3.8 HOPEDALE

A. **Introduction.** The Hopedale Wastewater Treatment Facility (WWTF) is located at 154 Mendon Street in Hopedale, MA. It has a permitted average annual capacity of 0.588 mgd and serves the Town of Hopedale only. Only septage from Hopedale is accepted at this facility.

The existing facility was built in 1983. Prior to 1983, a primary treatment facility existed on the site. Changes that have occurred since 1983 include the addition of ultraviolet disinfection, the addition of fine bubble aeration and sludge processing at the facility has ceased.

B. **Existing Facilities.**

1. **Description of Existing Facilities.** All flow is conveyed to the Hopedale Wastewater Treatment Facility (WWTF) by gravity where it enters the Influent Pump Station. This structure contains the influent pumps and a screenings grinder with a manual bypass rack. From there, flow is conveyed to a vortex grit removal system.

Aerial photo taken from www.google.com

After grit removal, ferric chloride is added to the raw wastewater for removal of phosphorus in the primary clarifiers. After primary clarification, the primary effluent flows by gravity to the aeration tanks.

The facility has two aeration tanks. Each tank is 100 ft long by 15 ft wide with a 10 ft sidewater depth. The tanks have coarse bubble aeration. The aeration tanks are followed by two 8 ft deep, 35 ft diameter secondary clarifiers.

Secondary effluent flows to a UV disinfection unit prior to being discharged to the Mill River. Sludge is stored in sludge tanks and then hauled off site for disposal. A process flow schematic is shown in Figure 3.8-1.

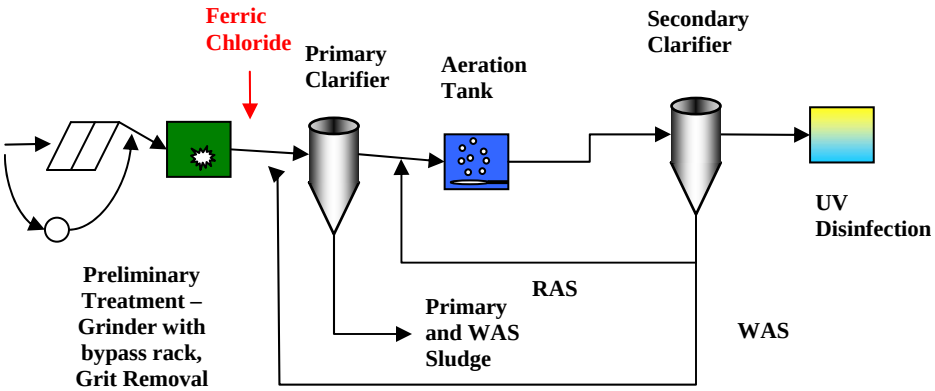


FIGURE 3.8-1: PROCESS FLOW SCHEMATIC – EXISTING FACILITY

All plant recycle flows are returned to the Influent Building. Septage is introduced to the wastewater stream at the Influent Building also. Most of the time, the plant wastes activated sludge to the primary clarifiers for co-settling. The influent sampler at this facility is located downstream of the grit removal facility and thus all plant flows including internal recycle flows are included in the plant influent loads.

All process tanks are in use at all times. The plant does not try to suppress nitrification at any time of the year.

The plant has three full-time employees, one administrator and one half time laborer. This crew serves the plant and pump stations.

Design flows and loads for the most recent upgrade were not made available.

2. **Summary of Plant Data.** Data from January 2004 through December 2006 was provided by the Town for this study. A summary of the monthly data is shown in Table 3.8-1. Seasonal and annual average and maximum month data is summarized in the table.

