor OH&P:	15%	\$0	127	
			·		
	Engineering and Constr. Mgr	mt: 15%	- \$0	,	1
	Subtotal:	72	\$0		1
	Contingency:	30% -			1
		0078			- 1
	Total Capital Cost:		\$0	**	
	Capital Cost per lb. 20-Yr. N	removal:	\$0.00		
V.				9	8
OPERATIONS COST:	Additional Horsepower_(from	Page 2):	0 HP		
		-			
	Electrical Power Cost:	0.05 \$/kW	\$0 \$/ye	(1	
2 .	Nitrate Reduction using Meth	anol:	38.7 mg/	L	
8 ^	Methanol Required:	-	180 gals		
	Methanol Cost:	0.75 \$/gal	\$49,300 \$/ye		- 1
	Separate Stage Ammonia Re	eduction:	0.0_ mg/l		
*	Caustic Soda @ 25% conc.		0 gais	/d	1
	Caustic Soda Cost:	0.60 \$/gal	\$0 \$/ye		
	Equipment Maintenance Cos		\$0 \$/ye		1
	Denitrification Sludge Produc	tion w/Methanol	560 lbs/d	1	- 1
	Sludge Disposal Cost:	400 S/ton	\$40,900 \$/ye	ar	
8	Total Annual O&M Cost:		\$90,200 \$/ye		
8 8		4 1 - 5 . *		uı	
	Effective Annual Interest Rate		2.91%		- 1
	20-Year Present Worth of O8	kM Costs:	\$1,350,000		
			*S		
TOTAL 20.VEAR DRESENTING	DTU COCT.		£4 350 000		1
TOTAL 20-YEAR PRESENT WO			\$1,350,000		
	Total Cost per lb. 20-Yr. N rei	moval:	\$0.47		1

	A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					144
PROJECT:	Implementing a 3 m	ng/L Annual Average	Total Nit	rogen Limit		277
PREPARED FOR:	USEPA, Chesapeak	ke Bay Office				
PREPARED BY:	Virginia Tech with	Stearns & Wheler, LL	LC			
DATE:	March 19, 2001					
FACILITY:	Middle River-Veron	ıa WWTP				
LOCATION:	Augusta County, VA					
RATED FLOW:				PE COD:	N/a mg/L	
	4.5 mgd			PE TKN:	N/a mg/L	
CURRENT EFFLUENT TN:	5.0 mg/L			PE INN.	IV/a myrc	
EFFLUENT TN GOAL:	3.0 mg/L					
NITROGEN REDUCTION:	80 lbs/d					
	29 1000 lbs/yr	-				
	584 1000 lbs/20-ye	ears				
entertaining to the	= :== 1 10	0.7(c)(<u>hr</u>)			- · · · · · · · · · · · · · · · · · · ·	2101 N/o
CURRENT PROCESS (CHECK	. ALL THAT APPLY): I				Existing Aerated Volu	
ν.	*	BEPR (A2/0, VIP.	(etc.)		Existing Anoxic Volu	
		Bardenpho			Current MLSS at W	inter ADF: 5000
	W T	X Oxidation Ditch				
	J.	Lagoon (Biolac, e				
	J	Cyclical Aeration				(*
	J	SBR				151
	r	High-Rate Biofilte	ع د			
	J.	Effluent Filtration				
				Oxidation Ditch		
=	ñ	X Other. D.F.	Actawa	JAIUauvii Dig.		
SUPPRINT SEEL LIGHT AMMON	10 mall	V From Renord				
CURRENT EFFLUENT AMMON	IIA-N: ≤1.0 mg/L		25 224 10	MCB	- 100 O mintar condi	
	I	From Model (at A	DF and id	13 d MUN	RT, 12° C winter condi-	tions)
		Ann 1				2
PROPOSED MODIFICATIONS	TO GET AMMONIA					
	9	X No modifications		(4)		New MLSS
4					eck clarifier capacity)	N/a
2 2	T	Construct addition			Flow (mgd): _	0
	ľ	Construct addition			Flow (mgd):	0
	r				onstruct separate den	
	1				ly (construct separate	• • • • • • • • • • • • • • • • • • • •
	15	Add influent flow			ly (construct soperare,	Hivucinciaomy
	1	Other:	equanzas	Oll Calin		Section 1
	i. it	Other.				
TOTOGED MODIFICATIONS	TO SET MITDATE 24	- 2				
PROPOSED MODIFICATIONS	TO GET NIIKAIE		irod			
	-	No modifications		in mathan		
8		X Add downstream				
/I	2.1				DeNit filter with meth	nanol
L ~		Add methanol to e				
	- 7	Add downstream		nk with methar	nol feed	
		Add effluent filtrat	lion		14	
	· J	Other:	-2347	3303	Wallett Off	(A)
16				- V		
CAPITAL COST:	Equipment and Struc	ctures (from Page 2)		\$2,530,000		
CAPITAL COST.	Electrical and Instrum	,	12%	\$304,000		
			15%	\$380,000		
	Yard Piping and Site	Work:				
	Subtotal:			\$3,210,000		
lie _	Contractor OH&P:		15%	\$482,000		
	Engineering and Con	istr. Mgmt:	15%	\$482,000		
	Subtotal:		\$	\$4,170,000		
	Contingency:		30%	\$963,000		
	Total Capital Cost:			\$5,130,000		
	Capital Cost per lb. 2	O_Yr N removal		\$8.78	V.	
	Capital Cook per	.0-11, 11 .5				
OPERATIONS COST:	Additional Horsepowe	or (from Page 2):		90 HF	0	
OPERATIONS COST.	. v			\$29,400 \$/		94
*	Electrical Power Cost				•	
fi av je	Nitrate Reduction usi	ing Methanoi:		2.0 mg	-	
	Methanol Required:	1 -1		. 30 ga		
	Methanol Cost:	0.75 \$/gal		\$8,200 \$/	•	
	Separate Stage Amm	nonia Reduction:	<u> </u>	0.0 mg		
2	Caustic Soda @ 25%			0 ga	ils/d	
	Caustic Soda Cost:	0.60 \$/gal		\$0 \$/y		
	Equipment Maintenar	-		\$41,700 \$/y		
		e Production w/Methan	aol:	110 lbs		
			101.			
	Sludge Disposal Cos			\$8,000 \$/y		
	Total Annual O&M Co			\$87,300 \$/y	<i>y</i> ear	
-		rest Rate after Inflation		2.91%		
	20-Year Present Wor	rth of O&M Costs:	\$	\$1,310,000		
TOTAL 20-YEAR PRESENT WO	ORTH COST:	•	\$1	6,440,000		
	Total Cost per lb. 20-	Yr N removal:		\$11.03		
	Total oost per is a	11. 11 101		•••••		

PROJECT:	Implementing a 3 mg/L Annual Average Total	ai Nitrogen Limit
PREPARED FOR:	USEPA, Chesapeake Bay Office	AND SOME WAS INCOMESSED.
PREPARED BY:	Virginia Tech with Steams & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY:	Opequon WWTP	
LOCATION:	Frederick County, VA	
RATED FLOW:	6.3 mgd	PE COD: N/a mg/L
CURRENT EFFLUENT TN:	8.0 mg/L	PE TKN: N/a mg/L
EFFLUENT TN GOAL:	3.0 mg/L	
NITROGEN REDUCTION:	260 lbs/d	
Total Company	95 1000 lbs/yr	2
193	1898 1000 lbs/20-years	
		The American Street
CURRENT PROCESS (CHEC		Existing Aerated Volume (MG): N/a
25	X BEPR (A2/0, VIP, etc.	
	Bardenpho	Current MLSS at Winter ADF: 3000
	Oxidation Ditch	· ·
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
	SBR	
-	High-Rate Biofilter	
	Effluent Filtration	200000000
	X. Other: Step-feed	A2/0 system
CURRENT EFFLUENT AMMO	NIA-N: 0.4 mg/L X From Report	
l		nd load, 15 d MCRT, 12° C winter conditions)
		*
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
	X No modifications requi	
		existing tanks (check clarifier capacity) N/a
	Construct additional ac	erated volume Flow (mgd): 0000
	Construct additional cl	arifiers Flow (mgd): 0
- E	Use existing anoxic vo	tume as aerobic (construct separate denit facility)
	Use aerated system fo	r BOD removal only (construct separate nit/denit facility)
	Add influent flow equal	ization tank
	Add influent flow equal Other:	ization tank
PROPOSED MODIFICATIONS		
PROPOSED MODIFICATIONS	Other: TO GET NITRATE < 1.0 mg/L:	red
PROPOSED MODIFICATIONS	Other: TO GET NITRATE < 1.0 mg/L: No modifications requiint X Add downstream DeNi	red
PROPOSED MODIFICATIONS	Other: TO GET NITRATE < 1.0 mg/L: No modifications requiint X Add downstream DeNi	red t filter with methanol cation Biofilter and DeNit filter with methanol
PROPOSED MODIFICATIONS	Other: TO GET NITRATE < 1.0 mg/L: No modifications required to the second sec	red t filter with methanol cation Biofilter and DeNit filter with methanol
PROPOSED MODIFICATIONS	Other: TO GET NITRATE < 1.0 mg/L: No modifications required to the second sec	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process
PROPOSED MODIFICATIONS	Other: TO GET NITRATE < 1.0 mg/L: No modifications requirate and downstream DeNi Add downstream Nitrifications Add downstream Nitrifications Add downstream Add downstream anoxidate and Add downstream anoxidate anoxidate and Add downstream anoxidate	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process
	Other: TO GET NITRATE < 1.0 mg/L: No modifications requii X Add downstream DeNii Add downstream Nitrifi Add methanol to existii Add downstream anoxi Add downstream anoxi Add effluent filtration Other:	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process c tank with methanol feed
	Other: TO GET NITRATE < 1.0 mg/L: No modifications requii Add downstream Nitrifi Add methanol to existin Add downstream anoxi Add downstream anoxi Add effluent filtration Other: Equipment and Structures (from Page 2):	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000
	Other: TO GET NITRATE < 1.0 mg/L: No modifications requii X Add downstream DeNii Add downstream Nitrifi Add methanol to existii Add downstream anoxi Add downstream anoxi Add effluent filtration Other:	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000
	Other: TO GET NITRATE < 1.0 mg/L: No modifications requii Add downstream Nitrifi Add methanol to existin Add downstream anoxi Add downstream anoxi Add effluent filtration Other: Equipment and Structures (from Page 2):	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000
	Other: TO GET NITRATE < 1.0 mg/L: No modifications required by the second sec	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000
	Other: TO GET NITRATE < 1.0 mg/L: No modifications required by the second of the sec	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process c tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000
	Other: TO GET NITRATE < 1.0 mg/L: No modifications required by the second sec	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000
	Other: TO GET NITRATE < 1.0 mg/L: No modifications required by add downstream DeNired Add downstream Nitrification Add downstream anoxion Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15%	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process c tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000
	Other: TO GET NITRATE < 1.0 mg/L: No modifications required by the second of the sec	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process c tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$599,000
	Other: TO GET NITRATE < 1.0 mg/L: No modifications required by the state of the s	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$3,77,000 \$471,000 \$3,990,000 \$5,99,000 \$5,99,000 \$5,190,000 \$5,190,000
	Other: No modifications required by the first part of the first p	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$599,000 \$51,197,000 \$1,197,000
CAPITAL COST:	Other: TO GET NITRATE < 1.0 mg/L: No modifications requiration No modifications requiration Add downstream DeNir Add downstream Nitrification Add downstream anoxicated Add downstream anoxicated Add downstream anoxicated Add defluent filtration Other:	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$5,990,000 \$5,990,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3,37
CAPITAL COST:	Other: TO GET NITRATE < 1.0 mg/L: No modifications required by the property of the property	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3.37
PROPOSED MODIFICATIONS CAPITAL COST: OPERATIONS COST:	Other: TO GET NITRATE No modifications required by the contractor OH&P: Subtotal: Contingency: Contingency: Contingency: Contingency: Contingency: Contingency: Contingency: Contingency: Contingency: Contract OH&P: Contingency: Contingency: Contingency: Contingency: Contingency: Contract OH&P: Contingency: C	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process c tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$1,197,000 \$6,390,000 \$1,197,000 \$3,37 130 HP \$42,500 \$/year
CAPITAL COST:	Other: No modifications required add downstream DeNi Add downstream Nitrification and Mitter Add downstream Add downstream Add downstream And Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol:	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$599,000 \$5,190,000 \$1,197,000 \$6,390,000 \$1,337 130 HP \$42,500 \$/year 5.0 mg/L
CAPITAL COST:	Other: No modifications required: Notification occurred: Nother: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required:	t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$5,990,000 \$5,990,000 \$5,990,000 \$5,190,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNi Add downstream Nitrifi Add methanol to existing Add downstream anoxing Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$5,990,000 \$5,990,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3,37 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year
CAPITAL COST:	Other: TO GET NITRATE 1.0 mg/L: No modifications required: Add downstream DeNi	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3,37 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year 0.0 mg/L
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNired Add downstream Nitrification of them and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: O.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc.	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$1,197,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modifications required and downstream DeNi Add downstream Nitrification of the control of the c	filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$1,197,000 \$6,390,000 \$1,337 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year 0.0 mg/L 0 gals/d \$0 \$/year
CAPITAL COST:	Other: No modifications required in Add downstream DeNi Add downstream Nitrification in Add downstream Nitrification in Add downstream Add downstream anoxion in Add effluent filtration in Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost:	filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,200 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,197,000
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modifications required in Add downstream DeNi Add downstream Nitrification in Add downstream Add downstream anoxi Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Dentirification Sludge Production w/Methanol:	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$5,990,000 \$5,990,000 \$5,190,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$1,20
CAPITAL COST:	Other: No modifications required in Add downstream DeNi Add downstream Nitrification in Add downstream Nitrification in Add downstream Add downstream anoxion in Add effluent filtration in Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost:	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$5,990,000 \$5,190,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3,337 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year 0.0 mg/L 0 gals/d \$51,900 \$/year \$51,900 \$/year 380 lbs/d \$27,700 \$/year
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNi	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3,337 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$51,900 \$/year 380 lbs/d \$27,700 \$/year \$155,000 \$/year
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNi Add downstream Nitrification In Add downstream Add downstream anoxi Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Dentrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$5,990,000 \$5,990,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3,37 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$51,900 \$/year 380 lbs/d \$27,700 \$/year 380 lbs/d \$27,700 \$/year \$155,000 \$/year \$155,000 \$/year
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modifications required: Add downstream DeNi	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3,337 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$51,900 \$/year 380 lbs/d \$27,700 \$/year \$155,000 \$/year
CAPITAL COST:	Other: No modifications required No modifications No modi	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$599,000 \$599,000 \$5,190,000 \$1,197,000 \$6,390,000 \$1,197,000 \$6,390,000 \$33.37 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$51,900 \$/year 380 lbs/d \$27,700 \$/year \$155,000 \$/year
CAPITAL COST:	Other: No modifications required No modifications No modi	red t filter with methanol cation Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$3,140,000 \$377,000 \$471,000 \$3,990,000 \$5,990,000 \$5,990,000 \$5,190,000 \$1,197,000 \$6,390,000 \$3,37 130 HP \$42,500 \$/year 5.0 mg/L 120 gals/d \$32,900 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$51,900 \$/year 380 lbs/d \$27,700 \$/year 380 lbs/d \$27,700 \$/year \$155,000 \$/year \$155,000 \$/year

PROJECT:	Implementing a 3 mg/L Annual Average	Total N	litrogen Limit	
PREPARED FOR:	USEPA Chesapeake Bay Office			
PREPARED BY:	Virginia Tech with Stearns & Wheler, LL	_C		
DATE:	March 19, 2001			
FACILITY:	Parkins Mill WWTP			
LOCATION:	Frederick County, VA			
RATED FLOW:	2.0 mgd		PE COD: N/a	_ mg/L
CURRENT EFFLUENT TN:	4.0 mg/L		PE TKN: N/a	mg/L
EFFLUENT TN GOAL:	3.0 mg/L			
NITROGEN REDUCTION:	20 lbs/d			
- :: -	7 1000 lbs/yr			
	146 1000 lbs/20-years			
CONTRACTOR CONTRACTOR			Frietie	Aerated Volume (MG): N/a
CURRENT PROCESS (CHECK	ALL THAT APPLY): MLE		Existing	g Aerated Volume (MG): N/a ng Anoxic Volume (MG): N/a
	BEPR (A2/0, VIP	, etc.)		nt MLSS at Winter ADF: 3000
	Bardenpho		Curre	TILIVIESS AL WINTEL ADI
- ·	X Oxidation Ditch	-1-1		
	Lagoon (Biolac, e			X(
	Cyclical Aeration			
l	SBR			
l	High-Rate Biofilte			
0 ×	Effluent Filtration		Andrew Police Confirme	Na.
	X Other: Biode	nipho C	xidation Ditch configura	tion
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L X From Report	NDE and	l load, 15 d MCRT, 12°	C winter conditions)
	From Model (at A	ADF and	11080, 15 0 MCR1, 12 1	C winter conditions)
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	comuico	d R	New MLSS
	X No modifications		u kisting tanks (check clar	
	Construct additio			Flow (mgd): 0 Flow (mgd): 0
x	Construct additio	nai ciari	mers	
	Use existing and	XIC VOIUI	me as aerobic (construc	t separate denit facility)
				truct separate nit/denit facility)
	Add influent flow	equaliza	ation tank	to a second
-	Other:			
Anna na mana n	(d)			
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:		_	
l .	No modifications	require	a filter with methanol	
A	X Add downstream	Deniti	ation Biofilter and DeNit	filter with methanol
l	Add downstream	Nitritica	NO STATE TO DE NOI DE N	filter with methanor
l	Add methanol to	existing	tank with methanol feed	
-			tank with methanor leed	1.
	Add effluent filtra	HON	CONTRACTOR DESCRIPTION OF THE PARTY OF THE P	NEW WEST NEW WAY TO THE
	Other:	49.00	-850 APRIL 4 1 APRIL 1974 19 F.	ADE NOT
resource	- I Charathana (from Bogo 3):		\$1,650,000	3
CAPITAL COST:	Equipment and Structures (from Page 2):	400/		*5
	Electrical and Instrumentation:	12%	\$198,000	
0.00	Yard Piping and Site Work:	15%	\$248,000	
	Subtotal:	460:	\$2,100,000	*
14	Contractor OH&P:	15%	\$315,000	
1 "	Engineering and Constr. Mgmt:	15%	\$315,000	
	Subtotal:		\$2,730,000	
	Contingency:	30%	\$630,000	
	Total Capital Cost:		\$3,360,000	1 1 1
20	Capital Cost per lb 20-Yr N removal		\$23.01	14
OPERATIONS COST:	Additional Horsepower (from Page 2):		40 HP	
l	Electrical Power Cost: 0.05 \$/kW		\$13,100 \$/year	
	Nitrate Reduction using Methanol:	_	1.0_mg/L	
1	Methanol Required:		10 gals/d	
	Methanol Cost: 0.75 \$/gal		\$2,700 \$/year	
T	Separate Stage Ammonia Reduction:		0.0 mg/L	
1	Caustic Soda @ 25% conc.		0 gals/d	
	Caustic Soda Cost: 0.60 \$/gal		\$0 \$/year	
1	Equipment Maintenance Cost:		\$27,300 \$/year	
8 -	Denitrification Sludge Production w/Metha	inol:	20 lbs/d	
	Sludge Disposal Cost: 400 \$/ton		\$1,500 \$/year	
	Total Annual O&M Cost:		\$44,600 \$/year	¥2
	Effective Annual Interest Rate after Inflation	on:	2.91%	
	20-Year Present Worth of O&M Costs:		\$670,000	
TOTAL 20-YEAR PRESENT W	ORTH COST:		\$4,030,000	
The second record in	Total Cost per lb, 20-Yr. N removal:		\$27.60	2
		- 2		

PROJECT: PREPARED FOR: PREPARED BY: DATE:	Implementing a 3 mg/L Annual Aver USEPA, Chesapeake Bay Office Virginia Tech with Steams & Whele March 19, 2001	A. A.	3
FACILITY:	Purcellville WWTP		
LOCATION:	Purcellville, VA		
RATED FLOW:	1.0 mgd -	PE COD: N/a mg/L	
CURRENT EFFLUENT TN:	6.0 mg/L	PE TKN: N/a mg/L	
EFFLUENT TN GOAL:	3.0 mg/L	E E	
NITROGEN REDUCTION:	30 lbs/d		
	11 1000 lbs/yr		
	219 1000 lbs/20-years		
			_
CURRENT PROCESS (CHEC	K ALL THAT APPLY): X MLE	Existing Aerated Volume (MG):	Va.
	BEPR (A2/0,		V/a
	Bardenpho		000
	Oxidation Dito		000
	Lagoon (Biola		
	Cyclical Aerai		
	SBR	alon .	
		- Gu	
	High-Rate Bio		
	Effluent Filtra		
	X Other: St	lep Feed MLE with Effluent Filters	
	Warner and		
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L X From Report		
	From Mode! (a	at ADF and load, 15 d MCRT, 12° C winter conditions)	
			
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:		
	X No modification	ons required New N	AI CC
		HERE WILLIAM SAN Lagrange are not a compare the compare of the property of the compare of the co	
	Raise WCK1//		/a
. A1		litional clarifiers Flow (mgd): 0	
	Use existing a	anoxic volume as aerobic (construct separate denit facility)	
		system for BOD removal only (construct separate nit/denit facility)	
	Add influent flo	ow equalization tank	
	Other:		
	Other:		-
PROPOSED MODIFICATIONS	(4).		-
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	ons required	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificatio		30
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstrea	am DeNit filter with methanol	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstrea Add downstrea	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstrea Add downstrea X Add methanol	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstrea Add downstrea X Add methanol Add downstrea	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstres Add downstres X Add methanol Add downstres Add deffluent fill	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstrea Add downstrea X Add methanol Add downstrea	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed	
28	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstres Add downstres X Add methanol Add downstres Add deffluent fill	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed	
28	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstres Add downstres X Add methanol Add downstres Add deffluent fill	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed Itration	
28	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstres Add methanol Add downstres Add downstres Add effluent fill Other	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000	
28	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add methanol Add downstreat Add downstreat Add downstreat Add deffluent fill Other. Equipment and Structures (from Page 2 Electrical and Instrumentation:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000	
28	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstrea Add downstrea X Add methanol Add downstrea Add effluent fill Other. Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000	
28	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstree Add methanol Add downstree Add downstree Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000	
28	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add downstreat Add downstreat Add downstreat Add downstreat Add downstreat Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed Itration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000	
28	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 15% \$48,000	
28	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add downstreat Add methanol Add downstreat Add downstreat Add downstreat Add methanol Add downstreat Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 \$420,000	30
28	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 15% \$48,000	
28	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add downstreat Add methanol Add downstreat Add effluent fill Other. Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 30% \$96,000	
28	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstrea Add methanol Add downstrea Add effluent fill Other. Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 30% \$96,000 \$520,000	
28	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add downstreat Add methanol Add downstreat Add effluent fill Other. Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 30% \$96,000	
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CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kV	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 \$520,000 \$520,000 \$520,000 \$520,000 \$520,000 \$2.37 O HP W . \$0 \$/year	
PROPOSED MODIFICATIONS CAPITAL COST: OPERATIONS COST:	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kt Nitrate Reduction using Methanol:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 \$44,000 30% \$96,000 \$520,000 \$520,000 \$2.37 O HP W \$0 \$/year 3.0 mg/L	
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modification Add downstrea Add downstrea Add downstrea Add methanol Add downstrea Add effluent fill Other. Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kt Nitrate Reduction using Methanol: Methanol Required:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 \$40,000 30% \$96,000 \$520,000 \$520,000 \$2.37 Uhe Ohe Ohe Ohe Ohe Ohe Ohe Oh	20
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kt Nitrate Reduction using Methanol:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 \$40,000 30% \$96,000 \$520,000 \$520,000 \$2.37 O HP W . \$0 \$/year 3.0 mg/L 10 gals/d	
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modification Add downstrea Add downstrea Add downstrea Add methanol Add downstrea Add effluent fill Other. Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kt Nitrate Reduction using Methanol: Methanol Required:	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 \$40,000 30% \$96,000 \$520,000 \$520,000 \$2.37 Uhe Ohe Ohe Ohe Ohe Ohe Ohe Oh	
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modificatio Add downstrea Add downstrea Add methanol Add downstrea Add effluent fill Other. Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kt Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/ga	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 15% \$48,000 \$520,000 \$520,000 \$520,000 \$5237 O HP W . \$0 \$/year 3.0 mg/L 10 gals/d al \$2,700 \$/year	
CAPITAL COST:	TO GET NITRATE < 1.0 mg/L: No modification Add downstreat Add effluent fill Other: Equipment and Structures (from Page 2 Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kl Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gs Separate Slage Ammonia Reduction: Caustic Soda @ 25% conc.	am DeNit filter with methanol am Nitrification Biofilter and DeNit filter with methanol to existing BNR process am anoxic tank with methanol feed ltration 2): \$250,000 12% \$30,000 15% \$38,000 \$320,000 15% \$48,000 15% \$48,000 \$520,000 \$420,000 \$520,000 \$520,000 \$520,000 \$2.37 O HP W \$0 \$/year 3.0 mg/L 10 gals/d al \$2,700 \$/year 0.0 mg/L 0 gals/d	7
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PROJECT: Implementing 3 mg/L Annual Average Total Nitrogen Limit PREPARED RPE PREPARED RPE. User/A. Chesapase & Bay Office PREPARED RPE.	y 60			
### PREPARED FOR: USEFA, Chesapeake Bay Office PREPARED FOR PREPARED BY: Virginal Tech with Steams & Wheler, LLC DATE: March 19, 2001 ### COATION: Remain Authority, Charlottesvile, VA ### RATED FLOW: USEFA Chesapeake Bay Office PREPARED BY: Virginal Tech with Steams & Wheler, LLC ### COATION: Remain Authority, Charlottesvile, VA ### RATED FLOW: USEFA Chesapeake Bay Office PREPARED BY: VA ### RATED FLOW: USEFA Chesapeake Bay Office PREPARED BY: VA ### RATED FLOW: USEFA Chesapeake Bay Office PREPARED BY: VA ### COATION: BROWN AND AND AND AND AND AND AND AND AND AN	PRO IFCT:	Implementing a 3 mg/L Annual Avera-	ge Total N	litrogen Limit
PREPARED BY: Virginia Tech with Steams & Wholer, LLC		LISERA Chasanaska Bay Office	_	
DATE:		USEPA, Cliesapeake Bay Office		
DATE:	PREPARED BY:	Virginia Tech with Stearns & Wheler,	LLC	
FACILITY: LOCATION: RATED FLOW: LOCATION: RATED FLOW: LOCATION: RATED FLOW: LOCATION: RATED FLOW: LOCATION: ROBING FROM REDUCTION: LOCATION: ROBING REDUCTION: LOCATION: ROBING REDUCTION: LOCATION:	DATE:			
COLORION: Riverand Authority, Charlottes valle, VA PETKIN Ma mg/L		•		
RATED FLOW:	FACILITY:	Moores Creek VVVVIP		
RATED FLOW:	LOCATION:	Rivanna Authority, Charlottesville, VA		
CURRENT EFFLUENT TN. 7.0 mg/L PETKN. N/a mg/L				PE COD: N/a mo/L
### APPLICATION STO GET NITRATE < 1.0 mg/L: From Process Current Ammonia				
NITROGEN REDUCTION: 500 Ibsid 3650 1000 lbs/20-years 3650 1000 lbs/20-years 3650 1000 lbs/20-years 3650 1000 lbs/20-years 2 2 2 2 2 2 2 2 2	CURRENT EFFLUENT TN:	7.0 mg/L		PETKN: N/a mg/L
NITROGEN REDUCTION: 500 Ibsid 3650 1000 lbs/20-years 3650 1000 lbs/20-years 3650 1000 lbs/20-years 3650 1000 lbs/20-years 2 2 2 2 2 2 2 2 2	EFFLUENT TN GOAL:	3.0 mo/l		
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CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE	NITROGEN REDUCTION:	500 lbs/d		
CURRENT PROCESS (CHECK ALL THAT APPLY): X MLE		183 1000 lbs/vr		
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A SEPR (A2/D, VIP, etc.) Existing Anoxic Volume (MG) Na 3000		W-10		
A SEPR (A2/D, VIP, etc.) Existing Anoxic Volume (MG) Na 3000	CURRENT PROCESS ICHECK	ALL THAT APPLY Y X MIF		Existing Aerated Volume (MG): N/a
Sandenpho Current MLSS at Winter ADF: 3900	CONTRACT I NOCEDO (CILEON		(ID ata)	
Overlation Dirich Lapson (Solicia, etc.) Lapson (Solicia, etc.) Cyclical Aeration SBR High-Rate Biofiller Effluent Filtration SBR High-Rate Biofiller Effluent Filtration Throm Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA > 1.0 mg/t: X No modifications required Raise MCRT/MLSS in existing tanks (check clarifler capacity) Construct additional aerated volume Flow (mgg): Use existing anxix volume as aerobic (construct separate denit facility) Add influent flow equalization tank Other: No modifications required Raise MCRT/MLSS in existing tanks (check clarifler capacity) Use existing anxix volume as aerobic (construct separate denit facility) Add influent flow equalization tank Other: No modifications required No different flow equalization tank Other: No modifications required No downstream Nethit filter with methanol Add demenand to existing BNR process Add downstream anxix tank with methanol feed Add defilment filtration Other: Solicitical and instrumentation: Equipment and Structures (from Page 2): Electrical and instrumentation: Contractor OH8P: Subtotat: Contractor OH8P: Subtotat: Contractor OH8P: Subtotat			/IP, etc.)	· · · · · · · · · · · · · · · · · · ·
Contractor OHEP PROPOSED MODIFICATIONS TO GET NITRATE		Bardenpho		Current MLSS at Winter ADF:3000
Capital Agriculture Capital Capital Cost Capital	(*)		h	
Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: A2/O that also can be operated as an MLE CURRENT EFFLUENT AMMONIA-N: 0.5 mg/L From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA-1.0 mg/L Construct additional aerated volume Flow (rngg): 0 Construct additional aerated volume Flow (rngg): 0 Construct additional aerated volume Flow (rngg): 0 Use existing anxive volume as aerobic (construct separate denit facility) Use sented system for 600 removal only (construct separate denit facility) Use sented system for 600 removal only (construct separate inl/denit facility) Add influent flow equalization tax Other PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required No downstream DeNti filter with methanol Add downstream DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Biofilter and DeNti filter with methanol Add demination and the statistic Bi				
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Methanol Cost: 0.75 \$/gal \$63,000 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0.60 \$/gal \$0 \$/year Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$102,300 \$/year Denitrification Sludge Production w/Methanol: 720 lbs/d Sludge Disposal Cost: 400 \$/ton \$52,600 \$/year Total Annual O&M Cost: \$315,900 \$/year Effective Annual Interest Rate after Inflation: 2,91% 20-Year Present Worth of O&M Costs: \$4,740,000				230 gals/d
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Caustic Soda @ 25% conc. Caustic Soda Cost: Caustic Soda Syear Caustic Soda Syear Caustic Soda Cost: Caustic		Separate Stage Ammonia Reduction:		0.0 mg/L
Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$102,300 \$/year Denitrification Sludge Production w/Methanol: \$12,300 \$/year Denitrification Sludge Production w/Methanol: \$2,600 \$/year Total Annual O&M Cost: \$315,900 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$4,740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$17,330,000			*(
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Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Stat Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$15,900 \$/year 20.91% \$4,740,000 \$17,330,000				\$102.300 \$/year
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Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$4,740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$17,330,000		Oldago Eleptini		
20-Year Present Worth of O&M Costs: \$4,740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$17,330,000				
20-Year Present Worth of O&M Costs: \$4,740,000 TOTAL 20-YEAR PRESENT WORTH COST: \$17,330,000	74		tion:	2.91%
TOTAL 20-YEAR PRESENT WORTH COST: \$17,330,000	-			
TO THE 28 TERRIT RECEIT WORTH COOK		20-Year Present Worth of O&M Costs:		\$4,740,000
TO THE 28 TERRIT RECEIT WORTH COOK				
TO THE 28 TERRIT RECEIT WORTH COOK	TOTAL 20 VEAD DDECENT	NOTH COST.		\$17,330,000
Total Cost per Ib. 20-Yr. N removal: \$4.75	I O I AL 20-TEAR PRESENT WO			
	7.8.5	Total Cost per lb. 20-Yr. N removal:		\$4.75

PROJECT: PREPARED FOR:		
THE PARED FOR.	Implementing a 3 mg/L Annual Average To USEPA, Chesapeake Bay Office	an innogen chine
PREPARED BY:	Virginia Tech with Stearns & Wheler, LLC	
DATE:	March 19, 2001	
FACILITY:	Rocco Farm Foods WWTP	
LOCATION:		
A CONTRACTOR OF THE CONTRACTOR	Edinburg, VA	PE COD: N/a mg/L
RATED FLOW:	1.2 mgd	s
CURRENT EFFLUENT TN:	12.0 mg/L	PE TKN: N/a mg/L
EFFLUENT TN GOAL:	3,0 mg/L	
NITROGEN REDUCTION:	90 lbs/d	
^	33 1000 lbs/yr	
	657 1000 lbs/20-years	
CURRENT PROCESS (CUES	KALL THAT ADDING THE	Eviating Assetad Values (MC)
CURRENT PROCESS (CHEC		Existing Aerated Volume (MG): N/a
	X BEPR (A2/0, VIP, etc	
	Bardenpho	Current MLSS at Winter ADF: 4000
	Oxidation Ditch	
	Lagoon (Biolac, etc.)	
	Cyclical Aeration	
l'I	SBR	
	High-Rate Biofilter	
	Effluent Filtration	5 × 1/2 0 3x 2
2	X Other A2/O with	integral Schreiber Process
CURRENT SEC. VIEWS AND A		
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L X From Report	
74	From Model (at ADF	and load, 15 d MCRT, 12° C winter conditions)
		n = 21
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	
	X No modifications requ	
	Raise MCRT/MLSS in	existing tanks (check clarifier capacity) N/a
	Construct additional a	
	Construct additional of	larifiers Flow (mgd): 0
	- Indiana	olume as aerobic (construct separate denit facility)
		or BOD removal only (construct separate nit/denit facility)
	Add influent flow equa	
	CARCON CO.	CONSECUTIVE CONTROL OF THE VIOLENCE OF THE CONTROL
	Other	
	Other:	
PROPOSED MODIFICATIONS		
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modifications requ	ired
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modifications requ X Add downstream DeN	ired it filter with methanol
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modifications requ X Add downstream DeN Add downstream Nitri	ired it filter with methanol ication Biofilter and DeNit filter with methanol
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modifications requ X Add downstream DeN Add downstream Nitri Add methanol to exist	ired it filter with methanol ication Biofilter and DeNit filter with methanol ing BNR process
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	No modifications requested Add downstream DeN Add downstream Nitri Add methanol to exist Add downstream and Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15%	ired it filter with methanol fication Biofilter and DeNit filter with methanol ng BNR process tic tank with methanol feed \$1,370,000 \$164,000 \$206,000
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CAPITAL COST:	No modifications requal Add downstream DeN Add downstream Nitrice Add methanol to exist Add downstream another: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation:	ired it filter with methanol ication Biofilter and DeNit filter with methanol ing BNR process icic tank with methanol feed \$1,370,000 \$164,000 \$164,000 \$206,000 \$1,740,000 \$261,000 \$2,260,000 \$2,260,000 \$2,260,000 \$2,260,000 \$4,23 20 HP \$6,500 \$/year 9.0 mg/L 40 gals/d \$11,000 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$2,600 \$/year \$130 lbs/d \$9,500 \$/year \$49,600 \$/year \$49,600 \$/year \$49,600 \$/year
CAPITAL COST:	No modifications requal Add downstream DeN Add downstream Nitri Add methanol to exist Add downstream ano: Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost:	ired it filter with methanol ication Biofilter and DeNit filter with methanol ing BNR process icic tank with methanol feed \$1,370,000 \$164,000 \$206,000 \$1,740,000 \$261,000 \$2,260,000 \$2,260,000 \$2,260,000 \$2,260,000 \$2,280,000 \$2,780,000 \$4,23 20 HP \$6,500 \$/year 9.0 mg/L 40 gals/d \$11,000 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$22,600 \$/year \$130 lbs/d \$9,500 \$/year \$49,600 \$/year
CAPITAL COST:	No modifications requested Add downstream DeN Add downstream DeN Add downstream Nitri Add methanol to exist Add downstream ano: Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	ired it filter with methanol ication Biofilter and DeNit filter with methanol ng BNR process ic tank with methanol feed \$1,370,000 \$164,000 \$164,000 \$206,000 \$1,740,000 \$261,000 \$261,000 \$261,000 \$2,260,000 \$2,260,000 \$2,260,000 \$2,2780,000 \$4.23 20 HP \$6,500 \$/year 9.0 mg/L 40 gals/d \$11,000 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$22,600 \$/year 130 lbs/d \$9,500 \$/year \$49,600 \$/year \$49,600 \$/year \$2,91% \$740,000
	No modifications requested Add downstream DeN Add downstream DeN Add downstream Nitri Add methanol to exist Add downstream ano: Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal: Contractor OH&P: 15% Engineering and Constr. Mgmt: 15% Subtotal: Contingency: 30% Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs:	ired it filter with methanol ication Biofilter and DeNit filter with methanol ing BNR process icic tank with methanol feed \$1,370,000 \$164,000 \$164,000 \$206,000 \$1,740,000 \$261,000 \$2,260,000 \$2,260,000 \$2,260,000 \$2,260,000 \$4,23 20 HP \$6,500 \$/year 9.0 mg/L 40 gals/d \$11,000 \$/year 0.0 mg/L 0 gals/d \$0 \$/year \$2,600 \$/year \$130 lbs/d \$9,500 \$/year \$49,600 \$/year \$49,600 \$/year \$49,600 \$/year

-		`	
nno mor.	Implementing a 3 mg/L Annual Average	Total Nitrogen Limit	
PROJECT:	implementing a 3 mg/L Allitual Average	Total Hittogen Emitt	
PREPARED FOR:	USEPA, Chesapeake Bay Office		
PREPARED BY:	Virginia Tech with Stearns & Wheler, Ll	.C	
The state of the s			
DATE:	March 19, 2001		
FACILITY:	Strasburg WWTP		
LOCATION:	Stasburg, VA		
RATED FLOW:	1.0 mgd	PE COD: N/a mg/L	
MATERIAL SALES AND STREET		PE TKN: N/a mg/L	
CURRENT EFFLUENT TN:	6.0 mg/L	FE TAN mg/c	
EFFLUENT TN GOAL:	3.0 mg/L		
NITROGEN REDUCTION:	20 lbs/d		
	7 1000 lbs/yr		
	• • • • • • • • • • • • • • • • • • • •		
	146 1000 lbs/20-years		
	ALL THAT APPLY): MLE	Existing Aerated Volume (MG):	N/a
CURRENT PROCESS (CHECK	ACE TOTAL TOTAL		
	BEPR (A2/0, VIF	. etc.) Existing Anoxic Volume (MG):	N/a
	Pardonnho	Current MLSS at Winter ADF:	4000
	Bardenpho	Culter MECO at White Met	4000
	X Oxidation Ditch		
	Lagoon (Biolac.	atc \	
		:10,7	
	Cyclical Aeration		
	SBR		
	High-Rate Biofilt	er	
	°		
	Effluent Filtration	C. A. C	
4	X Other: Brush	Aerator Oxidation Ditch	
	LA JOHNST	anatomorphic and a substitution of the substit	
10			
CURRENT SEEL LIENT AMMOU	VIA-N: <1.0 mg/L X From Report		
SOUTH ELLFORM I MINIMO	TINGE THE TOTAL TOTAL	DE	
	From Model (at A	DF and load, 15 d MCRT, 12° C winter conditions)	
	and the contract of	<i>i</i>	
	A1985		
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	Α	
The state of the s	X No modifications	required	New MLSS
		Todamou	The state of the state of the
	Raise MCRT/ML	SS in existing tanks (check clarifier capacity)	N/a
		nal aerated volume Flow (mgd): 0	
		: THE STATE OF THE	
	Construct addition	nal clarifiers Flow (mgd): 0	
	Ulas aviatios ago	xic volume as aerobic (construct separate denit facility)	
	Use existing and	tic volume as aerobic (construct separate denit racinty)	
	Use aerated syst	em for BOD removal only (construct separate nit/denit fa	icility)
I .		equalization tank	
		Equalization tank	- 15 th
	Other:		1 7 7
	Add methanol to	Nitrification Biofilter and DeNit filter with methanol existing BNR process anoxic tank with methanol feed	Al .
	Add downstream	anoxic tank with methanol leed	
÷-	Add effluent filtra	tion	
l		A. C. C. SERBAN STORM STREET, SEC. (54.77)	0 153, 35
l	Other:		
	Equipment and Structures (from Page 2):	\$1,300,000	
CAPITAL COST:			
	Electrical and Instrumentation:	12% \$156,000	
		15% \$195,000	
	Yard Piping and Site Work:		
~	Subtotal:	• \$1,650,000	
I		15% \$248,000	
I	Contractor OH&P:		
I	Engineering and Constr. Mgmt:	15% \$248,000	#1
I -		\$2,150,000	
2	Subtotal:	·	
l .	Contingency:	30% \$495,000	
1		\$2,650,000	
	Total Capital Cost:		
	Capital Cost per lb. 20-Yr. N removal:	\$18.15	
1	*		
Lancas and the same of the sam		20 HP	
OPERATIONS COST:	Additional Horsepower (from Page 2):		
	Electrical Power Cost: 0,05 \$/kW	\$6,500 \$/year	
1 -	All at Deduction union Mathematic	3.0 mg/L	
	Nitrate Reduction using Methanol:		
1	Methanol Required:	10 gals/d	
1		\$2,700 \$/year	
I			
I	Separate Stage Ammonia Reduction:	0.0 mg/L	
I -	Caustic Soda @ 25% conc.	0 gals/d	
1	Caustic Soua @ 23 /6 Conc.		
L	Caustic Soda Cost: 0.60 \$/gal	\$0 \$/year	
E.	Equipment Maintenance Cost:	\$21,500 \$/year	
71	Equipment Maintenance Cost.		
1	Denitrification Sludge Production w/Metha	nol: 40 lbs/d	
1	Sludge Disposal Cost: 400 \$/lon	\$2,900 \$/year	
	Oldage Bieperer areas	\$33,600 \$/year	
1	Total Annual O&M Cost:		
1	Effective Annual Interest Rate after Inflation	on: 2,91%	
I		\$500,000	
14	20-Year Present Worth of O&M Costs:	40-21-2	
1			
TOTAL 20-YEAR PRESENT W	OPTH COST.	\$3,150,000	
LIGIAL TOTENE PRESENT M	ORTHOUSIA		
1	Total Cost per lb. 20-Yr. N removal:	\$21.58	
1			

PROJECT: PREPARED FOR:	Implementing a 3 mg/L Annu USEPA, Chesapeake Bay Off	fice	Nitrogen Limit		
PREPARED BY: DATE:	Virginia Tech with Stearns & March 19, 2001	Wheler, LLC	- 1		
FACILITY:	Stuarts Draft WWTP			20	
LOCATION:	Augusta County, VA				
RATED FLOW:	1.4 mgd			<u>/a</u> mg/L	
CURRENT EFFLUENT TN:	5.0 mg/L		PE TKN: N	<u>/a</u> mg/L	
EFFLUENT TN GOAL: NITROGEN REDUCTION:	3.0 mg/L 20 lbs/d				
MINOGEN REDUCTION.	7 1000 lbs/yr	5.			
	146 1000 lbs/20-years				
CURRENT PROCESS (CHEC	K ALL THAT APPLY): MLE		Exi	sting Aerated Volume (MG)	: N/a
*		R (A2/0, VIP, etc.)		isting Anoxic Volume (MG)	
*	Barde	•	Cı	rrent MLSS at Winter ADF	5000
5.60		tion Ditch			
		on (Biolac, etc.)			
02	SBR	al Aeration			
		Rate Biofilter			
		nt Filtration			
	X Other:		r Oxidation Ditches		545
			CONTRACTOR OF THE PROPERTY OF THE PARTY OF T		
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L X From P	•	load, 15 d MCRT, 1	2° C winter conditions)	
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:				
		difications required			New MLSS
			isting tanks (check o	,	N/a
		uct additional aera		Flow (mgd): 0	-
		ruct additional clarit		Flow (mgd): 0	_
				ruct separate denit facility) instruct separate nit/denit fi	acility)
		fluent flow equaliza		monder separate moderni n	acinty)
PROPOSED MODIFICATIONS	Add do	difications required ownstream DeNit file ownstream Nitrifical ethanol to existing	Iter with methanol tion Biofilter and Del	lit filter with methanol	¥21
		wnstream anoxic t	ank with methanol fe	ed	
	Other:	dentari sesi 1	表示。 企业的问题	Company of the second	
CAPITAL COST:	Equipment and Structures (from	Page 2):	\$250,000		
	Electrical and Instrumentation:	12%	\$30,000		
	Yard Piping and Site Work:	15%	\$38,000		
	Subtotal:	4.504	\$320,000		
	Contractor OH&P:	15%	\$48,000		
	Engineering and Constr. Mgmt: Subtotal:	15%	\$48,000 \$420,000		
	Contingency:	30%	\$96,000		
	Total Capital Cost:	50 70	\$520,000		
	Capital Cost per lb. 20-Yr. N rem	noval_	\$3.56		
OPERATIONS COST:	Additional Horsepower (from Pag	ge 2):	0 HP		
THE PARTY OF THE P		.05 \$/kW	\$0 \$/year		v
	Nitrate Reduction using Methano		2.0 mg/L		
	Methanol Required:		10 gals/d	*	
		.75 \$/gal	\$2,700 \$/year		
	Separate Stage Ammonia Reduc	ction:	0.0 mg/L		
	Caustic Soda @ 25% conc.	00.611	0 gals/d		
		.60 \$/gal	\$0 \$/year	e .	
	Equipment Maintenance Cost: Denitrification Sludge Production	w/Methanol:	\$4,200 \$/year 30 lbs/d	THE RESERVE	
		100 \$/ton	\$2,200 \$/year		
	Total Annual O&M Cost:	4.10	\$9,100 \$/year		
	Effective Annual Interest Rate aft	ter Inflation:	2.91%		
	20-Year Present Worth of O&M C	Costs:	\$140,000		
OTAL 20-YEAR PRESENT W	ODTH COST.		\$660,000		
OTHE ANTICAK PRESENT W	Total Cost per lb. 20-Yr, N remov	val:	\$660,000 <u> </u>		
NE.	rotal Gost per lu. 20-11, N Telliov	oi.	47.3 2		