Table 3.8-1

HOPEDALE WWTF

Hopedale, Massachusetts

Monthly Averages 2004-2006

GENERAL		INFLUENT						AERATION SYSTEM				EFFLUENT				
DATE		TEMP	INF	BOD	TSS	BOD	TSS	MLSS	MLVSS	RAS	WAS	BOD	BOD	TSS	PH	NH3
MONTH	YEAR	°F	MGD	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MGD	GD	MG/L	%	MG/L		MG/L
January	2004	52.0	0.2700	222.8	147.6	169	58	2615	2281	0.307	9,652	17.600	92.100	9.300	6.620	5.300
February	2004	50.0	0.2680	324.1	183.3	227	73	2256	1985	0.287	8,376	18.800	94.200	8.800	6.770	9.200
March	2004	52.0	0.3330	250.5	161.3	199	76	2228	1869	0.251	6,800	22.800	90.900	10.000	6.840	6.700
April	2004	53.0	0.6190	276.9	106.1	155	43	1685	1302	0.252	3,380	25.200	90.900	12.200	6.760	3.400
May	2004	59.0	0.4310	284.8	170.8	178	81	2154	1608	0.268	4,781	9.400	96.700	12.300	6.990	3.700
June	2004	64.0	0.3560	650.0	500.0	182	87	2584	1940	0.314	8,057	22.100	96.600	15.000	7.360	2.380
July	2004	68.0	0.3310	283.3	274.3	154	120	3110	2365	0.288	12,742	10.200	96.400	9.600	7.140	1.200
August	2004	69.0	0.3150	232.7	268.3	123	98	3326	2410	0.340	9,171	12.100	94.800	11.000	7.040	0.980
September	2004	68.0	0.3700	330.0	213.6	189	153	3503	2500	0.326	10,057	9.900	97.000	9.400	6.960	1.300
October	2004	63.0	0.3430	364.0	144.1	210	100	2778	1977	0.256	9,055	9.100	97.500	9.800	6.760	4.780
November	2004	58.0	0.2940	406.7	246.9	287	113	2967	2426	0.270	9,000	12.200	97.000	12.100	6.510	3.400
December	2004	53.0	0.3990	243.0	149.4	217	59	2286	1953	0.262	7,465	20.900	91.400	13.000	6.590	5.700
January	2005	48.0	0.3990	307.1	150.6	217	60	1557	1305	0.265	7,348	12.900	95.800	13.100	6.980	7.300
February	2005	47.0	0.3730	328.3	118.2	202	59	1885	1601	0.305	9,336	15.100	95.400	10.400	7.180	9.000
March	2005	48.0	0.3520	275.0	161.6	157	62	2415	2063	0.329	9,171	12.100	95.600	13.900	7.120	7.500
April	2005	52.0	0.6440	204.0	80.7	173	59	2450	2113	0.320	8,363	15.300	92.500	8.800	6.940	14.100
May	2005	57.0	0.6060	271.1	73.2	202	59	3040	2486	0.315	10,213	20.600	92.400	9.300	6.530	1.100
June	2005	64.0	0.2570	364.5	165.2	210	73	2982	2232	0.290	10,540	11.300	96.900	7.600	6.500	0.890
July	2005	70.0	0.2170	103.2	600.0	172	62	2456	1840	0.300	13,798	3.200	96.900	4.800	6.680	1.240
August	2005	75.2	0.2010	475.0	898.9	264	134	4034	2953	0.400	5,216	11.400	97.600	8.000	6.710	1.090
September	2005	71.6	0.1550	153.1	465.2	344	91	3031	2162	0.285	1,510	7.500	95.100	10.700	6.620	1.470
October	2005	64.2	0.4993	152.8	200.0	115	74	3081	2184	0.397	3,880	6.416	95.800	7.520	6.520	0.248
November	2005	60.4	0.5050	196.6	170.2	188	76	3219	2402	0.375	1,420	12.780	93.500	16.000	6.600	0.108
December	2005	55.4	0.5409	220.6	160.7	175	61	4338	3448	0.387	2,200	13.680	93.800	13.175	6.910	0.105
January	2006	55.4	0.6444	189.9	135.1	117	58	2886	2410	0.305	2,797	13.100	93.100	17.700	6.720	0.213
February	2006	51.6	0.5985	146.8	148.0	120	50	2211	1878	0.311	1,767	11.450	92.200	7.550	6.720	6.370
March	2006	51.4	0.3318	334.5	350.0	245	83	3321	2831	0.202	2,177	9.700	97.100	7.000	6.850	11.000
April	2006	55.4	0.3398	217.0	243.1	202	109	2685	2132	0.197	2,200	11.500	94.700	12.400	7.090	9.500
May	2006	52.2	0.5372	232.7	322.3	127	90	2387	1839	0.288	1,245	7.680	96.700	8.380	6.590	4.360
June	2006	62.2	0.7601	136.4	157.9	118	65	2029	1456	0.309	1,427	12.000	91.200	18.000	6.540	1.190
July	2006	66.9	0.2822	310.0	410.0	194	72	2179	1615	0.311	2,387	9.300	97.000	8.200	6.800	0.300
August	2006	55.4	0.2297	520.0	350.0	170	97	2705	1967	0.381	2,581	5.200	99.000	7.000	6.500	0.400
September	2006	68.0	0.2809	530.0	435.0	140	84	3209	2344	0.387	1,900	5.300	99.000	8.700	6.600	0.100
October	2006	64.9	0.2962	350.0	400.0	183	96	2218	1634	0.336	2,194	7.000	98.000	8.000	6.500	0.300
November	2006	60.8	0.5281	300.0	225.0	140	81	1881	1441	0.321	567	9.000	97.000	9.000	6.600	0.200
December	2006	56.5	0.4535	392.0	242.9	188	81	1732	1173	0.376	733	19.600	95.000	17.000	6.800	1.650
Min. Month		47.0	0.1550	103.2	73.2	115	43	1557	1173	0.197	567	3.200	90.900	4.800	6.500	0.100
Seasonal Average		**64.6**	**0.4**	**319.1**	**336.1**	**181.9**	**90.9**	**2823**	**2084**	**0.3**	**6153**	**10.0**	**96.4**	**9.6**	**6.7**	**1.5**
Average		**59.0**	**0.399**	**293.9**	**256.4**	**185**	**80**	**2651**	**2059**	**0.309**	**5653**	**12.595**	**95.189**	**10.687**	**6.776**	**3.549**
Max. Month		75.2	0.7601	650.0	898.9	344	153	4338	3448	0.400	13798	25.200	99.000	18.000	7.360	14.100

With a current average annual flow of 0.40 mgd and a permitted capacity of 0.588 mgd, this facility is operating at 68% of its permitted capacity.