Stuarts Draft, VA xls

PROJECT:	Implementing a 3 mg	L Annual Average Tota	I Nitrogen Limit	370	
PREPARED FOR:	USEPA, Chesapeake	Ray Office	- Lever and the Control of the Contr	1	
	USEFA, Chesapeake	- n 144 - 1 - 1 - 1			
PREPARED BY:	Virginia Tech with St	earns & wheler, LLC			
DATE:	March 19, 2001				
FACILITY:		ATD			
	Tyson Foods, Inc. W	4.1			
LOCATION:	Temperanceville, VA	_			
RATED FLOW:	1.0 mgd		PE COD:	345 mg/L	
CURRENT EFFLUENT TN:			PE TKN:	172 mg/L	
Commence of the control of the contr	28.0 mg/L		1 G 1100.		
EFFLUENT TN GOAL:	3.0 mg/L				
NITROGEN REDUCTION:	210 lbs/d	9			
	_				
1					
	1533 1000 lbs/20-yea	rs			
CURRENT PROCESS (CUECK	ALL THAT ADDI VICE	7 A41 E		Existing Aerated Volume (MG) 4.5
CURRENT PROCESS (CHECK	ALL THAT APPLY	TIVILE			
	1	BEPR (A2/0, VIP, etc.)		 Existing Anoxic Volume (
	-	Bardenpho		Current MLSS at Winter	ADF 4000
	 				
		Oxidation Ditch			
1		Lagoon (Biolac, etc.)			
	1	Cyclical Aeration			
	<u> </u>				
		SBR			
*5		High-Rate Biofilter			
i e	 				
		Effluent Filtration			
		Other: DAF and Ar	naerobic Lagoon p	retreatment	
l .	3)				
2000		-			
CURRENT EFFLUENT AMMON	IIA-N: 0.3 mg/L 🕽	(From Report			· · · · · · · · · · · · · · · · · · ·
		Terom Model (at ADE as	nd load 15 d MCE	RT, 12° C winter conditions)	
	L	I TOTTI WOODEI (at ADF at	na ioau, 15 u MCh	(1, 12 O WITHER COMMINDIS)	
l .					
PROPOSED MODIFICATIONS	TO GET AMMONIA < 4	0 mg/L :			
EROEOGED MODIFICATIONS				62	
	1.3	No modifications requir	red	10 00 000 OFF	New MLSS
	100	Raise MCRT/MLSS in	existing tanks (che	eck clarifier capacity)	N/a
	-				
		Construct additional ae		Flow (mgd):0	
	132	Construct additional cla	arifiers	Flow (mgd): 0	E2 *
	15	Lles existing apovie vol	ume as aerobic (c	onstruct separate denit fac	iliba
	100				
	12			ly (construct separate nit/de	enit facility)
	197	Add influent flow equal	ization tank		
	<u> </u>		955 985 TO STATE	07101 288888	ann iteanayes
	100	Other:	9.4	11 15	7,6 n V-
PROPOSED MODIFICATIONS	TO CET MITDATE < 10	mall .			
PROPOSED MODIFICATIONS	IO GEI NITRATE - 10				
	1.3	No modifications requir	red		
2	13	Add downstream DeNit	t filter with methan	ol	
	1			DeNit filter with methanol	
5				Delait litter with methanol	
		Add methanol to existing	ng BNR process		
	_	Add downstream anoxi	ic tank with methal	nol feed	
		1000000	C WITH WITH INCOME	1011000	
	1.4	Add effluent filtration			
	177	Other:		20-1	R - Sea beliebel
.01	52				
CAPITAL COST:	Equipment and Structu	res (from Page 2):	\$1,300,000	5 1	100
	Electrical and Instrume		\$156,000		
	Yard Piping and Site W	/ork: 15%	\$195,000	10	100
	Subtotal:		\$1,650,000		
		4.50/			
	Contractor OH&P:	15%	\$248,000		
	Engineering and Const	r. Mgmt: 15%	\$248,000		
	Subtotal:	-	\$2,150,000	390	
F.:		6601			
l .	Contingency:	30%			
	Total Capital Cost:		\$2,650,000		
	Capital Cast sails 00	Vr. N. removal:	\$1.73		
_	Capital Cost per lb. 20-	TI. N ICHIOVAL	\$1.75		
OPERATIONS COST:	Additional Horsepower	(from Page 2):	20 H	Р -	
POLENATIONS COST.					
l	Electrical Power Cost:	0.05 \$/kW	\$6,500 \$/	•	
	Nitrate Reduction using	Methanol:	25.0 m	g/L	
k			90 ga	• 01	
	Methanol Required:		_		
I.	Methanol Cost:	0.75 \$/gal	\$24,600 \$/	year	
I	Separate Stage Ammo	nia Reduction:	0.0 m	g/L	
	,				
D n	Caustic Soda @ 25% o	conc		als/d	
	Caustic Soda Cost:	0.60 \$/gal	\$0 \$/	year	1
20		•	\$21,500 \$/	•	
	Equipment Maintenance	e 0081.		•	
	Denitrification Sludge F	Production w/Methanol	300 lb	s/d	
		400 \$/ton	\$21,900 \$/		
	Sludge Disposal Cost:			•	
	Total Annual O&M Cos		\$74,500 \$/	year	
	Effective Annual Interes		2.91%		
	20-Year Present Worth	of O&M Costs:	\$1,120,000		
TOTAL OR VEAR SERVICE	2021 2027		£2 770 000		
TOTAL 20-YEAR PRESENT WO		5.9	\$3,770,000		1
	Total Cost per lb. 20-Yr	. N removal:	\$2.46		

PROJECT: PREPARED FOR: PREPARED BY: DATE: FACILITY:	Implementing a 3 mg/L Annual Av USEPA, Chesapeake Bay Office Virginia Tech with Stearns & Whel March 19, 2001 Waynesboro City WWTP		Nitrogen Limit		3	
LOCATION:	Waynesboro, VA					
RATED FLOW:	4.0 mgd		PE COD	270 mg/L		
CURRENT EFFLUENT TN:	8.0 mg/L			20 mg/L		
EFFLUENT TN GOAL:	3.0 mg/L					
NITROGEN REDUCTION:	170 bs/d					
	62 1000 lbs/yr					
	1241 1000 lbs/20-years					
CURRENT PROCESS (CHEC	CK ALL THAT APPLY): MLE		E	kisting Aerated V	/aluma (MC	V 17792
, , , , , ,	BEPR (A2/0). VIP. etc.)		Existing Anoxic V		
	Bardenpho			Current MLSS at		
	Oxidation D	itch			······································	14/4
E 92	Lagoon (Bio					
	Cyclical Aen					
	SBR					
	High-Rate B	liofilter				
	Effluent Filtr					
		-	er-RBCs, Denite Filt	are		- Higgs at
4		morning ranc	A-TOOS, DEIME I III	CIS		GI GITTINI G
CURRENT EFFLUENT AMMO			load, 15 d MCRT,	12° C winter cor	nditions)	
Y		(roda, to a morti,	12 G WITTER COI	iulions)	
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:					
	X No modificat	ions require	d			New MLSS
	Raise MCRT	/MLSS in ex	risting tanks (check	clarifier canacity	A	N/a
	Construct ad	ditional aera	ated volume	Flow (mgd)		IVIa
	Construct ad			Flow (mgd)		-
			me as aerobic (cons	truct constate d	onit facility	20
	Use aerated	system for F	BOD removal only (c	construct concre	to sit/donit t	(= = 104, A
	Add influent	Bow equation	etion tank	onstruct separa	te nivaenit i	acility)
			SHOLL IGHT			
	I Joulei,	CPH.			100	1000000000
		(A)			-34	VEHES!
PROPOSED MODIFICATIONS		1. 1. 1.				ASSESS
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:		1			A246.34
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L:	ons required	d Iter with methanol			ASSES.
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificati	ions required	Iter with methanol	Nit filter with me	ethanol	- 1 - 1
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificati Add downstre	ions required eam DeNit fil eam Nitrifica	lter with methanol tion Biofilter and De	Nit filter with me	ethanol	- 1 - 1
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificati Add downstre Add downstre Add downstre	ions required eam DeNit fil eam Nitrifica ol to existing	Iter with methanol tion Biofilter and De BNR process		ethanol	William I
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.0 mg/L: No modificati Add downstre Add downstre Add methano Add downstre	ions required eam DeNit file eam Nitrifica of to existing eam anoxic t	lter with methanol tion Biofilter and De		ethanol	AVERAGE AND A SECOND AND A SECOND ASSESSMENT AND A SECOND ASSESSMENT ASSESSME
PROPOSED MODIFICATIONS	No modificati Add downstre Add methano Add downstre Add downstre Add downstre Add downstre Add downstre	ions required eam DeNit file eam Nitrifica of to existing eam anoxic t ittration	Iter with methanol tion Biofilter and De BNR process ank with methanol f		ethanol	
	No modificati Add downstre Add methano Add downstre Add downstre Add downstre Add downstre Add downstre	ions required eam DeNit file eam Nitrifica of to existing eam anoxic t	Iter with methanol tion Biofilter and De BNR process ank with methanol f		ethanol	
	No modificati Add downstre Add methano Add downstre Add downstre Add downstre Add downstre Add downstre	ions required eam DeNit file eam Nitrifica of to existing eam anoxic t iltration	Iter with methanol tion Biofilter and De BNR process ank with methanol f		ethanol	2.073
	No modificati Add downstre Add methano Add downstre Add ownstre Add ownstre Add ownstre Add downstre Add effluentf X Other:	ions required earn DeNit file earn Nitrifica of to existing earn anoxic t iltration dd Additiona 2):	Iter with methanol tion Biofilter and De BNR process tank with methanol if Methanol \$0		ethanol	
	No modificati Add downstre Add downstre Add methano Add downstre Add effluent f X Other: Equipment and Structures (from Page Electrical and Instrumentation:	ions required earn DeNit file arn Nitrifica of to existing earn anoxic to iltration dd Additional 2):	Iter with methanol tion Biofilter and De BNR process tank with methanol I Methanol \$0 \$0		ethanol	
	No modificati Add downstre Add downstre Add downstre Add downstre Add downstre Add defluent f Y Other: Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work:	ions required earn DeNit file earn Nitrifica of to existing earn anoxic t iltration dd Additiona 2):	Iter with methanol tion Biofilter and De BNR process tank with methanol IMethanol \$0 \$0 \$0		ethanol	
	No modificati Add downstre Add downstre Add downstre Add downstre Add downstre Add effluent f X Other: Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Sublotal:	ions required eam DeNit file eam Nitrifica of to existing eam anoxic t iltration id Additiona 2): 12% 15%	Iter with methanol tion Biofilter and De BNR process ank with methanol Methanol \$0 \$0 \$0 \$0 \$0		ethanol	
PROPOSED MODIFICATIONS	No modificati Add downstre Add downstre Add downstre Add downstre Add downstre Add downstre Add doffluent f X Other: X Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P:	ions required earn DeNit file earn Nitrifica of to existing earn anoxic t iltration dd Additiona 2): 12% 15%	Iter with methanol tion Biofilter and De BNR process ank with methanol Methanol \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0		ethanol	
	No modificati Add downstre Add downstre Add downstre Add downstre Add downstre Add downstre Add doffluent f X Other: Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt:	ions required eam DeNit file eam Nitrifica of to existing eam anoxic t iltration id Additiona 2): 12% 15%	Iter with methanol tion Biofilter and De BNR process tank with methanol f I Methanol \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0		ethanol	
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CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost per lb. 20-Yr. N removal:	ions required earn Nitrifica bearn Nitrifica of to existing earn anoxic t litration dd Additiona 2): 12% 15% 15%	Iter with methanol tion Biofilter and De BNR process tank with methanol I Methanol S0		ethanol	
CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2).	ions required earn DeNit file earn Nitrifica of to existing earn anoxic t iltration dd Additiona 2): 12% 15% 15% 30%	Iter with methanol tion Biofilter and De BNR process tank with methanol if Methanol \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0		ethanol	
CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2). Electrical Power Cost: 0.05 \$/k	ions required earn DeNit file earn Nitrifica of to existing earn anoxic t iltration dd Additiona 2): 12% 15% 15% 30%	Iter with methanol tion Biofilter and De BNR process tank with methanol fill Methanol \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	reed	ethanol	
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CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2). Electrical Power Cost: 0.05 \$/k Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/g	ions required earn DeNit file earn Nitrifica of to existing earn anoxic t litration 3d Additiona 2): 12% 15% 15% 30%	Iter with methanol tion Biofilter and De BNR process cank with methanol if Methanol \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	reed	ethanol	
CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Constr. Mgmt: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/k Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/g Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc.	ions requirected months of the control of the contr	Iter with methanol tion Biofilter and De BNR process tank with methanol fill Methanol \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	reed	ethanol	
CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2). Electrical Power Cost: 0.05 \$/k Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/g Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc.	ions requirected months of the control of the contr	Iter with methanol tion Biofilter and De BNR process cank with methanol for the standard stan	reed	ethanol	
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CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2). Electrical Power Cost: 0.05 \$/k Nitrate Reduction using Methanol: Methanol Cost: 0.75 \$/g Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/g Equipment Maintenance Cost: Denitrification Sludge Production w/Meth	ions required cam DeNit file am DeNit file am DeNit file am Nitrifica of to existing the cam anoxic to denit filtration of the came of the	Iter with methanol tion Biofilter and De BNR process cank with methanol for the biograph of th	reed	ethanol	
CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contractor OH&P: Engineering and Constr. On S. \$/\$ Mgmt: Subtotal: Contractor OH&P: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/\$ Equipment Maintenance Cost: Denitrification Sludge Production w/Meti Sludge Disposal Cost: 400 \$/\$\$	ions required cam DeNit file am DeNit file am DeNit file am Nitrifica of to existing the cam anoxic to denit filtration of the came of the	Iter with methanol tion Biofilter and De BNR process cank with methanol for the biograph of th	reed	ethanol	
CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2). Electrical Power Cost: 0.05 \$/k Nitrate Reduction using Methanol: Methanol Required: Methanol Required: Methanol Required: Methanol Cost: 0.75 \$/g Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/g Equipment Maintenance Cost: Denitification Sludge Production w/Met Sludge Disposal Cost: 400 \$/g Total Annual O&M Cost:	ions required cam DeNit file am Nitrifica all to existing parm anoxic tritration de Additiona 2): 12% 15% 15% 30% www	Iter with methanol tion Biofilter and De BNR process tank with methanol fill Methanol \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	reed	ethanol	
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CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2). Electrical Power Cost: 0.05 \$/k Nitrate Reduction using Methanol: Methanol Required: Methanol Required: Methanol Required: Methanol Cost: 0.75 \$/g Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/g Equipment Maintenance Cost: Denitification Sludge Production w/Met Sludge Disposal Cost: 400 \$/g Total Annual O&M Cost:	ions required cam DeNit file am Nitrifica all to existing parm anoxic tritration de Additiona 2): 12% 15% 15% 30% www	Iter with methanol tion Biofilter and De BNR process tank with methanol fill Methanol \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0 \$0	reed	ethanol	
CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2). Electrical Power Cost: 0.05 \$/s Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/g Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/g Equipment Maintenance Cost: Denitrification Sludge Production w/Met Sludge Disposal Cost: 400 \$/ts Total Annual O&M Cost: Effective Annual Interest Rate after Infla 20-Year Present Worth of O&M Costs:	ions required cam DeNit file am Nitrifica all to existing parm anoxic tritration de Additiona 2): 12% 15% 15% 30% www	Iter with methanol tion Biofilter and De BNR process ank with methanol for the biological state of the	reed	ethanol	
CAPITAL COST:	Equipment and Structures (from Page Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2). Electrical Power Cost: 0.05 \$/s Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/g Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/g Equipment Maintenance Cost: Denitrification Sludge Production w/Met Sludge Disposal Cost: 400 \$/ts Total Annual O&M Cost: Effective Annual Interest Rate after Infla 20-Year Present Worth of O&M Costs:	ions required cam DeNit file am Nitrifica all to existing parm anoxic tritration de Additiona 2): 12% 15% 15% 30% www	Iter with methanol tion Biofilter and De BNR process tank with methanol for the stank	reed	ethanol	

PROJECT:	Implementing a 3	mg/L Annual Averag	e Total	Nitrogen Limit		
PREPARED FOR:	USEPA, Chesape		je rotai	Tita og en Emilie		*(
PREPARED BY:		Steams & Wheler, I	LLC			
DATE:	March 19, 2001	Ottodino di minoroni				
FACILITY:	Wilderness WWT	•				
LOCATION:	Ruckersville, VA	-				
RATED FLOW:	1.0 mgd			PE COD:	435 mg/L	
CURRENT EFFLUENT TN:	8.0 mg/L			PE TKN:	25 mg/L	
EFFLUENT TN GOAL:	3.0 mg/L	2		1 = 1100.		
NITROGEN REDUCTION:	40 lbs/d					
MITTOGEN REDUCTION.						
-	15 1000 lbs/yr 292 1000 lbs/20-	VASCE		83		
	232 1000 103/20	years				
CURRENT PROCESS (CHECK	Z ALL THAT ADDIV	: MLE			Existing Aerated Volu	ime (MG): N/a
COMMENT PROCESS (CHECK	ALL THAT AFFLT	BEPR (A2/0, VI	D ata)		Existing Anoxic Volu	
		Bardenpho	r, etc.)		Current MLSS at Wi	me (MG): N/a
1		Table 10 common a common	4 Dina	Orhal	Current WILSS at VVI	nter ADF: N/a
		X Oxidation Ditch,	_	Orbai		
1		Lagoon (Biolac,			5.5	
2		Cyclical Aeratio	11			
		SBR				
1		High-Rate Biofil			18	
ł		Effluent Filtratio	n			
		Other:	-V			
I						
CURRENT EFFLUENT AMMO	NIA-N: <u>0.5</u> mg/L	X From Report				
		From Model (at.	ADF and	d load, 15 d MCR	T, 12° C winter condit	ions)
727					le le	,
PROPOSED MODIFICATIONS	TO GET AMMONIA	< 1.0 mg/L:				
		X No modifications	s require	ed .		New MLSS
					eck clarifier capacity)	N/a
1		Construct addition			Flow (mgd):	0.4
	4	Construct addition			Flow (mgd):	01
F:				•	onstruct separate den	
					y (construct separate	
		Add influent flow) (construct separate	invacint racinty)
		Other:	- cquair	The state of the s	10.70	-100 (CE) CE (CE)
		2028-0-20				
PROPOSED MODIFICATIONS	TO GET NITRATE <					
		No modifications				
(A)				filter with methan		
		Add downstream	n Nitrifica	ation Biofilter and	DeNit filter with meth	anol
		X Add methanol to	existing	BNR process		
		Add downstream	n anoxic	tank with methar	nol feed	
		Add effluent filtra	ation			
2.5		Other:				
CAPITAL COST:	Equipment and Stru	ctures (from Page 2):		\$250,000		*
Section of the sectio	Electrical and Instru		12%	\$30,000		A
	Yard Piping and Sile	Work:	15%	\$38,000		
	. Subtotal:			\$320,000		
2	Contractor OH&P:		15%	\$48,000		-
	Engineering and Co	nstr. Mamt	15%	\$48,000	S	
	Subtotal:		1070	\$420,000		
	Contingency:		30%	\$96,000		
	Total Capital Cost:		3070	\$520,000		
_		20 Vr. N. romovol:		\$1.78		
1	Capital Cost per lb.	20-11, N Terrioval.		\$1.10		
ODEDATIONS COST.	Additional Harrison	San (from Dana O).		0.115	(a)	
OPERATIONS COST:	Additional Horsepov			0 HF		
	Electrical Power Co.			\$0 \$/y		1
	Nitrate Reduction us	ing Methanol:	1	5.0 mg		
	Methanol Required:			20 ga		
2. 2	Methanol Cost:	0.75 \$ /gal		\$5,500 \$/y		
Z)	Separate Stage Am	monia Reduction:	_	0.0_ mg	ı/L	
	Caustic Soda @ 25°			0 ga	s/d	* ·
#/ #/	Caustic Soda Cost:	0.60 \$/gal		- \$0 \$/y		į.
	Equipment Maintena	ince Cost:		\$4,200 \$/y	ear	
95	Denitrification Sludg	e Production w/Metha	not:	60 lbs	/d	
	Sludge Disposal Co	st: 400 \$/ton		\$4,400 \$/y	ear	
	Total Annual O&M C			\$14,100 \$/y		
	•	rest Rate after Inflatio	n:	2.91%		10
	20-Year Present Wo			\$210,000		
TOTAL 20-YEAR PRESENT WO	ORTH COST:			\$730,000		
POPULATION OF THE PROPERTY OF	Total Cost per lb. 20	Yr N removal		\$2.50		
		II ICIIIOYAI.		42.00		

Wilderness WWTP.xls

PROJECT:			tal Mitrogon Lin		
		3 mg/L Annual Average To	tai iviitogen ciii		
PREPARED FOR:		eake Bay Office			
PREPARED BY:	•	ith Stearns & Wheler, LLC	8		
DATE: .	March 19, 2001				
FACILITY:	Woodstock WW	TP			
LOCATION:	Woodstock, VA				
RATED FLOW:	1.0 mgd		PE COD): 306 mg/L	
CURRENT EFFLUENT TN:	8.0 mg/L		PE TKN	: 20 mg/L	
EFFLUENT TN GOAL:	3.0 mg/L				
	3				
NITROGEN REDUCTION:	40 lbs/d				
	15 1000 lbs/y				
	292 1000 lbs/2	0-years			
* *					
CURRENT PROCESS (CHEC	K ALL THAT APPL	Y): MLE		Existing Aerated Volu	me (MG): 1.3
SERGAN SHEATH)		BEPR (A2/0, VIP, etc	2.)	Existing Anoxic Volu	
		Bardenpho		-	
		The state of the s		Current MLSS at Wi	niei ADP. 3200
		X Oxidation Ditch		16. 2	
		Lagoon (Biolac, etc.)		Note: Oxidation Ditches	operate Cyclically
	9	Cyclical Aeration		U.S.	
		SBR			
		High-Rate Biofilter			
_					
		Effluent Filtration	ALUE COLOR III	- Arte - Frederick	- Arms w
		Other:	TOTAL TOTAL		CHOOSE T.
		(And the second			
CURRENT EFFLUENT AMMO	NIA-N: 0.5 mo	/L X From Report			
			and load, 15 d M	CRT, 12° C winter conditi	ions)
				, o winter contait	,
DRODOSED MODIFICATIONS	TO OFT 11110'"	A and Committee			
PROPOSED MODIFICATIONS	TO GET AMMONIA				
		X No modifications requ	uired		New MLSS
		Raise MCRT/MLSS in	n existing tanks (check clarifier capacity)	N/a
		Construct additional a		Flow (mgd):	0
	75	Construct additional of		Flow (mgd):	.0
				(construct separate deni	
				only (construct separate i	nit/denit facility)
		Add influent flow equa	alization tank		
		Other:			
	e i	Add methanol to exist Add downstream ano	fication Biofilter a ing BNR process	and DeNit filter with metha s	anol
	*	Add effluent filtration		to a reconstruction of the contract of the con	
		Other:	Manager III A Company	25.	ATTENDED TO A STATE OF THE PARTY OF THE PART
					TOTAL STATE OF THE
					TOTAL STATE OF THE
CAPITAL COST:	Equipment and St	tructures (from Page 2):	- \$1,300,000		Car area
CAPITAL COST:	, ,	, -			(C. 1911)
CAPITAL COST:	Electrical and Inst	rumentation: 12%	\$156,000		TOP NEW TOTAL
CAPITAL COST:	Electrical and Inst Yard Piping and S	rumentation: 12% lite Work: 15%	\$156,000 \$195,000		100 3-13 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5
CAPITAL COST:	Electrical and Inst Yard Piping and S Subtotal:	rumentation: 12% bite Work: 15%	\$156,000 \$195,000 \$1,650,000		
CAPITAL COST:	Electrical and Inst Yard Piping and S	rumentation: 12% bite Work: 15% 15%	\$156,000 \$195,000 \$1,650,000 \$248,000		
CAPITAL COST:	Electrical and Inst Yard Piping and S Subtotal:	rumentation: 12% bite Work: 15%	\$156,000 \$195,000 \$1,650,000 \$248,000	λ. *	
CAPITAL COST:	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P	rumentation: 12% bite Work: 15%	\$156,000 \$195,000 \$1,650,000 \$248,000	λ. *	
CAPITAL COST:	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal:	rumentation: 12% site Work: 15% constr. Mgmt: 15%	\$156,000 \$195,000 \$1,650,000 \$248,000 \$2,150,000	λ	
CAPITAL COST:	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal: Contingency:	rumentation: 12% site Work: 15% Constr. Mgmt: 15%	\$156,000 \$195,000 \$1,650,000 \$248,000 \$2,150,000 \$2,150,000 \$495,000	λ	
CAPITAL COST:	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal: Contingency: Total Capital Cost	rumentation: 12% iite Work: 15%	\$156,000 \$195,000 \$1,650,000 \$248,000 \$2,150,000 \$2,150,000 \$2,650,000	λ	
CAPITAL COST:	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal: Contingency: Total Capital Cost	rumentation: 12% site Work: 15% Constr. Mgmt: 15%	\$156,000 \$195,000 \$1,650,000 \$248,000 \$2,150,000 \$2,150,000 \$495,000	λ	
	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal: Contingency: Total Capital Cost Capital Cost per It	rumentation: 12% site Work: 15% Constr. Mgmt: 15% 30% Co. 20-Yr. N removal:	6 \$156,000 \$195,000 \$1,650,000 \$248,000 \$248,000 \$2,150,000 \$495,000 \$2,650,000 \$9.08	λ. *	
	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal: Contingency: Total Capital Cost Capital Cost per It	rumentation: 12% iite Work: 15%	6 \$156,000 \$195,000 \$1,650,000 \$248,000 \$2,150,000 \$495,000 \$2,650,000 \$9.08	HP	
CAPITAL COST: OPERATIONS COST:	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal: Contingency: Total Capital Cost Capital Cost per It	rumentation: 12% site Work: 15% Constr. Mgmt: 15% 30% : 5. 20-Yr. N removal: ower (from Page 2):	6 \$156,000 \$195,000 \$1,650,000 \$248,000 \$248,000 \$2,150,000 \$495,000 \$2,650,000 \$9.08	HP	
	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal: Contingency: Total Capital Cost Capital Cost per It Additional Horsep: Electrical Power C	rumentation: 12% site Work: 15% Constr. Mgmt: 15% 30% : 5. 20-Yr. N removal: ower (from Page 2): cost: 0.05 \$/kW	6 \$156,000 \$195,000 \$1,650,000 \$248,000 \$2,150,000 \$495,000 \$2,650,000 \$9.08	HP	
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OPERATIONS COST:	Electrical and Inst Yard Piping and S Subtotal: Contractor OH&P: Engineering and C Subtotal: Contingency: Total Capital Cost per lt Additional Horsep Electrical Power C Nitrate Reduction Methanol Required Methanol Cost: Separate Stage Ai Caustic Soda @ 2 Caustic Soda @ 2 Caustic Soda Cos Equipment Mainte Denitrification Sludge Disposal C Total Annual In 20-Year Present V	rumentation: 12% ite Work: 15% Constr. Mgmt: 15% 30% : 15% 20-Yr. N removal: 25% 20-Yr.	\$156,000 \$195,000 \$1,650,000 \$248,000 \$248,000 \$248,000 \$245,000 \$495,000 \$9.08 20 \$6 500 5.0 20 \$5,500 0.0 \$21,500 60 \$4,400 \$37,900 2.91% \$570,000	HP S/year mg/L gals/d \$/year mg/L gals/d \$/year \$/year Ibs/d \$/year	

SUMMARY COST SHEETS FOR THE 7 JAMES RIVER, VIRGINIA WWTPS

PROJECT:	Implementing a 3 mg	g/L Annual Average	Total Nitr	rogen Limit				
PREPARED FOR:	USEPA, Chesapeak							
PREPARED BY:	Virginia Tech with S	tearns & Wheler, LL	C ·					
DATE:	March 25, 2001	is a market of			19			
FACILITY:	Richmond WWTP							
LOCATION:	Richmond, VA							
	50.0 mgd			PE COD:	r	ma/L		
RATED FLOW:				PF TKN	r	ma/I		
CURRENT EFFLUENT TN:	16.0 mg/L ⇒				·	g. =		
EFFLUENT TN GOAL:	3.0 mg/L							
NITROGEN REDUCTION:	5420 lbs/d							
82	1978 1000 lbs/yr							
	39566 1000 lbs/20-ye	ears			711			_
	CALL THAT ADDING !	TME	(3)		Existing A	erated Volume	e (MG):	
CURRENT PROCESS (CHECK	(ALL THAT APPLT):	MLE BEPR (A2/0, VIP	ota)				(MG):	
			, etc.)		Current N	MLSS at Winte	r ADF:	
	-	Bardenpho Ditab			Outtent	VIEGO DE VIIII		. 1
		Oxidation Ditch	do \					
	1	Lagoon (Biolac, e	(C.)					
		Cyclical Aeration						
	- 1	SBR						
		High-Rate Biofilte						
31		Effluent Filtration						
		X Other: Conve	entional A	ctivated Sluc	ige			
CURRENT EFFLUENT AMMO	NIA-N: <u>0.5</u> mg/L	X From Report					171	
The second second		From Model (at A	DF and lo	ad, 15 d MC	RT, 12° C w	vinter condition	is)	
PROPOSED MODIFICATIONS	TO GET AMMONIA <	1.0 mg/L:						
I TO SOLD INODITION TON TON	1	X No modifications	required				New M	ILSS
		Raise MCRT/MLS	SS in exis	ting tanks (c	heck clarifie	r capacity)	N/	la .
		Construct addition	nal aerate	d volume		ow (mgd):	0	
	1	Construct addition				ow (mgd):		
	1	Use existing anox	ric volume	as serobio				
		Use aerated syste	om for BC)D removal o	oly (constru	ct senarate nit	/denit facility)	
		TUSE aerateu syst	SILL FOLDO	O ICINOVAL C	iny (constitu	or separate m	donie idomey/	
l .	1	A SERVICE AND ADDRESS.		an Annie	100			
· ·	ļ	Add influent flow		an Annie	erner eensens	entraminaria e	Artigraphy and	and a
PROPOSED MODIFICATIONS	TO GET NITRATE < 1	Add influent flow Other: 0 mg/L: No modifications	equalizati	on tank		MINISTER OF PROPERTY OF PROPER	arquit id	त्रज्ञ
PROPOSED MODIFICATIONS	TO GET NITRATE < 1	Add influent flow Other: No mg/L: No modifications X Add downstream Add downstream Add methanol to Add downstream	required DeNit filte Nitrification existing B anoxic tal	er with metha	anol nd DeNit filte		50	a go
PROPOSED MODIFICATIONS	TO GET NITRATE < 1	Add influent flow Other: O mg/L: No modifications X Add downstream Add downstream Add methanol to Add downstream Add downstream	required DeNit filte Nitrification existing B anoxic taltion	er with metha on Biofilter at NR process nk with meth	anol nd DeNit filte anol feed		50	18 A
PROPOSED MODIFICATIONS	TO GET NITRATE < 1	Add influent flow Other: O mg/L: No modifications X Add downstream Add downstream Add methanol to Add downstream Add downstream	required DeNit filte Nitrification existing B anoxic taltion	er with metha	anol nd DeNit filte anol feed		50	##C
		Add influent flow Other: No mg/L: No modifications X Add downstream Add downstream Add methanol to Add downstream Add downstream Add effluent filtrat X Other: Modifi	required DeNit filte Nitrification existing B anoxic taltion y for MLE	er with metha on Biofilter and NR process nk with methal	anol nd DeNit filte anol feed		50	
PROPOSED MODIFICATIONS	Equipment and Struc	Add influent flow Other: No mg/L: No modifications Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications	required DeNit filte Nitrification anoxic tartion y for MLE	er with metha on Biofilter and INR process ink with methal Operation	anol nd DeNit filte anol feed		£(10 mg
	Equipment and Struc Electrical and Instrum	Add influent flow Other: No mg/L: No modifications X Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications:	required DeNit filte Nitrification Anoxic taltion y for MLE	er with metha on Biofilter at tNR process nk with meth Operation (22,740,000 \$2,729,000	anol nd DeNit filte anol feed		£(
	Equipment and Struc	Add influent flow Other: No mg/L: No modifications X Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications:	required DeNit filte Nitrification existing B anoxic taltion y for MLE \$ 12% 15%	er with metha on Biofilter at NR process nk with meth Operation (22,740,000 \$2,729,000 \$3,411,000	anol nd DeNit filte anol feed		£(
	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal:	Add influent flow Other: No mg/L: No modifications X Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications:	required DeNit filte Nitrification existing B anoxic taltion y for MLE \$ 12% 15% \$	er with metha on Biofilter and NR process nk with metha Operation 522,740,000 \$2,729,000 \$3,411,000 528,880,000	anol nd DeNit filte anol feed		£(
	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P	Add influent flow Other: No mg/L: No modifications Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications	required DeNit filte Nitrificatic existing B anoxic taltion y for MLE 12% 15%	er with metha on Biofilter and INR process nk with methal 22,740.000 \$2,729,000 \$3,411.000 (28,880.000 \$4,332.000	anol nd DeNit filte anol feed		£(
	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal:	Add influent flow Other: No mg/L: No modifications Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications	required DeNit filte Nitrification existing B anoxic tailtion y for MLE \$ 12% \$ 15% \$ 15%	er with metha on Biofilter ari NR process nk with meth Operation :22,740,000 \$2,729,000 \$3,411.000 :28,880,000 \$4,332,000 \$4,332,000	anol nd DeNit filte anol feed		£(
	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P	Add influent flow Other: No mg/L: No modifications Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications	required DeNit filte Nitrification existing B anoxic tartion for MLE \$ 12% 15% \$ 15% \$ 15% \$	er with metha on Biofilter and INR process ink with methal Operation 122,740.000 \$2,729,000 \$3,411.000 28,880.000 28,332.000 34,332.000 37,540.000	anol nd DeNit filte anol feed		£(e de
	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P Engineering and Con	Add influent flow Other: No mg/L: No modifications Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications	required DeNit filte Nitrification existing B anoxic taition of for MLE \$12% \$15% \$15% \$30%	er with metha on Biofilter at tNR process nk with meth Operation (22,740,000 \$2,729,000 \$3,411,000 (28,830,000 (34,332,000 (34,332,000 (37,540,000 (38,664,000	anol nd DeNit filte anol feed		£(
	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P Engineering and Con Subtotal:	Add influent flow Other: No mg/L: No modifications Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifications	required DeNit filte Nitrification existing B anoxic taition of for MLE \$12% \$15% \$15% \$30%	er with metha on Biofilter at tNR process nk with meth Operation 22,740,000 \$2,729,000 \$3,411,000 28,8382,000 54,332,000 54,332,000 37,540,000 \$8,664,000	anol nd DeNit filte anol feed		£(- (a)
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	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P Engineering and Con Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Additional Horsepowe	Add influent flow Other: No mg/L: No modifications X Add downstream Add downstream Add downstream Add downstream Add effluent filtrat X Other: Modification: Work str. Mgmt 0-Yr. N removal: er (from Page 2):	required DeNit filte Nitrification existing B anoxic taition of for MLE \$12% \$15% \$15% \$30%	er with methe on Biofilter and INR process nk with methe Operation 322,740,000 \$2,729,000 \$3,411,000 28,880,000 \$4,332,000 54,332,000 37,540,000 38,664,000 46,200,000 \$1.17	anol nd DeNit filte anol feed		£(
CAPITAL COST:	Equipment and Struc Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P Engineering and Con Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Additional Horsepowe Electrical Power Cost	Add influent flow Other: No modifications Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifi tures (from Page 2): nentation: Work str. Mgmt: 0-Yr. N removal: er (from Page 2): t: 0.05 \$/kW	required DeNit filte Nitrification existing B anoxic taition of for MLE \$12% \$15% \$15% \$30%	er with metha on Biofilter and INR process ink with methal of Economic Section 122,740,000 \$2,729,000 \$3,411,000 \$3,411,000 \$4,332,000 \$4,332,000 \$4,332,000 \$4,332,000 \$1,17 1,000	anol nd DeNit filte anol feed HP \$/year		£(
CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P Engineering and Con Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2: Additional Horsepowe Electrical Power Cost Nitrate Reduction usi	Add influent flow Other: No modifications Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifi tures (from Page 2): nentation: Work str. Mgmt: 0-Yr. N removal: er (from Page 2): t: 0.05 \$/kW	required DeNit filte Nitrification existing B anoxic taition of for MLE \$12% \$15% \$15% \$30%	er with metha on Biofilter and NR process nk with methal Operation 22,740,000 \$2,729,000 \$3,411,000 28,880,000 28,880,000 37,540,000 \$46,200,000 \$1,17 1,000 \$326,700	anol nd DeNit filte anol feed HP \$/year mg/L		£(-100
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CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P Engineering and Con Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2: Additional Horsepowe Electrical Power Cost Methanol Required: Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenan Denitrification Sludge Sludge Disposal Cost Total Annual O&M Cot Total Annual O&M Cot Cost Cost Cost Cost Cost Cost Cost	Add influent flow Other: No modifications X Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifi tures (from Page 2): nentation: Work str. Mgmt 0-Yr. N removal: er (from Page 2): t: 0.05 \$/kW ng Methanol: 0.75 \$/gal nonia Reduction: conc. 0.60 \$/gat nec Cost: Production w/Methan t: 400 \$/ton ost:	required DeNit filte Nitrificatic existing B anoxic tailition y for MLE 12% 15% \$ 15% \$ 30% \$	er with metha on Biofilter and INR process ink with methal process ink ink ink ink ink ink ink ink ink ink	HP \$/year mg/L gals/d \$/year mg/L gals/d \$/year fbs/d \$/year		£(
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CAPITAL COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P Engineering and Con Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2: Additional Horsepowe Electrical Power Cost Methanol Required: Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenan Denitrification Sludge Sludge Disposal Cost Total Annual O&M Cot Total Annual O&M Cot Cost Cost Cost Cost Cost Cost Cost	Add influent flow Other: No modifications Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifi tures (from Page 2): tentation: Work str Mgmt 0-Yr. N removal: er (from Page 2): t: 0.05 \$/kW ng Methanol: 0.75 \$/gal nonia Reduction: c conc. 0.60 \$/gat nce Cost: e Production w/Methan t: 400 \$/ton ost: rest Rate after Inflatior	required DeNit filte Nitrification existing B anoxic tartion of the second seco	er with metha on Biofilter and INR process ink with methal process ink ink ink ink ink ink ink ink ink ink	HP \$/year mg/L gals/d \$/year mg/L gals/d \$/year fbs/d \$/year		£(
CAPITAL COST: OPERATIONS COST:	Equipment and Struct Electrical and Instrum Yard Piping and Site Subtotal: Contractor OH&P Engineering and Con Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 2 Additional Horsepowe Electrical Power Cost Nitrate Reduction usi Methanol Required: Methanol Required: Methanol Required: Methanol Cost: Separate Stage Amm Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenar Denitrification Sludge Sludge Disposal Cost Total Annual O&M Ce Effective Annual Inter 20-Year Present Wor	Add influent flow Other: No modifications Add downstream Add downstream Add methanol to Add downstream Add effluent filtrat X Other: Modifi tures (from Page 2): tentation: Work str Mgmt 0-Yr. N removal: er (from Page 2): t: 0.05 \$/kW ng Methanol: 0.75 \$/gal nonia Reduction: c conc. 0.60 \$/gat nce Cost: e Production w/Methan t: 400 \$/ton ost: rest Rate after Inflatior	required DeNit filte Nitrification of the MLE 12% 15% \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ \$ 15% \$ 30% \$ 30% \$ 15% \$ 30	er with metha on Biofilter and	HP \$/year mg/L gals/d \$/year mg/L gals/d \$/year fbs/d \$/year		£(
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, Y =			Tetal	liteagen Limit
PROJECT:	Implementing a 3 m	g/L Annual Average	lotal N	vitrogen Limit
PREPARED FOR:	USEPA Chesapeal	e Bay Office		
PREPARED BY:	Virginia Tech with	stearns & Wheler, LI	LC	
	March 25, 2001			
DATE:		MAATTD		
FACILITY:	Hopewell Regional	4444		
LOCATION:	Hopewell, VA			PE COD:mg/L
RATED FLOW:	50.0 mgd	780		PE CODmg/L
CURRENT EFFLUENT TN:	6.0 mg/L			PE TKN:mg/L
EFFLUENT TN GOAL:	3.0 mg/L			
	1250 lbs/d			
NITROGEN REDUCTION:	·			
	456 1000 lbs/yr			
	9125 1000 lbs/20-	ears		
4		C Thurs		Existing Aerated Volume (MG):
CURRENT PROCESS (CHECK	(ALL THAT APPLY):	MLE		Existing Anoxic Volume (MG):
paramatan constitu		BEPR (A2/0. VI	P etc.)	Existing Arloxic volume (MO).
		Bardenpho		Current MLSS at Winter ADF
		Oxidation Ditch		
		Lagoon (Biolac.	etc.)	
		Cyclical Aeratio	n	
V.			**	
		SBR	14	4
-		High-Rate Biofil		
		Effluent Filtratio	n	2 7 2500
		X Other: seco	and stage	e denitrification with methanol addition
-				
CURRENT COLUMN	AHA Ah4 A	Y From Report		
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L	H- TOTT REPORT	ADE ac-	nd load, 15 d MCRT, 12° C winter conditions)
		From Model (at	AUF and	iu ioau, 13 u ivionti, 12 O winter conditions/
*:		area officially		
PROPOSED MODIFICATIONS	TO GET AMMONIA	1.0 mg/L:		
I NOT USED MODII TOATTONS		I X INA MADDICAROR	s require	ed New ML
i		Paice MCRT/M	LSS in e	existing tanks (check clarifier capacity) N/a
		Construct addit	ional and	rated volume Flow (mgd): 0
		Construct addit	ional aei	arifiers Flow (mgd): 0
		Construct addit	ional clai	
		Use existing an	oxic volu	ume as aerobic (construct separate denit facility)
		Use aerated sy	stem for	BOD removal only (construct separate nit/denit facility)
		Add influent flor	w equaliz	ization tank
		Other:	E	7M :
a 0				
l .				
PROPOSED MODIFICATIONS	TO GET NITRATE <	1.0 mg/L:		
1		No modification	is require	eo
		Add downstrea	m DeNit	t filter with methanol
	12	Add downstrea	m Nitrific	cation Biofilter and DeNit filter with methanol
9		Y Add methanol t	o existin	ng BNR process
1		Add downstrea	m anoxid	ic tank with methanol feed
		X Add effluent filt	ration	
			i ation.	
		Other:		
8		×		
CAPITAL COST:	Equipment and Str	ctures (from Page 2)	. ,	\$20,950,000
CALLIAE COST.	Electrical and Instru	mentation:	12%	\$2,514,000
1	Yard Piping and Sit	e Work:	15%	\$3,143,000
		C TAOIN. /		\$26,610,000
	Subtotal:		4.50/	
	Contractor OH&P:		15%	
1	Engineering and Co	onstr. Mgmt:	15%	
1	Subtotal:			\$34,590,000
	Contingency:		30%	\$7,983,000
1	Total Castal Cost			\$42,570,000
	Total Capital Cost:			\$4.67
	Capital Cost per lb.	20-Yr. N removal.		44.01
I				500 UD
OPERATIONS COST:	Additional Horsepo	wer (from Page 2):		500 HP
O. EKAHONO GOOT.	Electrical Power Co	ost: 0.05 \$/k	W	\$163,400 \$/year
	Nitrate Reduction L	sing Methanol		3.0 mg/L
1				570 gals/d
	Methanol Required	: 0.75 \$/ g	al	\$156,000 \$/year
	Methanol Cost:		CA1	0.0 mg/L
8	Separate Stage An	monia Reduction:		
	Caustic Soda @ 25	5% conc.		0 gals/d
	Caustic Soda Cost	0.60 \$/ g	al	\$0 \$/year
	Equipment Mainter	ance Cost:		\$345,900 \$/year
II.	Denitrification Stud	ge Production w/Meth	nanol:	1800 ibs/d
			าก	\$131,400 \$/year
1	Sludge Disposal C			\$796,700 \$/year
ili	Total Annual O&M	Cost:	lian.	2.91%
	Effective Annual In	terest Rate after Inflat	uon:	
1	20-Year Present W	orth of O&M Costs:		\$11,950,000
11				
TOTAL 20-YEAR PRESENT	MORTH COST.			\$54,520,000
TIVIAL ZU-TEAK PRESENT	Total Cost per lb. 2	n.Vr. N removal:		\$5.97
1	rotar Cost per Ib. 4	U-11, IN ICHIOVAL.		

X BEPR (A2/0, VIP, etc.) Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	d Volume (MG): c Volume (MG): at Winter ADF:
PREPARED BY: DATE: March 25, 2001 FACILITY: LOCATION: Henrico County WWTP LOCATION: MATED FLOW: CURRENT EFFLUENT TN: 6.0 mg/L EFFLUENT TN GOAL: NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate: X BEPR (A2/0, VIP, etc.) Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
DATE: March 25, 2001 FACILITY: Henrico County WWTP LOCATION: Henrico County. VA RATED FLOW: 40.0 mgd PE COD: mg/L CURRENT EFFLUENT TN: 6.0 mg/L EFFLUENT TN GOAL: 3.0 mg/L NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerater X BEPR (A2/0, VIP, etc.) Existing Anoxi Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
FACILITY: LOCATION: RATED FLOW: RATED FLOW: CURRENT EFFLUENT TN: 6.0 mg/L EFFLUENT TN GOAL: 3.0 mg/L NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate X BEPR (A2/0, VIP, etc.) Existing Anoxi Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
LOCATION: Henrico County, VA RATED FLOW: 40.0 mgd PE COD: mg/L CURRENT EFFLUENT TN: 6.0 mg/L EFFLUENT TN GOAL: 3.0 mg/L NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate. X BEPR (A2/0, VIP, etc.) Existing Anoxi. Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
LOCATION: Henrico County, VA RATED FLOW: 40.0 mgd PE COD: mg/L CURRENT EFFLUENT TN: 6.0 mg/L EFFLUENT TN GOAL: 3.0 mg/L NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate. X BEPR (A2/0, VIP, etc.) Existing Anoxi. Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
RATED FLOW: G.0 mg/L CURRENT EFFLUENT TN: G.0 mg/L FFTUENT TN GOAL: NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate: X BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
EFFLUENT TN GOAL: 3.0 mg/L NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate X BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
EFFLUENT TN GOAL: 3.0 mg/L NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate X BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
NITROGEN REDUCTION: 1000 lbs/d 365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerater X BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
365 1000 lbs/yr 7300 1000 lbs/20-years CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate X BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X CURRENT EEEL LIENT AMMONIA No. <1.0 mg/l X From Report	c Volume (MG): at Winter ADF:
CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate X BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
CURRENT PROCESS (CHECK ALL THAT APPLY): MLE Existing Aerate X BEPR (A2/0, VIP, etc.) Bardenpho Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
X BEPR (A2/0, VIP, etc.) Existing Anoxi Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
X BEPR (A2/0, VIP, etc.) Existing Anoxi Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	c Volume (MG): at Winter ADF:
X BEPR (A2/0, VIP, etc.) Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	at Winter ADF:
Bardenpho Current MLSS Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	
Oxidation Ditch Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	
Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration Other: Two systems, a modified UCT & a modified p	. "
Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	. "
SBR High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	
High-Rate Biofilter Effluent Filtration X Other: Two systems, a modified UCT & a modified p	
Effluent Filtration X Other: Two systems, a modified UCT & a modified p	
X Other: Two systems, a modified UCT & a modified p	
CHROSENT SEELLISHT AMMONIA No. 51.0 mg/l X From Report	
CHROSENT SEELLISHT AMMONIA No. 51.0 mg/l X From Report	ure Oxygen
CURRENT FEELLIENT AMMONIA-N: <1.0 mg/l X From Report	
TELLEBERT FEET HENT AMMONIA N' \$10 MOUT ATTEUUT NEDUL	
From Model (at ADF and load, 15 d MCRT, 12° C winter	conditions)
From Model (at ADF and load, 15 d MCR1, 12 C Williem	Solidinolis,
2000 C	
PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L:	
I X INo modifications required	New MLSS
Raise MCRT/MLSS in existing tanks (check clarifier capa	ncity) N/a
Construct additional aerated volume Flow (m	gd): 0
Construct additional clarifiers Flow (m	gd): 0
Use existing anoxic volume as aerobic (construct separa	e denit facility)
Use existing anoxic volunte as actionic constitutions	arate nit/denit facility)
Use aerated system for BOD removal only (construct ser	arate inducting racing /
Add influent flow equalization tank	ANALYSIS OF STREET
Other: 7	12 de 1 de
Add downstream Nitrification Biofilter and DeNit filter with Add methanol to existing BNR process Add downstream anoxic tank with methanol feed	i methanol
Add effluent filtration	noith methanol addition
X Other: modify existing effluent filters for denitrification	I Will methanol addition
CAPITAL COST: Equipment and Structures (from Page 2): \$2,000,000	w.
Electrical and Instrumentation: 12% \$240,000	
Yard Piping and Site Work: 15% \$300,000	
Taid Fighting and One Work.	
Subtotal.	
CONTRACTOR OTHER	× .
Engineering and Constr. Mgmt: 15% \$381,000	
63 300 000	
Subtotal: \$3,300,000	
5000(01)	
Contingency: 30% \$762,000	
Contingency: 30% \$762,000 Total Capital Cost: \$4,060,000	
Contingency: 30% \$762,000	
Contingency: 30% \$762,000 Total Capital Cost: \$4,060,000 Capital Cost per lb. 20-Yr. N removal: \$0.56	
Contingency: 30% \$762,000 Total Capital Cost: \$4,060,000 Capital Cost per lb. 20-Yr. N removal: \$0.56 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP	
Contingency: 30% \$762,000 Total Capital Cost: \$4,060,000 Capital Cost per lb. 20-Yr. N removal: \$0.56 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP Electrical Power Cost: 0.05 \$/kW \$0 \$/year	
Contingency: 30% \$762,000 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: \$0.56 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP Electrical Power Cost: 0.05 \$/kW \$0 \$/year Nitrate Reduction using Methanol: 3.0 mg/L	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56	
Contingency: 30% \$762,000 **Total Capital Cost: \$4,060,000 Capital Cost per lb. 20-Yr. N removal: \$0.56 OPERATIONS COST: Additional Horsepower (from Page 2): 0 HP Electrical Power Cost: 0.05 \$/kW \$0 \$/year Nitrate Reduction using Methanol: 3.0 mg/L Methanol Required: 460 gals/d	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56	
Contingency: 30% \$762,000 \$4,060,	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56 \$0.5	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56 \$0	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56 \$0	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56 \$0	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56 \$0	
Contingency:	
Contingency: 30% \$762,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$4,060,000 \$0.56 \$0	

PREPARED FOR: USEPA, Chesapeake Bay Office PREPARED BY: Virginia Tech with Stearns & Wheler, LLC	550 1507	tt-monting 2.2 m	all Appual Average Tota	I Nitrogen Limit	-	
PROPOSED MODIFICATIONS TO GET AMMONIA -N. 	PROJECT:	implementing a 3 m	Bay Office			
March 25, 201 Mortok, VA		USEPA, Chesapeak	e Bay Office			
ACULTY: HRSD-VIP ACTED FLOW: More ATTED	PREPARED BY:		Stearns & Wheler, LLC			
ACAPITAL COST: Equipment and Structures (from Page 2) Equipment and DeNit (filter with methanol end of Montant Cost) Contractor OHAP	DATE:	March 25, 2001	- 22			
ACAPITAL COST: Equipment and Structures (from Page 2) Equipment and DeNit (filter with methanol end of Montant Cost) Contractor OHAP	FACILITY:	HRSD-VIP	4			
ARTEOFLOW: 40.0 mgd	ADE-SAME DISTRICT CONTRACT					
DURRENT EFFLUENT TIN GOL : 30 mg/L PETIN: mg/L				PE COD:	mg/L	
### CAPITAL COST: CAPITAL COST: Equipment and Structures (from Page 2): Electrical Park Work: Subtotal: Contringency:				DE TKN.	mg/l	
NERROGEN REDUCTION: 365 1000 lbs/d 355 1000 lbs/d 7300 lbs/d 7300 1000 lbs/d 7300 lbs/				TE IKN.	mg/c	
Ses 1000 be/yr 7300 1000 1000 1000 be/yr 7300 1000 1000 1000 1000 1000 1000 1000	EFFLUENT TN GOAL:	3.0 mg/L				
Set 1000 besyr 7300 1000 1000 1000 1000 1000 1000 1000	NITROGEN REDUCTION:	1000 lbs/d				
DURRENT PROCESS (CHECK ALL THAT APPLY): MLE		365 1000 lbs/vr				* .
### CURRENT PROCESS (CHECK ALL THAT APPLY): ### SEPR (A2/D, VIP, etc.) Existing Aerated Volume (MG):			ears	Vi		
September Sept		7000 1000 1000 20	-			
September Sept	CURRENT PROCESS (CHECK	ALL THAT ADDIVA-	MI E	E	kisting Aerated Volume (MC	G):
Add influent filter and surface from Page 2: CAPITAL COST: Equipment and Structure filter f	CURRENT PROCESS (CHECK	ALL THAT APPLIT.	WILL WILL AND VID of			
CURRENT EFFLUENT AMMONIA-N: <1.0 mg/L Lagoon (Bloads, etc.) Cyclical Aeration SBR						
Lagoon (Biolac, etc.) Cyclical Aeration SBR High-Rate Biofilter Effluent Filtration Continuence Co				,	Duttent wilds at winter Al	'
CURRENT EFFLUENT AMMONIA-N: <1.0 mg/L: Firm Report Firm Mode (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L:	*		Oxidation Ditch			
CURRENT EFFLUENT AMMONIA-N: <1.0 mg/L: Firm Report Firm Mode (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L:			Lagoon (Biolac, etc.)			
SBR High-Rate Biofiller Effuent Filtration High-Rate Biofiller Effuent Filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent filtration X Other The Original VIP Plant, no effluent each filtration X Other The Original VIP Plant, no effluent each filtration X Other The Original VIP Plant, no effluent each filtration X Other The Original VIP Plant, no effluent each filtration X Other The Original VIP Plant, no effluent each filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other The Original VIP Plant is a filtration X Other	0	3 "				
CURRENT EFFLUENT AMMONIA-N: <1.0 mg/L From Model (at ADF and load, 15 d MCRT, 12° C winter conditions) PROPOSED MODIFICATIONS TO GET AMMONIA < 1.0 mg/L And influent flow existing tanks (check clarifier capacity) Construct additional aerated volume Construct additional aerated volume Construct additional aerated volume Flow (mgd) Use aerated system for BOD removal only (construct separate denit facility) Use aerated system for BOD removal only (construct separate denit facility) Use aerated system for BOD removal only (construct separate denit facility) When a construct additional aerated volume Flow (mgd) Use aerated system for BOD removal only (construct separate denit facility) Use aerated system for BOD removal only (construct separate denit facility) And influent flow equalization tank Other: No modifications required Add downstream Nitrification Biofilier with methanol Add downstream Nitrification Biofilier with methanol flow do						
Effluent Filtration CONTRIENT EFFLUENT AMMONIA N: <1.0 mg/L: The Original VIP Plant, no effluent filtration						
CURRENT EFFLUENT AMMONIA-N: 						
CURRENT EFFLUENT AMMONIA-N: <1.0 mg/L: From Report From Model (at ADF and load, 15 d MCRT, 12° C winter conditions)						
PROPOSED MODIFICATIONS TO GET AMMONIA 1.10 mg/L: X			X Other The Origin	nal VIP Plant, no efflu	ent filtration	
PROPOSED MODIFICATIONS TO GET AMMONIA 1.10 mg/L: X						
PROPOSED MODIFICATIONS TO GET AMMONIA 1.10 mg/L: X	CURRENT FEEL LIENT AMMON	(IA-N: <1.0 ma/l	X From Report			
PROPOSED MODIFICATIONS TO GET AMMONIA - 1.0 mg/L: X	SOUTH CIT EDENT ANIMON		From Model (at ADE	and load, 15 d MCRT	12° C winter conditions)	
X No modifications required Raise MCRTMALS sin existing tanks (check clarifier capacity) Construct additional aerated volume Flow (mgd): 0 Construct additional clarifiers Flow (mgd): 0 Construct additional clarifiers Flow (mgd): 0 Construct separate denit facility) Use existing anoxic volume as aerobic (construct separate of entitle (activity) Use existing anoxic volume as aerobic (construct separate init/denit facility) Add influent flow equalization tank Other: The property of the property			FIOIII Woder (at Abi	and load, 10 d more	TE O TIME OF COMOUNTS,	
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Construct additional carefares Construct additional clarifiers Construct additional clarifiers Use existing anoxic volume as aerobic (construct separate denit facility) Use earated system for BOD removal only (construct separate init/denit facility) Add influent flow equalization tank Other: No modifications required Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol and methanol to existing BNR process Add downstream anoxic tank with methanol feed Add demonstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$1,794,000 Yard Piping and Site Work: 15% \$2,243,000 Subtotal: 51,990,000 Contractor OH&P: 15% \$2,243,000 Subtotal: 52,489,000 Subtotal: 52,489,000 Subtotal: 52,489,000 Contingency: 30% \$5,687,000 Total Capital Cost: 51,000,000 Capital Cost per lb. 20-Yr. N removal: \$4,16 OPERATIONS COST: Additional Horsepower (from Page 2): 80 HP Subtotal: 52,489,000 Subtotal: 52,489,000 Subtotal: 54,160 OPERATIONS COST: Additional Horsepower (from Page 2): 92,140 Methanol Cost: 0.05 \$/kW \$125,900 Subtotal: 52,489,000 Subtotal: 52,499,000 Subtotal	S-25-0-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-		X No modifications requ	uired		
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CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Subtotal: Contractor OH&P: Engineering and Costr. Mgmt. Subtotal: Contractor OH&P: Electrical Power Cost. Costr. Additional Horsepower (from Page 2): Electrical Power Cost. Costr. Additional Horsepower (from Page 2): Electrical Power Cost. Costr. Additional Horsepower (from Page 2): Electrical Power Cost. Costr. Additional Horsepower (from Page 2): Electrical Power Cost. Costs. Separate Stage Ammonia Reduction. Caustic Soda @ 25% conc. Caustic Soda Cost: Contractor Withhando: Contractor Withha	-		Construct additional a	erated volume	Flow (mgd): 0	
Use existing anoxic volume as aerobic (construct separate denit facility) Use arrated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank Other: No modifications required						7
Use aerated system for BOD removal only (construct separate nit/denit facility) Add influent flow equalization tank Other: Add downstream DeNit filter with methanol Add downstream DeNit filter and DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol leader and downstream anoxic tank with methanol centre and defluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Add downstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$1,794,000 Yard Piping and Site Work: 15% \$2,243,000 Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% \$2,849,000 Subtotal: Contractor OH&P: Subtotal: Contingency: 30% \$2,849,000 Subtotal: Contingency: 30% \$30,390,000 Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Add internation OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0,05 \$f/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: Openitrification Sludge Production wi/Methanol: Sudge Disposal Cost: Denitrification Sludge Production wi/Methanol: Sludge Disposal Cost: Denitrification Sludge Production wi/Methanol: Sludge Disposal Cost: Denitrification Sludge Production wi/Methanol: Sludge Disposal Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: Stage Disposal Cost: 21,480,000 TOTAL 20-YEAR PRESENT WORTH COST: Stage Office and Denitrification structures with methanol Sudge Disposal Cost: 21,490,000 Stage Size of Cost of Sylvar Stage Office and Denitrification structures with methanol Sudge Disposal Cost: 21,490,000 Stage Size of Cost of Sylvar Stage Office and Denitrification Stage Denitrification Studge Production wiffethanol Sudge Disposal Cost: Stage Office of Cost of Sylvar Stage Office of Cost of			Construct additional of	olumo se sorobio (cor		<u>~</u>
PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required			Use existing anoxic v	Countrie as acrossic (cor	/	it facility)
PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L:					(construct separate invoen	it lacility)
PROPOSED MODIFICATIONS TO GET NITRATE < 1.0 mg/L: No modifications required X Add downstream DeNit filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream anoxic tank with methanol feed Add effluent filtration Add downstream anoxic tank with methanol feed Add effluent filtration Add methanol to existing BioR process Add downstream anoxic tank with methanol feed Add effluent filtration Add methanol feed Add effluent filtration Add methanol feed Add effluent filtration Add process Add downstream anoxic tank with methanol feed Add effluent filtration Add process Add downstream anoxic tank with methanol feed Add effluent filtration Add process Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 s/k/W S2,849,000 S4,690,000 S4,690,0	13			alization tank		97. H 1993
Add downstream Delht filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream noxic tank with methanol feed Add downstream noxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$1,794,000 12% \$1,794,000 12% \$2,243,000 13,990,000 14% \$2,243,000 15% \$2,243,000 15% \$2,243,000 15% \$2,243,000 15% \$2,249,000 15%	χ*		Other:			5,5,0
Add downstream Delht filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream noxic tank with methanol feed Add downstream noxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$1,794,000 12% \$1,794,000 12% \$2,243,000 13,990,000 14% \$2,243,000 15% \$2,243,000 15% \$2,243,000 15% \$2,243,000 15% \$2,249,000 15%			7			
Add downstream Delht filter with methanol Add downstream Nitrification Biofilter and DeNit filter with methanol Add downstream noxic tank with methanol feed Add downstream noxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$1,794,000 12% \$1,794,000 12% \$2,243,000 13,990,000 14% \$2,243,000 15% \$2,243,000 15% \$2,243,000 15% \$2,243,000 15% \$2,249,000 15%	PROPOSED MODIFICATIONS	TO GET NITRATE <	1.0 mg/L:			
Add downstream DeNit filter with methanol Add downstream Nitification Biofilter and DeNit filter with methanol Add demethanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$1,794.000 Yard Piping and Site Work: 15% \$2,243.000 Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% \$2,849.000 Subtotal: Contingency: 30% \$2,849.000 Subtotal: Contingency: Total Capital Cost: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Capital Cost per lb. 20-Yr. N removal: Electrical Power Cost: Methanol Required: Methanol Required: Methanol Cost: Caustic Soda @25% conc. Caustic Soda @25% conc. Caustic Soda Cost: Denitrification Studge Production wiMethanol: Studge Disposal Cost: Denitrification Studge Production wiMethanol: Studge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: TOTAL 20-YEAR PRESENT WORTH COST: Add downstream Nitrification Studge with methanol: Add demthanol to wisting BNR process \$14,950.000 \$14,950.000 \$21,490.000 \$22,849.000 \$22,849.000 \$22,849.000 \$22,849.000 \$24,890.000 \$24,690.000 \$31,303.000 \$31,303.000 \$31,303.000 \$31,900	PROPOSED MODIFICATIONS	TO OLI MINUNIL S	No modifications requ	uired		
Add downstream Nitrification Biofilter and DeNit filter with methanol Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% 51,794,000 Yard Piping and Site Work: 15% 52,243,000 Subtotal: 15% 52,249,000 Engineering and Constr. Mgmt: 15% 52,849,000 Subtotal: 224,690,000 Subtotal: 224,690,000 Subtotal: 224,690,000 Subtotal: 224,690,000 Subtotal: 30% 35,697,000 Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: 30,399,000 Capital Cost per lb. 20-Yr. N removal: 4.16 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenanae Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$11,090,000		Ä.	Add describes Det	uit filler with methanel		
Add methanol to existing BNR process Add downstream anoxic tank with methanol feed Add effluent filtration Other: CAPITAL COST: Equipment and Structures (from Page 2): \$14,950,000 Electrical and Instrumentation: 12% \$1,794,000 Yard Piping and Site Work: 15% \$2,243,000 Subtotal: \$18,990,000 Contractor OH&P: 15% \$2,849,000 Engineering and Constr. Mgmt: 15% \$2,849,000 Subtotal: \$24,690,000 Contingency: 30% \$5,697,000 Total Capital Cost: \$30,390,000 Contingency: 30% \$5,697,000 Total Capital Cost (Capital Cost Pib. 20-Yr. N removal: \$4,16 OPERATIONS COST: Additional Horsepower (from Page 2): 800 HP Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: 3.0 mg/L Methanol Required: 0.75 \$/gal Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0 gals/d Caustic Soda Cost: 0.60 \$/gal Equipment Maintenanoc Cost: 0.05 \$/gal Sudge Disposal Cost: 400 \$/fon Total Annual O&M Cost: \$739,300 \$/year \$739,000 TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000	22		Add downstream Der	'Cast's - Disfles and I	Sablit filles with mothagol	
Add downstream anoxic tank with methanol feed Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$1,794,000 Yard Piping and Site Work: 15% \$2,243,000 Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: John Subtotal: Subtotal: Contingency: John Subtotal: Subtot			Add downstream Nitr	ification Biolitter and L	Jenn men with methanor	
Add downstream anoxic tank with methanol feed Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% \$1,794,000 Yard Piping and Site Work: 15% \$2,243,000 Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: John Subtotal: Subtotal: Contingency: John Subtotal: Subtot			Add methanol to exis	ting BNR process		
Add effluent filtration Other: Equipment and Structures (from Page 2): \$14,950,000 Electrical and Instrumentation: 12% \$1,794,000 Yard Piping and Site Work: 15% \$2,243,000 Subtotal: \$18,990,000 Contractor OH&P: 15% \$2,849,000 Engineering and Constr. Mgmt: 15% \$2,849,000 Subtotal: \$24,690,000 Contingency: 30% \$5,697,000 Subtotal: \$303,390,000 Contingency: 30% \$5,697,000 Total Capital Cost: \$303,390,000 Capital Cost per lb. 20-Yr. N removal: \$4,16 OPERATIONS COST: Additional Horsepower (from Page 2): 800 HP Electrical Power Cost: 0.05 \$/kW \$261,400 \$/year Nitrate Reduction using Methanol: 460 gals/d Methanol Required: 460 gals/d Methanol Cost: 0.75 \$/gal \$125,900 \$/year Caustic Soda @ 25% conc. 0.0 mg/L Caustic Soda @ 25% conc. 0.0 mg/L Caustic Soda @ 25% conc. 0.0 mg/L Caustic Soda @ 25% conc. 0.0 s/year Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: 0.60 \$/gal Equipment Main			Add downstream and	xic tank with methano	l feed	
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CAPITAL COST: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: Methanol Required: Methanol Required: Methanol Cost: Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: TOTAL 20-YEAR PRESENT WORTH COST: \$11,950,000 \$11,950,000 \$11,950,000 \$2,2459,000 \$2,2459,000 \$2,2459,000 \$2,2459,000 \$2,2459,000 \$2,2459,000 \$30,399,000 \$4,16 \$4,16 800 HP \$261,400 \$1/year \$3.0 mg/L 460 gals/d \$125,900 \$1/year \$125,900 \$1/year \$125,900 \$1/year \$1440 lbs/d \$105,100 \$1/year \$1440 lbs/d \$105,100 \$1/year \$139,300 \$1/year \$11,990,000		1	1.000	CHANGE OF STREET	50 576 5	1273
Electrical and Instrumentation: 12% \$1,794,000 Yard Piping and Site Work: 15% \$2,243,000 Subtotal: 518,990,000 Engineering and Constr. Mgmt: 15% \$2,849,000 Engineering and Constr. Mgmt: 15% \$2,849,000 Subtotal: 524,690,000 Contingency: 30% \$5,697,000 Total Capital Cost: 530,399,000 Capital Cost per lb. 20-Yr. N removal: 54.16 OPERATIONS COST: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol: Methanol Required: 460 gals/d Methanol Required: 460 gals/d Methanol Cost: 0.75 \$/gal Separate Stage Ammonia Reduction: Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda @ 25% conc. Caustic Soda Cost: 0.60 \$/gal Equipment Maintenance Cost: Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$11,090,000 TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000			Outer.			=
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Subtotal: \$18,990,000		Electrical and Instru	11101110111		**	
Subtotal:		Yard Piping and Site	e Work: 159	% \$2,243,000		
Contractor OH&P: 15% 52,849,000 Engineering and Constr. Mgmt: 15% 52,849,000 Subtotal: \$2,849,000 Contingency: 30% \$5,697,000 Total Capital Cost: \$30,390,000 Capital Cost per lb. 20-Yr. N removal: \$4.16 OPERATIONS COST: Additional Horsepower (from Page 2): 800 HP Electrical Power Cost: 0.05 \$/kW \$261.400 \$/year Nitrate Reduction using Methanol: 450 gals/d Methanol Required: 450 gals/d Methanol Cost: 0.75 \$/gal \$125,900 \$/year Separate Stage Ammonia Reduction: 0.0 mg/L Caustic Soda @ 25% conc. 0.60 \$/gal Equipment Maintenance Cost: 1400 \$/year Total Annual O&M Cost: 400 \$/ton Total Annual O&M Cost: 5739,300 \$/year 2.91% TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000				\$18,990,000		
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Subtotal: \$24,690,000	I				¥	
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Caustic Soda @ 25% conc. Caustic Soda Cost: Sale Soda Cost Soda Sylvear Caustic Soda Cost: Caustic Soda Cost	1		monia Reduction:	0.0 mg	'L	
Caustic Soda Cost: 0.60 \$/gal \$0 \$/year Equipment Maintenance Cost: \$246,900 \$/year Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: 400 \$/ton \$105,100 \$/year Total Annual O&M Cost: \$739,300 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$11,090,000		Cauctic Coda @ 25	% conc			
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Denitrification Sludge Production w/Methanol: Sludge Disposal Cost: Total Annual O&M Cost: Effective Annual Interest Rate after Inflation: 20-Year Present Worth of O&M Costs: \$1440 lbs/d \$105.100 \$/year \$739,300 \$/year \$2.91% \$11,090,000	1		-			11
Sludge Disposal Cost: 400 \$/ton \$705.100 \$/year Total Annual O&M Cost: \$739.300 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$11,090,000 TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000	(F)	Equipment Mainten	ance Cost:			
Sludge Disposal Cost: 400 \$/ton \$705.100 \$/year Total Annual O&M Cost: \$739.300 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$11,090,000 TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000	2 2	Denitrification Stude	ge Production w/Methanol:			
Total Annual O&M Cost: \$739,300 \$/year Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$11,090,000 TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000	1			\$105,100 \$/ye	ear	
Effective Annual Interest Rate after Inflation: 2.91% 20-Year Present Worth of O&M Costs: \$11,090,000 TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000	1			\$739,300 \$/y	ear	
20-Year Present Worth of O&M Costs: \$11,090,000 TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000	I	Effective Appropriate	erect Rate after Inflation:			
TOTAL 20-YEAR PRESENT WORTH COST: \$41,480,000		Ellective Annual Int	creat nate after ithlation.			1
ITOTAL 20-TEAK FILESENT MONTH COST.		20-Year Present W	Orth of Oaki Costs.	\$11,030,000		
ITOTAL 20-TEAK FILESENT MONTH COST.	a proposition of			6.44.400.000	2	
Total Cost per lb. 20-Yr. N removal: \$5.68	TOTAL 20-YEAR PRESENT W	ORTH COST:				21
	0.0	Total Cost per lb. 20	D-Yr, N removal:	\$5.68		

PROJECT:	Implementing a 3 mg	g/L Annual Average Total I	Nitrogen Limit		~
PREPARED FOR:	USEPA, Chesapeake	Bay Office		ai	
PREPARED BY:	Virginia Tech with St	tearns & Wheler, LLC		*:	
DATE:	March 25, 2001	tourno or tritter,		*	
FACILITY:	HRSD-Nansemond				
LOCATION:	Portsmouth, VA				
RATED FLOW:	30.0 mgd		PE COD:	ma/L	
CURRENT EFFLUENT TN:	6.0 mg/L		PE TKN	mg/L	
EFFLUENT TN GOAL:			121111	- mg/c	
NITROGEN REDUCTION:	750 lbs/d				
	274 1000 lbs/yr	arc			
	5475 1000 lbs/20-ye	:a15			
CURRENT PROCESS (CHECK	ALL THAT APPLY):	MLE	E	xisting Aerated Volur	me (MG)
		X BEPR (A2/0, VIP, etc.)		Existing Anoxic Volur	ne (MG):
	1	Bardenpho		Current MLSS at Wir	nter ADF:
	T I	Oxidation Ditch			
		Lagoon (Biolac, etc.)			
	1	Cyclical Aeration			
	1	SBR			
	1	High-Rate Biofilter			
	H	Effluent Filtration			
	1	46 46 602441 (47402417770111	w/o effluent filtration	n	0.5 - 38
	L	X Other.	THE CHICAGO		
CURRENT EFFLUENT AMMOI	NIA-N: <1.0 mg/L	X From Report From Model (at ADF and	d load, 15 d MCRT,	, 12° C winter condition	ons)
	-				
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1	.0 mg/L:		2	A Comment
		X No modifications require			New MLSS
		Raise MCRT/MLSS in e	xisting tanks (check	k clarifier capacity)	N/a
		Construct additional aer	ated volume	Flow (mgd):	- O × ×
		 Construct additional clar 	rifiers	Flow (mgd):	0
	-1	- IConstruct additional dai			(facility)
н		Use existing anoxic volu	me as aerobic (cor	nstruct separate denit	(ichamity)
		Use existing anoxic volu	me as aerobic (con BOD removal only	nstruct separate denit (construct separate r	nit/denit facility)
		Use existing anoxic volu Use aerated system for Add influent flow equaliz	BOD removal only	nstruct separate denit (construct separate r	nit/denit facility)
		Use existing anoxic volu Use aerated system for	BOD removal only	nstruct separate denit (construct separate r	nit/denit facility)
		Use existing anoxic volu Use aerated system for Add influent flow equaliz	BOD removal only	nstruct separate denit (construct separate r	nit/denit facility)
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other:	BOD removal only	nstruct separate denti (construct separate r	it/denit facility)
PROPOSED MODIFICATIONS	TO GET NITRATE < 1.	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other:	BOD removal only zation tank	nstruct separate dent (construct separate r	it/denit facility)
PROPOSED MODIFICATIONS		Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. 0 mg/L:	BOD removal only cation tank	(construct separate r	it/denit facility)
PROPOSED MODIFICATIONS		Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. D mg/L: No modifications require	BOD removal only cation tank ed filter with methanol	(construct separate r	it/denit facility)
PROPOSED MODIFICATIONS		Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. D mg/L: No modifications require X Add downstream DeNit	BOD removal only cation tank ed filter with methanol ation Biofilter and D	(construct separate r	it/denit facility)
PROPOSED MODIFICATIONS		Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. D mg/L: No modifications require X Add downstream DeNit Add downstream Nitrific	BOD removal only cation tank ed filter with methanol ation Biofilter and C	(construct separate r	it/denit facility)
PROPOSED MODIFICATIONS		Use existing anoxic volu Use aerated system for Add influent flow equaliz Other: D mg/L: No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic	BOD removal only cation tank ed filter with methanol ation Biofilter and C	(construct separate r	it/denit facility)
PROPOSED MODIFICATIONS		Use existing anoxic volu Use aerated system for Add influent flow equaliz Other: D mg/L: No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration	BOD removal only cation tank ed filter with methanol ation Biofilter and C	(construct separate r	it/denit facility)
PROPOSED MODIFICATIONS		Use existing anoxic volu Use aerated system for Add influent flow equaliz Other: No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration	BOD removal only ration tank ed filter with methanol ation Biofilter and C g BNR process tank with methano	(construct separate r	it/denit facility)
**************************************		Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. D mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existing Add effluent filtration Other:	BOD removal only cation tank ed filter with methanol ation Biofilter and Cg BNR process tank with methano	(construct separate r	it/denit facility)
PROPOSED MODIFICATIONS	Equipment and Structi	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. D mg/L: No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2):	BOD removal only cation tank ed filter with methanol ation Biofilter and D BNR process tank with methano	(construct separate r	it/denit facility)
**************************************	Equipment and Structi Electrical and Instrume	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12%	BOD removal only cation tank ed filter with methanol ation Biofilter and D g BNR process tank with methano \$11,450,000 \$1,374,000	(construct separate r	it/denit facility)
**************************************	Equipment and Structi Electrical and Instrume Yard Piping and Site V	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12%	ed filter with methanol ation Biofilter and C B BNR process tank with methano \$11,450,000 \$1,374,000 \$1,718,000	(construct separate r	it/denit facility)
**************************************	Equipment and Structi Electrical and Instrume Yard Piping and Site V Subtotal:	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. D mg/L: No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15%	BOD removal only ration tank ed filter with methanol ation Biofilter and C g BNR process tank with methano \$11,450,000 \$1,374,000 \$1,718,000 \$14,540,000	(construct separate r	it/denit facility)
**************************************	Equipment and Structor Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P:	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15%	BOD removal only cation tank ad filter with methanol ation Biofilter and Cg BNR process tank with methano \$11,450,000 \$1,374,000 \$1,718,000 \$14,540,000 \$2,181,000	(construct separate r	it/denit facility)
**************************************	Equipment and Structi Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15%	BOD removal only cation tank ad filter with methanol ation Biofilter and Cg BNR process tank with methano \$11,450,000 \$1,374,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000	(construct separate r	it/denit facility)
**************************************	Equipment and Structor Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal:	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% 15% etr. Mgmt: 15%	BOD removal only cation tank ad filter with methanol ation Biofilter and Cg BNR process tank with methano \$11,450,000 \$1,374,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$18,900,000	(construct separate r	it/denit facility)
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**************************************	Equipment and Structure Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost:	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% str. Mgmt: 15% 30%	BOD removal only cation tank ed filter with methanol ation Biofilter and D g BNR process tank with methano \$11,450,000 \$1,374,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000 \$23,260,000	(construct separate r	it/denit facility)
**************************************	Equipment and Structor Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency:	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% str. Mgmt: 15% 30%	BOD removal only cation tank ad filter with methanol ation Biofilter and D B BNR process tank with methanol \$11,450,000 \$1,718,000 \$1,778,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000	(construct separate r	it/denit facility)
CAPITAL COST:	Equipment and Structive Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20	Use existing anoxic voluse aerated system for Add influent flow equalized the control of the con	BOD removal only ration tank ad filter with methanol ation Biofilter and Cg BNR process tank with methano \$11,450,000 \$1,374,000 \$1,374,000 \$1,718,000 \$1,4540,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000 \$4,262,000 \$4,25	(construct separate r	it/denit facility)
**************************************	Equipment and Structive Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower	Use existing anoxic voluse aerated system for Add influent flow equalized the control of the con	BOD removal only ration tank ad filter with methanol ation Biofilter and Eg BNR process tank with methano \$11,450,000 \$1,374,000 \$1,374,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000 \$4,255 600 HP	(construct separate r	it/denit facility)
CAPITAL COST:	Equipment and Structor Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost:	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% 15%	BOD removal only ration tank ad filter with methanol ation Biofilter and D BNR process tank with methanol \$11,450,000 \$1,374,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000 \$4,25 600 HP \$196,000 \$/yee	construct separate r DeNit filter with methal of feed	it/denit facility)
CAPITAL COST:	Equipment and Structe Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% 15%	BOD removal only ration tank ad filter with methanol ation Biofilter and D BNR process rank with methanol \$11,450,000 \$1,718,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4	construct separate reconstruct	it/denit facility)
CAPITAL COST:	Equipment and Structic Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required:	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% str. Mgmt: 15% 30% 0-Yr. N removal: r (from Page 2): 0.05 \$/kW g Methanol:	BOD removal only ration tank ad filter with methanol ation Biofilter and D BNR process rank with methanol \$11,450,000 \$1,374,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4	construct separate r DeNit filter with methal of feed	it/denit facility)
CAPITAL COST:	Equipment and Structure Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% str. Mgmt: 15% 30% 0-Yr. N removal: r (from Page 2): 0.05 \$/kW g Methanol:	BOD removal only ration tank ad filter with methanol ation Biofilter and E BNR process rank with methanol \$11,450,000 \$1,374,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4	construct separate r DeNit filter with methal of feed	it/denit facility)
CAPITAL COST:	Equipment and Structic Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required:	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% str. Mgmt: 15% 30% 0-Yr. N removal: r (from Page 2): 0.05 \$/kW g Methanol:	BOD removal only ration tank ad filter with methanol ation Biofilter and Cg BNR process tank with methano \$11,450,000 \$1,374,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$	Construct separate r DeNit filter with methal of feed L L Sid	it/denit facility)
CAPITAL COST:	Equipment and Structure Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost	Use existing anoxic voluse aerated system for Add influent flow equalized the control of the con	BOD removal only ration tank ad filter with methanol ation Biofilter and Cg BNR process tank with methano \$11,450,000 \$1,374,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$0,000 \$4,362,000 \$0,	construct separate r DeNit filter with methal of feed L sid	it/denit facility)
CAPITAL COST:	Equipment and Structive Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost Separate Stage Ammod Caustic Soda @ 25% Caustic Soda Cost	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require X Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% atr. Mgmt: 15% 30% D-Yr. N removal: r (from Page 2): 0.05 \$/kW g Methanol: 0.75 \$/gat onia Reduction: conc. 0.60 \$/gat	BOD removal only ration tank ad filter with methanol ation Biofilter and D BNR process tank with methanol stank stank with methanol stank stank with methanol stank	construct separate r DeNit filter with methal of feed L ofd ear L ofd ear	it/denit facility)
CAPITAL COST:	Equipment and Structic Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost Separate Stage Ammor Caustic Soda @ 25% Caustic Soda Cost Equipment Maintenant	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% str. Mgmt: 15% 30% 0-Yr. N removal: r (from Page 2): 0.05 \$/kW g Methanol: 0.75 \$/gat onia Reduction: conc. 0.60 \$/gal ce Cost:	BOD removal only ration tank ad filter with methanol ation Biofilter and C BNR process tank with methanol stank	construct separate reconstruct	it/denit facility)
CAPITAL COST:	Equipment and Structic Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost Separate Stage Ammor Caustic Soda @ 25% Caustic Soda Cost Equipment Maintenant	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% str. Mgmt: 15% 30% 0-Yr. N removal: r (from Page 2): 0.05 \$/kW g Methanol: 0.75 \$/gat onia Reduction: conc. 0.60 \$/gal ce Cost:	BOD removal only ration tank ad filter with methanol ation Biofilter and D BNR process tank with methanol stank stank with methanol stank stank with methanol stank	construct separate reconstruct	it/denit facility)
CAPITAL COST:	Equipment and Structic Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost Separate Stage Ammor Caustic Soda @ 25% Caustic Soda Cost Equipment Maintenand Denitrification Sludge	Use existing anoxic volu Use aerated system for Add influent flow equaliz Other. No modifications require Add downstream DeNit Add downstream Nitrific Add methanol to existing Add downstream anoxic Add effluent filtration Other: ures (from Page 2): entation: 12% Nork: 15% str. Mgmt: 15% 30% 0-Yr. N removal: r (from Page 2): 0.05 \$/kW g Methanol: 0.75 \$/gat onia Reduction: conc. 0.60 \$/gat ce Cost: Production w/Methanol:	BOD removal only ration tank ad filter with methanol ation Biofilter and C BNR process tank with methanol stank	construct separate reconstruct	it/denit facility)
CAPITAL COST:	Equipment and Structive Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost Separate Stage Ammo Caustic Soda @ 25% Caustic Soda Cost Equipment Maintenan Denitrification Sludge Sludge Disposal Cost: Total Annual O&M Cost	Use existing anoxic voluse aerated system for Add influent flow equalized the control of the con	BOD removal only ration tank ad filter with methanol ation Biofilter and D BNR process rank with methanol stank with methanol	construct separate r DeNit filter with methal lear L s/d ear L s/d ear d ear	it/denit facility)
CAPITAL COST:	Equipment and Structive Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost Separate Stage Ammo Caustic Soda @ 25% Caustic Soda Cost Equipment Maintenan Denitrification Sludge Sludge Disposal Cost: Total Annual O&M Cost	Use existing anoxic voluse aerated system for Add influent flow equalized the control of the con	BOD removal only ration tank ad filter with methanol ation Biofilter and D BNR process rank with methanol \$11,450,000 \$11,374,000 \$1,718,000 \$14,540,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000 \$4,25 600 HP \$196,000 \$/ye 3.0 mg/l 340 gals \$93,100 \$/ye 0.0 mg/l 0 gals \$93,100 \$/ye \$189,000 \$/ye \$189,000 \$/ye \$189,000 \$/ye \$189,000 \$/ye \$189,000 \$/ye \$189,000 \$/ye \$78,800 \$/ye	construct separate r DeNit filter with methal lear L s/d ear L s/d ear d ear	it/denit facility)
CAPITAL COST:	Equipment and Structive Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost Separate Stage Ammode Caustic Soda @ 25% Caustic Soda Cost: Equipment Maintenand Denitrification Sludge Sludge Disposal Cost: Total Annual O&M Cost Effective Annual Interest	Use existing anoxic voluse aerated system for Add influent flow equalized the control of the con	BOD removal only ration tank ad filter with methanol ation Biofilter and Cg BNR process tank with methano \$11,450,000 \$1,374,000 \$1,374,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$	construct separate r DeNit filter with methal lear L s/d ear L s/d ear d ear	it/denit facility)
CAPITAL COST:	Equipment and Structive Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Cost Separate Stage Ammo Caustic Soda @ 25% Caustic Soda Cost Equipment Maintenan Denitrification Sludge Sludge Disposal Cost: Total Annual O&M Cost	Use existing anoxic voluse aerated system for Add influent flow equalized the control of the con	BOD removal only ration tank ad filter with methanol ation Biofilter and Eg BNR process tank with methanol \$11,450,000 \$1,374,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$18,900,000 \$4,362,000 \$18,900,000 \$4,362,000 \$1,78,800 \$1	construct separate r DeNit filter with methal lear L s/d ear L s/d ear d ear	it/denit facility)
CAPITAL COST:	Equipment and Structive Electrical and Instrume Yard Piping and Site V Subtotal: Contractor OH&P: Engineering and Cons Subtotal: Contingency: Total Capital Cost: Capital Cost per lb. 20 Additional Horsepower Electrical Power Cost: Nitrate Reduction usin Methanol Required: Methanol Required: Methanol Cost Separate Stage Ammode Caustic Soda @ 25% Caustic Soda Cost Equipment Maintenand Denitrification Sludge Sludge Disposal Cost Total Annual Interes 20-Year Present World	Use existing anoxic voluse aerated system for Add influent flow equalized the control of the con	BOD removal only ration tank ad filter with methanol ation Biofilter and Eg BNR process tank with methanol \$11,450,000 \$1,374,000 \$1,718,000 \$1,718,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$2,181,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$4,362,000 \$18,900,000 \$4,362,000 \$18,900,000 \$4,362,000 \$1,78,800 \$1	construct separate r DeNit filter with methal lear L s/d ear L s/d ear d ear	it/denit facility)

PROJECT:	Implementing a 3 mg/L Annual Average Total N USEPA, Chesapeake Bay Office	wogen anne	
REPARED FOR:	Virginia Tech with Stearns & Wheler, LLC		
PREPARED BY:			14
DATE:	March 25, 2001		
ACILITY:	Proctor's Creek WWTP Chesterfield County, VA		
OCATION:	20.0 mgd	PE COD:mg	/L
RATED FLOW:		PE TKNmg	/L
CURRENT EFFLUENT TN:	6.0 mg/L mg/L	• 0	
EFFLUENT TN GOAL:	500 lbs/d		
NITROGEN REDUCTION	183 1000 lbs/yr		
	3650 1000 lbs/20-years		
		Evisting Apr	ated Volume (MG):
CURRENT PROCESS (CHECK	(ALL THAT APPLY): X MLE	Existing An	oxic Volume (MG):
	BEPT (AZIO, VIII , CIOI)	Current MI	SS at Winter ADF:
	Bardenpho	Cullentime	OB at villion is a
	Oxidation Dilch		×
	Lagoon (Biolac, etc.)		
	Cyclical Aeration		
	SBR		
	High-Rate Biofilter		
	Effluent Filtration		140
	Other:		
	. CTT - VANCOU		
CURRENT EFFLUENT AMMO	NIA-N: <1.0 mg/L X From Report	d load, 15 d MCRT, 12° C wir	iter conditions)
	From Model (at ADF and	a load, 15 d MCR1, 12 C Wil	iter conditions,
PROPOSED MODIFICATIONS	TO GET AMMONIA < 1.0 mg/L:	ad.	New MLSS
		xisting tanks (check clarifier of	
× ×	Raise MCR1/MLSS in e	ested volume Flor	/ (mgd): 0
	Construct additional aer	aled tollaring	v (mgd): 0
	Construct additional cla	ime as aerobic (construct ser	acate denit facility)
1.00	Use existing anoxic void	BOD removal only (construct	senarate nit/denit facility)
· · · · · · · · · · · · · · · · · · ·	Use aerated system for Add influent flow equals	BOD removal only (construct	Separate message
	I Add influent flow poulsit	zanion rank	
1			
PROPOSED MODIFICATIONS	S TO GET NITRATE < 1.0 mg/L:	ed	6
PROPOSED MODIFICATIONS	Other TO GET NITRATE < 1.0 mg/L: No modifications requir Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxi Add effluent filtration	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed	with methanol
PROPOSED MODIFICATIONS	S TO GET NITRATE < 1.0 mg/L: No modifications requir Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxi	ed filter with methanol cation Biofilter and DeNit filter o BNR process	
	Other S TO GET NITRATE < 1.0 mg/L: No modifications required Add downstream DeNite Add downstream Nitrification Add downstream anoxional Add effluent filtration Other:	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed	
PROPOSED MODIFICATIONS	Other S TO GET NITRATE < 1.0 mg/L: No modifications required to Management and Structures (from Page 2): Other: No modifications required to modifications required to modifications required to modifications and downstream anoxional to modification of the modifications required to modifications require	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000	
	Other S TO GET NITRATE < 1.0 mg/L: No modifications requir Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxi Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12%	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000	
	Other S TO GET NITRATE < 1.0 mg/L: No modifications requir Add downstream DeNit Add downstream Nitrific Add downstream anoxi Add downstream anoxi Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15%	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000	
	Other S TO GET NITRATE < 1.0 mg/L: No modifications required and downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxing Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: 12% Yard Piping and Site Work: 15% Subtotal:	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000	
	Other S TO GET NITRATE < 1.0 mg/L: No modifications requir Add downstream DeNit Add downstream Nitrific Add downstream anoxic Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: 15%	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000 \$1,515,000	
	Other S TO GET NITRATE < 1.0 mg/L: No modifications requir Add downstream DeNit Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15%	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000 \$1,515,000 \$1,515,000	
	Other S TO GET NITRATE < 1.0 mg/L: No modifications requir Add downstream DeNit Add downstream Nitrific Add downstream anoxic Add effluent filtration Other: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: 15% Subtotal:	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$1,00,000 \$1,515,000 \$1,515,000 \$1,3130,000	
	Contractor OH&P: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Sito Mg/L: No modifications requir. Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxing Add effluent filtration Other: 12% Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: 30%	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000 \$1,515,000 \$1,515,000 \$13,130,000 \$3,030,000	
	Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Contracto	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$1,00,000 \$1,515,000 \$1,515,000 \$1,3130,000	
	Contractor OH&P: Equipment and Structures (from Page 2): Electrical and Instrumentation: Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Sito Mg/L: No modifications requir. Add downstream DeNit Add downstream Nitrific Add methanol to existin Add downstream anoxing Add effluent filtration Other: 12% Yard Piping and Site Work: Subtotal: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: 30%	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000 \$1,515,000 \$13,130,000 \$3,030,000 \$16,160,000	
CAPITAL COST:	Contractor OH&P: Engineering and Constr. Mgmt: Contingency: Contractor Constr. Mgmt: Contractor OH&P: Contra	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000 \$1,515,000 \$13,130,000 \$3,030,000 \$16,160,000	
	Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: C	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000 \$1,515,000 \$1,515,000 \$3,030,000 \$3,030,000 \$4,43	
CAPITAL COST:	Contractor OH&P: Engineering and Constr. Mgmt: Contingency: Contingency: Contractor OH&P: Contingency: Contractor OH&P: Contr	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000 \$1,515,000 \$1,515,000 \$13,130,000 \$3,030,000 \$4,43 400 HP	
CAPITAL COST:	Contractor OH&P: Engineering and Constr. Mgmt: Contractor OH&P: Engineering and Constr. Mgmt: Subtotal: Contingency: Total Capital Cost: Capital Cost: Capital Cost: Capital Cost per Ib. 20-Yr. N removal: Additional Horsepower (from Page 2): Electrical Power Cost: 0.05 \$/kW Nitrate Reduction using Methanol:	ed filter with methanol cation Biofilter and DeNit filter g BNR process c tank with methanol feed \$7,950,000 \$954,000 \$1,193,000 \$10,100,000 \$1,515,000 \$1,515,000 \$1,3130,000 \$3,030,000 \$4,43 400 HP \$130,700 \$/year	
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PROJECT:	Implementing a 3 r	ng/L Annual Average Tota	l Nitrogen Limit		
PREPARED FOR:	USEPA, Chesapea	ke Bay Office			
PREPARED BY:	Virginia Tech with	Stearns & Wheler, LLC			
DATE:	March 25, 2001				
FACILITY:	Falling Creek WW7	P			
LOCATION:	Chesterfield County				
RATED FLOW:	10.0 mgd		PE COD:	mo/l	
CURRENT EFFLUENT TN:			PE COD: PE TKN:	mg/l	
TO STATE OF THE PARTY OF THE PA	6.0 mg/L		FL 1700		
EFFLUENT TN GOAL:	3,0 mg/L		-5.1		
NITROGEN REDUCTION:	250 lbs/d	(*)			
	91 1000 lbs/yr				
	1825 1000 lbs/20-	years			
		And the same of th			
CURRENT PROCESS (CHECK	(ALL THAT APPLY):	XMLE	E	disting Aerated Volume (N	(G):
(2,120,		BEPR (A2/0, VIP, etc.		Existing Anoxic Volume (N	
		Bardenpho		Current MLSS at Winter A	
		The second secon	,	MITCH WESS AL WILLEN	
		Oxidation Ditch			
l ·		Lagoon (Biolac, etc.)			
		Cyclical Aeration			12
		SBR	41		
		High-Rate Biofilter			
2		Effluent Filtration			
		Other:			
CURRENT SECULEMENT		V Eson Barrel			
CURRENT EFFLUENT AMMOR	NIA-N: <1.0 mg/L				
		From Model (at ADF a	nd load, 15 d MCRT.	12° C winter conditions)	
PROPOSED MODIFICATIONS	TO GET AMMONIA <	1.0 mg/L:			
0.00000		X No modifications requi	red		New MLSS
		Raise MCRT/MLSS in		clarifier canacity)	N/a
		Construct additional as			14/4
4	G G			Flow (mgd):0	
		Construct additional cla		Flow (mgd):0	
		Use existing anoxic vo	lume as aerobic (con:	struct separate denit facili	ity)
		Use aerated system fo	r BOD removal only (construct separate nit/der	nit facility)
		Add influent flow equal	lization tank		
		Other:		5.01 LasA	100 2013
PROPOSED MODIFICATIONS	TO CET NITRATE	0 mall :			
PROPOSED MODIFICATIONS	TO GET NITRATE				
		No modifications requi			
	4	X Add downstream DeNi			
		Add downstream Nitrifi	ication Biofilter and De	eNit filter with methanol	
		Add methanol to existing	ng BNR process		
		Add downstream anoxi	ic tank with methanol	feed	1
		Add effluent filtration			
		Other:	and the second		75
CARITAL ASSE			64 450 000		- 1
CAPITAL COST:	Equipment and Struc		\$4,450,000		
	Electrical and Instrum		\$534,000		
	Yard Piping and Site	Work: 15%	\$668,000		
	Subtotal:		\$5,650 000		
	Contractor OH&P:	15%	\$848,000		1
	Engineering and Con		\$848.000		1
		istrativigint.	\$7,350,000		1
	Subtotal:	- 000/			
	Contingency:	30%	\$1,695,000		1
	Total Capital Cost:		\$9,050,000		1
	Capital Cost per lb. 2	0-Yr. N removal:	\$4.96		
			7	(8)	I
OPERATIONS COST:	Additional Horsepow	er (from Page 2):	200 HP		1
	Electrical Power Cos		\$65,300 \$/yea	ır	, I
140	Nitrate Reduction usi	ng wemano.	3.0 mg/L		1
8	Methanol Required:		110 gals/c		
*1	Methanol Cost:	0.75 \$ /gal	\$30,100 \$/yea		
::::	Separate Stage Amri	nonia Reduction:	0.0 mg/L		i
_	Caustic Soda @ 25%		0 gals/o		¥
	Caustic Soda Cost:	0.60 \$/gal	\$0 \$/yea		I
		_	\$73,500 \$/yea		25
	Equipment Maintena	Designation with fact and the			
		Production w/Methanol	360 lbs/d		1
	Sludge Disposal Cos		\$26,300 \$/yea		1
	Total Annual O&M Co	ost:	\$195,200 \$/yea	r ·····	1
		rest Rate after Inflation:	2.91%		
	20-Year Present Wor		\$2,930,000	3	li li
124	20-1601 LIESCHI AAOL		V-1-7-1		0
TOTAL 20 VEAR SPECIES	20711 2007		£44 000 000	- 4	1
TOTAL 20-YEAR PRESENT WO			\$11,980,000		61
5	Total Cost per lb 20-	Yr. N removal:	\$6.56		ľ

APPENDIX B

COST INFORMATION FROM THE FINAL REPORT FOR 8 MG/L EFFLUENT TN UPGRADES AT 51 WWTPS IN THE CHESAPEAKE BAY WATERSHED

modification costs in this report were based on the "permanent modification" standards of each owner, if such standards were known.

Pennsylvania WWTPs

The results of the 16 Pennsylvania WWTP evaluations are summarized in Table 7.

Table 7. Pennsylvania WWTPs Evaluated for BNR Removal

	BNR Design Flow	Total Capital Costs	Capital Cost/Flow	Cost per lb
WWTP	MGD	\$	\$/MGD	Removal
Altoona City (E)	9.0	1.230 x 10 ⁶	136,667	\$0.51
Altoona City (W)	13.5	1.233 x 10 ⁶	91,333	0.42
Chambersburg	4.5	6.347 x 10 ⁶	1,410,444	2.69
Greater Hazleton	8.9	7.84×10^6	880,899	3.24
Hanover	4.5	0.060 x 10 ⁶	13,333	0.08
Harrisburg	30.0	25.448 x 10 ⁶	848,250	2.00
Lancaster	29.7	1.077×10^6	36,263	0.19
Lebanon	8.0	4.039 x 10 ⁶	504,875	1.19
Scranton	16.0	2.815 x 10 ⁶	175,938	0.76
State College (UAJA)	6.0	0.780 x 10 ⁶	130,000	0.33
Sușquehanna (Lancaster Area)	12.0	1.619 x 10 ⁶	134,917	1.12
Throop	7.0	3.320 x 10 ⁶	474,285	1.68
Williamsport (C)	7.2	6.339 x 10 ⁶	880,417	1.36
Williamsport (C) Williamsport W)	4.5	5.246 x 10 ⁶	1,165,778	2.58
Wyoming Valley	32.0	0.763 x 10 ⁶	23,843	0.18
York City	26.0	1.780×10^6	68,462	0.42
Total/Average	218.8	69.936 x 10 ⁶	319,634	\$0.946

The 16 Pennsylvania WWTPs can be easily classified into two categories based on the capital costs of the needed modifications for BNR. Six of the plants, accounting for only 29% of the post BNR design flows, would account for 79% of the total capital costs. Of the six, the Harrisburg plant, alone, accounts for 36% of the total projected capital costs. The six plants, their post BNR design flows, their projected capital costs for BNR, and the BNR modification costs per MGD, are listed in Table 8. The capital cost per MGD would be nearly \$900,000, and the cost per pound additional N removal projects to \$2.09/lb.

Table 8. Pennsylvania High Cost BNR Modification Plants

WWTP	BNR Design Flow MGD	Total Capital Costs \$	Capital Cost/Flow \$/MGD	Cost per lb Add. N Removal
Chambersburg	4.5	6.347 x 10 ⁶	1.4104 x 10 ⁶	\$2.69/lb
Greater Hazleton	8.9	7.840×10^6	880,899	\$3.24/lb
Harrisburg	30.0	25.448 x 10 ⁶	848,250	\$2.00/lb
Lebanon	8.0	4.039 x 10 ⁶	504,875	\$1.19/16
W'msport Central	7.2	6.339 x 10 ⁶	880,474	\$1.36/lb
W'msport West	4.5	5.246 x 10 ⁶	1.166 x 10 ⁶	\$2.58/lb
Total/Average	63.1	55.26 x 10 ⁶	875,737	\$2.09/lb

The high capital investment and cost per pound projections suggest that these plants are good candidates for nutrient trading with non-point source controls or other WWTPs, if such an option is developed.

In contrast to the six plants listed in Table 8, the 10 other plants account for 155.7 MGD (71%) of the post BNR design flow, but only \$14.676 x 10⁶ (21%) of the projected capital costs, for a modification cost of only \$94,258 per MGD. Also, five of these 10 plants would have a reduction in annual O&M costs from converting to BNR. The projected average cost per pound of additional N removal by these 10 plants is only \$0.41/lb. It is unlikely that non-point controls could even remotely approach these costs, and obviously could not promise the same reliability of N reduction. Clearly, these plants are good candidates for economical BNR modification and operation.

Maryland and New York WWTPs

The nine Maryland WWTPs included in this draft report are small scale plants, with one exception, and, consequently, the projected costs per additional pound of nitrogen removed are very high for most of them. The information is tabulated in Table 9. The two New York plants are relatively large, but one is a trickling filter (TF) plant, and the other has very severe site constraints. Consequently, the projected costs for implementing BNR at the two NY plants are high. Their data also are included in Table 9.

Table 9. Maryland and New York WWTPS Evaluated for BNR Removal

WWTP	BNR Design Flow MGD	Total Capital Costs \$	Capital Cost/Flow \$/MGD	Cost per lb Add. N Removal
Brunswick	0.7	390,000	557,143	\$0.50/lb N
Chestertown	0.9	1.350×10^6	1.50 x 10 ⁶	\$5.92/lb N
Crisfield	1.0	1.949 x 10 ⁶	1.949 x 10 ⁶	\$4.95/lb N
Elkton	2.7	1.970 x 10 ⁶	729,630	\$1.87/lb N
Federalsburg	0.75	1.525 x 10 ⁶	2.033×10^6	\$3.34/lb N
Georges Creek (Alleghany Cty.)	0.6	1.663 x 10 ⁶	2.772 x 10 ⁶	\$3.55/lb N
Indian Head	0.49	532,000	1.085×10^6	\$2.90/lb N
Mattawoman	15	4.250 x 10 ⁶	283,333	\$0.07/lb N
Winebrenner	0.6	1.480×10^6	2.467 x 10 ⁶	\$3.77/lb N
MD Totals/Avg.	22.74	15.109 x 10 ⁶	0.664 x 10 ⁶	1.31/lb N
Binghampton	25	13.057 x 10 ⁶	522,280	\$2.24/lb N
Endicott	8	6.656 x 10 ⁶	832,000	\$3.35/lb N
NY Totals/Avg.	33	19.713 x 10 ⁶	597,364	\$2.49/lb N

Only two of the Maryland WWTPs, Brunswick and Mattawoman, have the potential for low cost BNR modification. This is because most of the other plants have fixed-film biological processes, either trickling filters or rotating biological contactors, or are old facilities that need substantial upgrading before BNR is possible. One, Chestertown, is an aerated lagoon system that cannot maintain nitrification during the winter months. The cost per pound of additional nitrogen removed is relatively small for the nine plants collectively, but that is because the Mattawoman flow dominates the total flow, and it potentially can be modified for BNR very economically. The seven WWTPs other than Brunswick and Mattawoman account for only 31% of the design

BNR flow, but 69% of the projected capital costs. The cost per additional pound of N-removal for the seven "high cost" plants averages \$3.36/lb N, which is substantially higher than the \$2.09/lb N average of the high cost Pennsylvania WWTPs. Clearly, it would be economical to upgrade the Brunswick and Mattawoman WWTPs for BNR. The other plants do not fall into the low cost category based on cost per additional pound of potential nitrogen removal, and non-point pollution reduction trading may be more attractive. However, this cost per pound is still considerably less than the estimates for some types of non-point source controls. Also, some of the Maryland plants are in need of upgrades for conventional treatment. If they are to be upgraded or expanded, it may be possible to economically include modifications that enable BNR along with the expansions and upgrades.

Virginia WWTPs

The twenty-four Virginia WWTPs are primarily small plants, as shown by the data listed in Table 10.

Table 10. Virginia BNR Modification Plants

WWTP	Table 10. V BNR Design Flow MGD	/irginia BNR Modifi Total Capital Costs \$	Capital Cost/Flow \$/MGD	Cost per lb Add. N removal
Arlington	30	560,000	18,667	\$0.605/lb
Colonial Beach	2.0	90,000	45,000	-\$0.065/lb
Dahlgren	0.325	30,000	92,000	-\$0.12/lb
Dale Services#1	3.0	220,000	73,000	\$0.29/lb
Dale Services#8	3.0	220,000	73,000	\$0.29/lb
DuPont, Waynesboro	2.0	0		-\$0.11/lb
Fishersville	2.0	790,000	395,000	\$2.20/lb
Front Royal	4.0	50,000	13,000	\$0.02/lb
Harrisonburg	16	4.688 x 10 ⁶	293,000	\$0.54/lb
H. L. Mooney	18	490,000	27,222	\$0.063/lb
Leesburg	4.85	2.980 x 10 ⁶	614,000	\$0.68/lb
Lower Potomac	67.0	20.800 x 10 ⁶	310,448	\$0.50/lb
Luray	2.0	0	0	N/A
Merck and Co.	1.2	0	0	0
Middle River/Verona	4.5	150,000	33,000	\$0.30/lb
Opequon	6.25	570,000	91,000	\$0.16/lb
Parkins Mill	2.0	97,000	49,000	-\$0.79/lb
Purcellville	1.0	1.3 x 10 ⁶	1.3 x 10 ⁶	\$1.80/16
Rocco Foods, Edinburg	1.2	4,480 x 10 ⁶	3,733,000	\$0.338/lb
Strasburg	0.975	120,000	123,000	-\$0.14/lb
Stuarts Draft	1.4	1.240 x 10 ⁶	886,000	\$2.36/lb
Waynesboro	4.0	3.500 x 10 ⁶	875,000	\$1.27/lb
Woodstock	1.0	70,000	70,000	-\$0.22/lb
Total/Average	173.7	42.445 x 10 ⁶	244,358	\$0.48/lb

Four of the Virginia plants are large and collectively will be designed to treat 131 MGD by BNR, which is 75% of the Virginia total. The other 20 WWTPs treat an average flow of only 2.14 MGD and twelve of them are designed to treat 2 MGD or less. Although the plants are relatively small, they should be much more economical to modify for BNR removal than the typical Maryland WWTP. This is because nearly all of them are activated sludge (AS) process facilities, and several of them are oxidation ditch AS systems. Oxidation ditches typically are easy to operate for biological nitrogen removal, simply by changing the operating approach. The primary expense for most of them is the purchase and installation of timer switches for the aerators. Also, most of the Virginia facilities are not near design flow, and can be easily modified for BNR with the existing activated sludge basin volumes and clarifier capacities. However, the recommended constructive or operative modifications may lead to a downsizing of the plants' hydraulic design capacity. Therefore, the resulting BNR process might have a shorter useful service life (as plant flow increases) than a more permanent retrofit designed to maintain the existing permitted design capacity. The savings accumulated during the interim years, however, may be sufficient to pay for much of the subsequent expansion. Regardless, the average cost per additional pound of N removed for the Virginia plants is projected as only \$0.48/lb, the lowest of the three states. Even this figure is misleading because most of the projected capital costs would be expended on six of the WWTPs, and three plants project much higher costs per additional pound of N removed than the rest. The seven high capital outlay and/or high N removal cost plants are listed in Table 11.

Table 11. Virginia High Cost BNR Modification Plants.

WWTP	BNR Design Flow MGD	Total Capital Costs \$	Capital Cost/Flow \$/MGD	Cost per lb Add. N removal
Fishersville	2.0	790,000	395,000	\$2.20/lb
Harrisonburg	16	4.688 x 10 ⁶	293,000	\$0.54/lb
Leesburg	4.85	2.980 x 10 ⁶	614,000	\$0.68/lb
Lower Potomac, Fairfax County	67.0	20.8 x 10 ⁶	310 448	\$0.50/lb
Rocco Farm Foods, Edinburg	1.2	4.480 x 10 ⁶	3,733,000	\$0.338/lb
Stuarts Draft	1.4	1.240 x 10 ⁶	886,000	\$2.36/lb
Waynesboro	4.0	3.500 x 10 ⁶	875,000	\$1.27/lb
Total/Average	96.45	38.478 x 10 ⁶	398,942	\$0.61/lb

The seven plants listed above account for only 56% of the total discharge flow, but nearly 91% of the projected BNR modification capital costs. In spite of the high capital costs, the projected average cost per additional pound of nitrogen removed is only \$0.61/lb. The other 17 Virginia plants would have a cost per lb additional N removed of only \$0.27, and six of these plants should save money over 20 yrs by implementing the recommended BNR approach. Two of the evaluated plants, Merck, Inc. and Luray, have no reason to implement BNR because their wastewaters are nitrogen deficient for biological wastewater treatment, which necessitates nitrogen addition.

Table 1. Summary List of Plants and NPDES Permit Requirements

NGD TSS NH4-N TN TP DO	Maryland							1	7	STOTES
ck 0.7 30 30 - 2 >5.0 ch 0.9 30 - 5.0 ch 0.9 30 30 20 2 >5.0 ch 0.0 30 30 20 2 >5.0 ch 0.0 30 30 30 30 20 2 >5.0 ch 0.0 30 30 30 30 30 30 30 30 30 30 30 30 30	Plant	Permit Flow MGD	BOD5 mg/L	TSS mg/L	NH4-N mg/L	TN mg/L	TP mg/L	mg/L	E .	NO.
town 0.9 30 90		1	000	30	1	١.	2	>5.0	6.5-8.5	
town 0.9 30 90	Brunswick	0.7	20	2			ı	0 4	6.5.8.5	
1.0 30 30 20* 2 >5.0 1.6 30 30 20* 2 >5.0 sburg 0.75 30 30 10 2 >5.0 s Creek 0.6 30 8* 2 >5.0 oman 15 30 30 0.65 2 >5.0 enner 0.6 10 10 0.65 2 >5.0	Chestertown	6.0	30	06		•		5 6		
sburg 0.75 30 30 20* - 2 >5.0 sburg 0.75 30 30 20 10 2 >5.0 screek 0.6 30 30 8* 2 >5.0 screek 0.49 16 30 8* 2 >5.0 screek 0.6 10 10 0.65 2 >5.0			20	30			7	>5.0	6.5-8.5	
sburg 0.75 30 30 10 2 >5.0 sburg 0.75 30 30 10 2 >5.0 s Creek 0.6 30 8* 2 >5.0 oman 15 30 30 0.65 2 >5.0 omen 16 10 10 0.65 2 >5.0	Cristield	0.	000	9 6	*00		c	>5.0	6.5-8.5	*TKN
sburg 0.75 30 30 10 2 >5.0 screek 0.6 30 30 8* 2 >5.0 screek 0.49 16 30 8* 0.18 >5.0 sman 15 30 30 0.65 2 >5.0 sman 0.6 10 10 0.65 2 >5.0	Elkton	9	30	300	7				0 40	
ek 0.6 30 8 2 >5.0 ek 0.49 16 30 8 0.18 >5.0 15 0.65 2 >5.0 0.18 >5.0 0.65 2 >		37.0	30	30		10	.71	0.04	0.0-0.0	
ek 0.6 30 8* 2 >5.0 0.49 16 30 8* 2 >5.0 15 30 30 0.18 >5.0 0.6 10 10 0.65 2 >5.0	rederaispurg	2.0	3 6	0 6			c	>5.0	6.5-8.5	
0.49 16 30 8* 2 25.0 15 30 30 0.18 >5.0 0.6 10 10 0.65 2 >5.0	Georges Creek	9.0	30	ۍ ص			1 .		2020	*TKN
15 30 30 0.65 - 2 >5.0 0.6 10 10 0.65 - 2 >5.0	1.4:00	0.40	16	30	*		7	20.0	0.0-0.0	
0.6 10 0.65 - 2 >5.0	ווומומוו וובמח	2	2 6				0.18	>5.0	6.5-8.5	
0.6 10 10 0.65	Mattawornan	CL CL	2	3	-		c	4/	8.5.8.5	
	Winebrenner	9.0	10	9	0.65	•	7	23.0	200	

All permits include a goal of a yearly average 8 mg/L TN, which go into effect once the average annual plant flow exceeds 0.50 MGD.

Altoona City(E) 9 20 25 30 2.5 4 >5 6.0-9.0 and III: May-Oct; II and IV: Nov-Apr. Altoona City(X) 9 20 25 30 2.5 4 >5 6.0-9.0 and III: May-Oct; II and IV: Nov-Apr. Chambersburg 4.5 15 25 30 3.5 10	Pennsylvania Plant	Permit Flow	BOD5 mg/L		TSS mg/L	NH4-N mg/L	ر د ب	TN mg/L	TP mg/L	DO mg/L	됩	NOTES
9 20 25 30 2.5 4 5 5 60-9.0 9 20 25 30 2.5 4 5 5 60-9.0 9 20 25 30 2.5 4 5 5 60-9.0 9 20 25 30 3.5 10 5 60-9.0 9 20 2.5 30 3.5 10 5 60-9.0 9 20 2.5 30 1.5 4.5 2 5 60-9.0 9 20 2.5 30 2.5 7.5 2 5 60-9.0 9 20 2.5 7.5 2 5 60-9.0 9 20 2.5 7.5 2 5 60-9.0 9 20 2.5 7.5 2 5 60-9.0 9 20 2.5 7.5 2 5 60-9.0 9 20 2.5 7.5 2 5 60-9.0 9 20 2.5 30 4.5 13.5 2 5 60-9.0 9 2.5 25 30 4.5 13.5 2 5 60-9.0 9 2.5 25 30 4.5 13.5 2 5 60-9.0 9 2.5 25 30 4.5 13.5 2 5 60-9.0 9 2.5 25 30 4.5 13.5 2 5 60-9.0 9 2.5 25 30 4.5 13.5 2 5 60-9.0 9 2.5 25 30 4.5 13.5 2 5 60-9.0 9 2.5 25 30 20 2.5 25 25 25 20 2.5 25 25 25 25 25 25 20 2.5 25 25 25 25 25 25 25 25 25 25 25 25 25			_	=			2				000	Lood III: May Oct: II and IV: Nov. Apr
4.5 15 25 30 2.5 4 >5 6.0-9.0 or 8.9 25 30 3.5 10 >5 6.0-9.0 or 8.9 25 30 3.5 10 >5 6.0-9.0 or 8.9 25 30 3.5 10 >5 6.0-9.0 or 8.9 25 30 1.5 4.5 25 30 6.0-9.0 or 9.0 2.5 7.5 2 >5 6.0-9.0 or 9.0 2.5 7.5 2 >5 6.0-9.0 or 9.0 2.5 7.5 2 >5 6.0-9.0 or 9.0 or 9.	Allocate City/El	σ	20	25	30	2.5	4			Ω Λ	0.0-0.0	Callo III. May-Oct. II alid IV. Nov. Apr.
1	Altoona City(E)	9 0	2	25	30	2.5	4			ς Λ	0.6-0.9	I and III; May-Oct; II and IV; Nov-Apr.
4.5 15 25 30 1.5 4.5 2 5 60-9.0 8.9 25 15 25 30 1.5 4.5 2 2 5 60-9.0 8.9 25 30 1.5 4.5 2 2 5 60-9.0 8.0 25 30 2.5 7.5 2 5 60-9.0 8.0 25 30 2.5 7.5 2 5 60-9.0 8.0 20 25 30 2.5 7.5 2 5 60-9.0 6.0 10 1 1 varies 0.13 5 60-9.0 6.0 9.0 1.2 25 30 4.5 13.5 5 60-9.0 6.0 9.0 8.0 9.0 1.5 25 30 4.5 13.5 5 60-9.0 9.0 9.0 9.0 9.0 9.0 9.0 9.0 9.0 9.0	Altoona City(W)	מ	0,1	2 6	8 6	i c	, Ç			ις Λ	6.0-9.0	I and III; May-Oct; II and IV: Nov-Apr.
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5.5 15 25 30 1.5 4.5 2 5 5 0.0-3.0 30 25 30 1.5 4.5 2 5 6.0-3.0 29.7 15 25 30 2.5 7.5 2 5 6.0-3.0 8 10 20 30 2.5 7.5 2 5 6.0-3.0 6 10 1 1 varies 0.13 >5 6.0-3.0 7 25 30 4.5 13.5 5 6.0-3.0 7 25 30 4.5 13.5 5 6.0-3.0 8 6.0-9.0 9 20 30 1.7 2.1 2 5 6.0-9.0 9 20 30 1.7 2.1 2 >5 6.0-9.0 9 20 25 6.0-9.0 9 20 30 1.7 2.1 2 >5 6.0-9.0 9 20 30 1.7 2.1 2 >5 6.0-9.0	Greater Hazleton	6.0	25		30		•		c	4	000	1 and 111. May-Oct. 11 and IV: Nov-Apr. V. All Year Round
rg 30 25 30 15 7.5 2 5 5 0.0-3.0 15 1 6 0.0-3.0 15 1 7.5 2 5 5 0.0-3.0 15 1 7.5 2 5 5 0.0-3.0 17 1	Hanover	5.5	15	52	30	<u>ر.</u> رن	4. C	•	۷ (2 .	0.00	Target V. All Xoor Doing. III. Max. Oct.
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Fig. 29.7 (1) 20.30 2.5 7.5 2 >5 6.0-9.0 20 25 30 3 3 9	Bingellian	2000	4	25	30	2.5	7.5		7	٧	6.0-9.0	and III; May-Oct, II and IV. Nov-Api, V. Aii Teal Nound
8 10 20 30 2.3 7.3 5 6.0-9.0 20 2.5 30 17 2.1 2 25 6.0-9.0 6.0-9.0 6.0-9.0 7.2 25 30 4.5 13.5 5.4 50 6.0-9.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6	Lancaster City	7.67	2 :	2 6	8 6	ic	1 2		۰		0.6-0.9	I and III; May-Oct; If and IV; Nov-Apr; V; All Year Kound
20 25 30 3 9 0.13 >5 0.0-5.0 0.10 0.13 >5 0.0-5.0 0.10 0.10 0.10 0.10 0.10 0.10 0.10 0	Lebanon	œ	10	ZO.	20	6.7	<u>.</u>		'	4	000	1. All Year Round: III: May-Oct.: IV: Nov-Apr.
ea) 7 25 30 15 2 5 6.0-9.0 (c) 7.2 25 30 4.5 13.5 6.0-9.0 (c) 7.2 25 30 7.5 50 6.0-9.0 (c) 7.2 25 30 7.5 50 6.0-9.0 (c) 7.2 25 30 7.5 54 50 6.0-9.0 (c) 7.5 25 30 7.5 54 50 6.0-9.0 (c) 7.5 25 30 7.5 54 50 6.0-9.0 (c) 7.5 54 55 6.0-9.0 (c) 7.5	Coranton	20	25		30	က	ຫ			9	0.0-0.0	the All I call I call the time of the call the Catholical Desired
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12 25 30 15 2.5 6.0-9.0 (6.9.0) 2 5 6.0-9.0 (7.2 25 30 4.5 13.5 5.4 50 (6.9.0)	State College	o)								a	
12 25 30 19 2 60-9.0 25 30 4.5 13.5 5 60-9.0 6.0-9.0 25 30 4.5 13.5 54 50 80 80 80 80 80 80 80 80 80 80 80 80 80	(UAJA)				ć		*		c	4	0 6-0 9	I and V. All Year Round; III: May-Oct.
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7 25 30 4.5 13.5 7.2 25 30 60-9.0 4.5 54 50 60-9.0 9 32 25 30 1.7 2.1 2 >5 6.0-9.0 9) 26 15 20 30 1.7 2.1 2 >5 6.0-9.0	(Lancester Area)				;					4	6.0-9.0	I: All Year Round: III: May-Oct: IV:Noy-Apr.
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7 4.5 54 50 y 32 25 30 y) 26 15 20 30 1.7 2.1 2 >5	Williamsbort(C)	7.2	25		30	2					0.00	I. All Cost Dough
y 32 25 30 y) 26 15 20 30 1.7 2.1 2 >5	Whitement	4.5	54		20						0.6-0.0	I. All Teal Rould
) 26 15 20 30 1.7 2.1 2 >5	A MINISTER	2 6	36		30						0.6-0.9	I: All Year Kound
County) 26 15 20 30 1.7 2.1 2 >5	Wyoming Valley	32	67		3							
26 15 20 30 1.7 2.1 2	(Luzeme County,	_		600					c	4	0.00	I and III. May-Oct - II and IV. Nov-Apr
	York City	26	15	20	30	1:/	7.7		1		200	

Table 1. Summary List of Plants and NPDES Permit Requirements

Plant Permit Flow BODS TSS NH4N TN TP DO PH	Plant Permit Flow BOD5 TSS NH4-N TN TP DO DH	New York								8	70	SHICK
20 24 11 1	20 24 11 1	1	Permit Flow MGD	BODS mg/L	TSS mg/L		_	mg/L	mg/L	mg/L	5.	
8 30 12.5* Permit Flow Bods TSS NH4.N TN TP DO PH MGD III Mg/L Mg/L Mg/L Mg/L Mg/L Mg/L Mg/L Mg/L	8 30 30 12.5* NH4-N TN TP DO PH Mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L m	Dischamton Johnson City	20	24*	24*							*At 25 MGD (i.e. the limit is 5004 lbs/d) ; III: Jun-Oct
AL Permit Flow BODS TSS NH4-N TN TP DO PH MGD HILL MgL MgL MgL MgL MgL MgL MgL MgL MgL M	AL Permit Flow BODS TSS NH4-N TN TP DO PH MGD III Mg/L Mg/L Mg/L Mg/L Mg/L Mg/L Mg/L Mg/L	Village of Endicott	ဆ	30	93							At 8 McD (i.e. the limit is 650 lbs/d) sulf-oct
Plant	Plant Permit Flow BODS TSS NH4+N TN TP DO DH	TOTAL	28				٠		a .			
Plant Permit Flow BOD5 TSS NH4.N TN TP DO PH	Plant Plant Plant TP DO PH Plant MGD Image TIR+N TN TP DO PH Plant MGD Image MGD TM Image MGD PM	Visoinia							×			Valor
30 10 11 11 11 11 11 11 11 11 11 11 11 11	#1 50 10 11 11 1		Permit Flow MGD	BOD5 mg/L	TSS Mgm	55		TN mg/L	. TP mg/L	mg/L	Ŧ	NOIES
2 2 1 28 463 - 2	2 2 1 10 10 10 110 110 110 110 110 110 1								0,0	0 97	0000	III. Vear Round
2 2 21 28 4.63 5.50 6.0 ##1 3 2 3 6.69 0.801 Figure William Cty. 18 1.5 5.4 5.9 5.0 6.0 6.5-9.5 1.2 5.0 6.0 6.5-9.5 1.2 5.0 6.0 6.5-9.5 1.2 5.0 6.0 6.0-9.0 1.3 5.0 6.0-9.0	#1 0.325 30 1.35 -8.5 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0	Adioofon	30	10	9				0.18	20.0	0.00	III. Teal Modifie
#1 3 2 2 3 0.689 0.801 **The seboro	#1 3 2 2 3 0.689 0.801	10000	0	21	28	•	•	•	*	>6,5		III: Apr-sep
2 2 8 3 0.689 0.801 14 24 24 8.14 10.6 14 30 7 13 0.18 >6.0 6.5-9.5 18 10 1 4 9° 6° 2 >5.0 6.5-9.5 11.5# 1567 2664 496 1291° Monitor >4.5 6.5-9.5 11.5# 25 23 30 3.1 3.8 1.5 >6.0 6.0-9.0 11.5# 25 23 30 0.44 0.9 1.5 2 30 4.9° 10.4° 0.9 1.5 14.5 25 30 4.9° 10.4° >6.0 6.0-9.0 1.5 14.5 30 30 4.9° 10.4° >6.0 6.0-9.0 1.5 14.5 30 30 4.9° 10.4° >6.0 6.0-9.0 1.5 14.5 30 30 4.9° 10.4° >6.0 6.0-9.0 1.5 15.5 30 4.9° 10.4° >6.0 6.0-9.0 1.5 15.6 5.9.5 50 6.0-9.0 1.5 15	3 2 3 0.11 3 2 2 3 0.689 0.801 14 24 24 8.14 10.6 18 10 1 13 0.18 >5.0 6.5-9.5 18 10 10 1 1 0.18 >6.0 6.0-9.0 19 10 10 1 1 0.18 >6.0 6.0-9.0 11.5# 1567 2864 496 1291* Monitor >4.5 6.5-9.5 11.5# 1567 2864 496 1291* Monitor >4.5 6.5-9.5 11.5# 14.5 14.5 1.7 8 1.5 >6.0 6.0-9.0 11.4 14.5 25 30 4* 112.6* >6.0 6.0-9.0 11.4 14.5 25 30 4* 112.6* >6.0 6.0-9.0 11.4 14.5 25 30 4* 112.6* >6.0 6.0-9.0 11.4 14.5 25 30 4* 112.6* >6.0 6.0-9.0 11.4 14.5 25 30 4* 112.6* >6.0 6.0-9.0 11.4 14.5 25 30 4* 112.6* >6.0 6.0-9.0 11.5 164.6		0.325	30	30		ıc	•	7	>5.0	0.9	
2 218.84* 0.689 0.801 55.0 6.59.5 14 24 8.14 10.6 5.9.0 118 10 10 10 1 1 30 5.0 6.59.5 118 10 10 10 1 1 30 5.0 6.59.0 118 10 10 10 1 1 5.0 6.59.0 118 10 10 10 118 5.0 6.59.0 118 10 10 11 11.5	2 218.84* 0.689 0.801 55.0 6.59.5 14 24 8.14 10.6 5.9.0 118 10 10 10 1 13 5.0 6.59.5 118 10 10 10 1 1 13 5.0 6.59.0 118 10 10 10 1 1 10.8 5.0 6.59.0 118 10 10 10 1 1 10.8 5.0 6.59.0 11.5	Danigren	2.0	3 6	"				0.1			*PO4-P
2 218.84* 0.689 0.801	2 218.84* 0.689 0.801	Date Services; #1	n (4 ("				0.1			*PO4-P
2 218.84	2 218.84	Date Services; #8	m (7 000					•			*kg/d; All maximum values. Temp:31 C; III:Jun-Dec; IV:Jan-May.
14 24 24 24 24 24 24 24 24 24 24 24 24 24	14 24 24 24 24 24 24 24 24 24 24 24 24 24	DuPont, Waynesboro	. 2	218.84				į		>5.0	6.5-9.5	III. Jun-Dec; IV: Jan-May
4 30 30 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 30 30 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Tishersville	1.4	4 2	200			29	•	2	6.5-9.0	III; Jun-Dec; IV; Jan-May
18 10 10 10 4 9 6 2 >5.0 6.5-8.5 4.85 12 20 3 3 6 2 >5.0 6.5-8.5 5 6.5-9.0 10 1 1	18 10 10 10 4 9 6 2 >50 6.58.5 4.85 12 20 3 9 6 2 >50 6.58.5 54 10 10 1 - 0.18 >60 6.0-9.0 11.5# 1567 2664 496 1291 Monitor >4,5 6.5-9.5 6.25 6 18.4 30 0.44 0.9	Front Royal	4	OS :	00 4	20	2		ر د د	0 94	6.0-9	III: Year Round
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4 7.5 15 30 2 - 56.0 1 30 - 7.2 6.5.9.5	4 7.5 15 30 2 - >6.0 1 30 30 - 7.2 6.5.9.5 164.6	Cataly Cataly	4.1	14.5					ž.	×7.1	6.5-9.5	*TKN; I and III: Jun-Dec; II and IV: Jan-May
30 30 - 72	164.6	Wayneshom	4	7.5			•	•	•	>6.0	7.1	l and III; Jun-Oct; II; Nov-May
		Woodstock	*	30	30	(40)	•		•	7.2	6.5-9.5	

TOTAL # Includes cooling water.

Table 2. Summary of Projected Nitrogen Removals and Costs

	Qcurrent MGD	Qdesign MGD	Ncurrent Ib/d	Nreduc. Ib/20yrs in thousand	Cost \$/lb N
Maryland					
BYONSWICK WWIP	0.325	0.7	9	530	0.5
CHESTERTOWN WWTP	0.65	6.0	58	247	5.92
CRISFIELD WWTP	0.7	-	91	379	4.95
ELKTON WWTP	1.37	2.7	206	1452	1.87
FEDERALSBURG WWTP	0,355	0.75	54	205	3.34
GEORGES CREEK WWTP, ALLEGANY COUNTY	0.626	9.0	107	457	3.55
INDIAN HEAD WWTP	0.314	0.5	43	219	2.9
MATTAWOMAN WWTP	7.55	15	869	4913	0.07
WINEBRENNER WWTP, WASHINGTON COUNTY	0.3	9.0	44	411	3.77
Maryland Totals/Average	12.19	22.75	1540	9115	1.31
VILLAGE OF ENDICOTT WWTP	7.39	ς, ω	3011 924	9965 3292	3.35
New York Totals/Average	32.29	33	3935	13257	2.49
Pennsylvania					
ALIOUNA CITY ACTION TO EASTERLY PLANT	6.67	თ	645	3185	0.51
ALICONA CITY AUTHORITY WESTERLY PLANT	9.14	13.5	1052	3880	0.42
	4.5	4.5	563	2841	2.69
GREATER HAZLETON JOINT SEWER AUTHORITY WWTP	6.2	ත ල	765	3860	3.24
HANOVER AREA REGIONAL WWTP	3.46	3.65**	568	3046	-0.08
HARKISBURG WW/ P	24	30	4003	27635	2.00
LANCAS I ER CITY WWTP	23.4	29.7	1971	9230	0.19
LEBANON WWTP	2.5	ω	870	4652	1.19
SCRANION SEWER AUTHORITY WMTP	13.8	16	1266	4464	92.0
SIAIE COLLEGE UAJA WWTP	4.5	9	582	3330	0.33
SUSQUEHANNA WWYTP, LANCASTER AREA AUTHORITY	9.45	12	962	2288	1.12
HHOOF WWIP, LACKAWANNA RBSA,	4.5	7	499	1982	1.68 //
WILLIAMSPORT SANITARY AUTHORITY CENTRAL PLANT	8.98	7.2	1296	0099	1.36
WILLIAMSPORT SANITARY AUTHORITY WEST PLANT	3.5	4.5	989	3200	2.58
WYOMING VALLEY SANITARY AUTHORITY WWTP, LUZERNE CTY.	22.3	32	1213	5575	0.17
YORK CITY SEWER AUTHORITY STP	13.1	26	1289	5806	0.36
Pennsylvania Totals/Average	163.2	218	18064	91574	0.97

Table 2. Summary of Projected Nitrogen Removals and Costs

	Ocurrent	Odesign	Neurrant	Nredito	Cost
	MGD	MGD	p/qI	lb/20yrs in thousand	8/Ib N
Virginia	n b				
ARLINGTON WWTP	32.4	30	2432	1973	0.605
COLONIAL BEACH WWTP	0.64	2	72	431	-0.065
DAHLGREN WWTP	0.28	0.325	41	218	-0.12
DALE SERVICES Section 1 WWTP	က	ო	300	730	0.29
DALE SERVICES Section 8 WWTP	2.12	ო	210	900	0.29
DUPONT WAYNESBORO WWTP	0.491	2	188	3184	-0.11
FISHERSVILLE WWTP	1.3	2*	121	260	2.2
FRONT ROYAL WWTP	2.27	4	284	1023	0.02
HARRISONBURG WWTP	©	16	1334	8712	0.54
H.L.MOONEY WWTP, PRINCE WILLIAM COUNTY	12.8	48	1858	8820	90.0
LEESBURG WATER POLLUTION CONTROL FACILITY	2.86	4.85	382	1560	0.68
LOWER POTOMAC WWTP, FAIRFAX COUNTY	45	54/67	5630	34,094	0.5
LURAY WWTP	1.5	2	300	ΑN	A A
MERCK AND CO., INC. WWTP	906.0	1.2	27	Ϋ́Z	0
MIDDLE RIVERVERONA WWTP	3.65	4.5#	180	420	0.3
OPEQUON WRF, CITY OF WINCHESTER	5.14	6.25*	857	5328	0.16
PARKINS MILL WWTP	1.09	7	82	200	-0.79
PURCELLVILLE EXISTING WWTP	0.315	0.5	63	•	56
PURCELLVILLE NEW DESIGN, WWTP	Č	-	29	720	1.8
ROCCO FARM FOODS WWTP	1.1	1.2	1238	8840	0.338
STRASBURG WWTP	9.0	0.975	75	4366	-0.14
STUARTS DRAFT WWTP	0.98	1.4*	85	484	2.36
WAYNESBORO WWTP	3.63	4	424	3548	1.27
WOODSTOCK WWTP	0.77	-	77	292	-0.22
Virginia Totals/Average	130.8	164.2	16260	85703	0.48
GRAND TOTALS	339	438	39799	199649	0.94
*Average daily flows **Design flow less than permit flow	#Combined Effluent	NA: Not Applicable	plicable	V 0	-

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