Based on the average BOD concentration of 294 mg/L, this wastewater is slightly higher than medium strength.

3. **Permit Requirements and Current Performance.** The current permit for this facility has been in effect since September 3, 1999. Monthly permit limits that are relevant to this study are shown below in Table 3.8-2.

Table 3.8-2
SELECT MONTHLY PERMIT LIMITS

PARAMETER	LIMIT
BOD5	
November – May	30 mg/L
June - October	15 mg/L
TSS	
November – May	30 mg/L
June - October	15 mg/L
Total Ammonia	
November – April	11 mg/L
May	5 mg/L
June - October	2 mg/L

The plant meets permit nearly every month with a single BOD excursion and three ammonia excursions in the past three years.

4. **Nitrogen Removal Performance.** This facility does not collect influent nitrogen data. However, effluent ammonia data is collected and as can be seen in Table 3.8-1, the facility fully nitrifies at times.

C. **Nitrogen Removal Alternatives.** The existing maximum month loads over the three-year data collection period were used to determine the BioWin input data; one outlier was found in the data and not included in the analysis. The influent data which correspond to maximum-month loads is shown in Table 3.8-3 below for each permitting scenario. In addition, due to a lack of influent nitrogen data, the TN/BOD ratio was estimated to be 0.20

Table 3.8-3
EXISTING INFLUENT PARAMETERS

PERMIT CONDITIONS	PARAMETER	VALUE
Annual Average	Flow, mgd	0.45
	BOD, mg/L	392
	TSS, mg/L	342
	TN, mg/L	77
	Temperature, F	47
Seasonal	Flow, mgd	0.61
	BOD, mg/L	271
	TSS, mg/L	237
	TN, mg/L	53
	Temperature, F	52

The existing plant data was then projected to the permitted capacity of the facility to develop model input parameters for the average annual and seasonal model runs. This projected data is shown in Table 3.8-4.

Table 3.8-4
MODEL INPUT PARAMETERS AT PERMITTED CAPACITY

PERMIT CONDITIONS	PARAMETER	VALUE
Annual Average	Flow, mgd	0.67
	BOD, mg/L	392
	TSS, mg/L	342
	TN, mg/L	77
	Temperature, F	47
Seasonal	Flow, mgd	0.89
	BOD, mg/L	271
	TSS, mg/L	237
	TN, mg/L	53
	Temperature, F	52

The model input data was used to run uncalibrated simulations to determine planning level, order-of-magnitude costs for implementing different levels of nitrogen reduction at the facility. A discussion of operational changes or minor modifications that can be made to the facility to improve current nitrogen reduction performance as well as a presentation of the simulation results are presented in the following sections.

1. **Minor Modifications/Retrofits.** At the current assumed influent TN levels, there are no operational or minor modifications/retrofits that could be implemented at this facility to achieve any appreciable level of nitrogen removal.

2. **Modifications Required to Meet TN of 8.** The modifications to the facility that are required to meet an effluent TN of 8 mg/L on a seasonal and annual average basis are as follows.

a. **Seasonal.** At the assumed influent TN levels for this facility, an MLE process will not accomplish a seasonal effluent TN level of 8 mg/L. The MLE process will yield a seasonal effluent TN of 18-20 mg/L. Thus, a Bardenpho process with methanol addition is recommended as shown in the BioWin model in Figure 3.8-2 below.

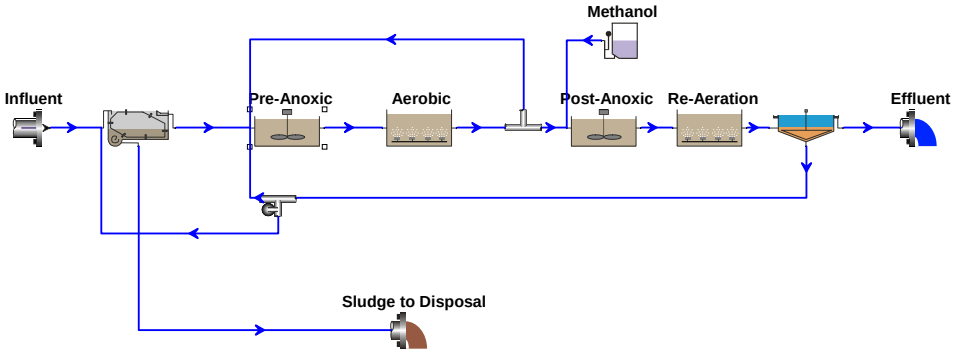
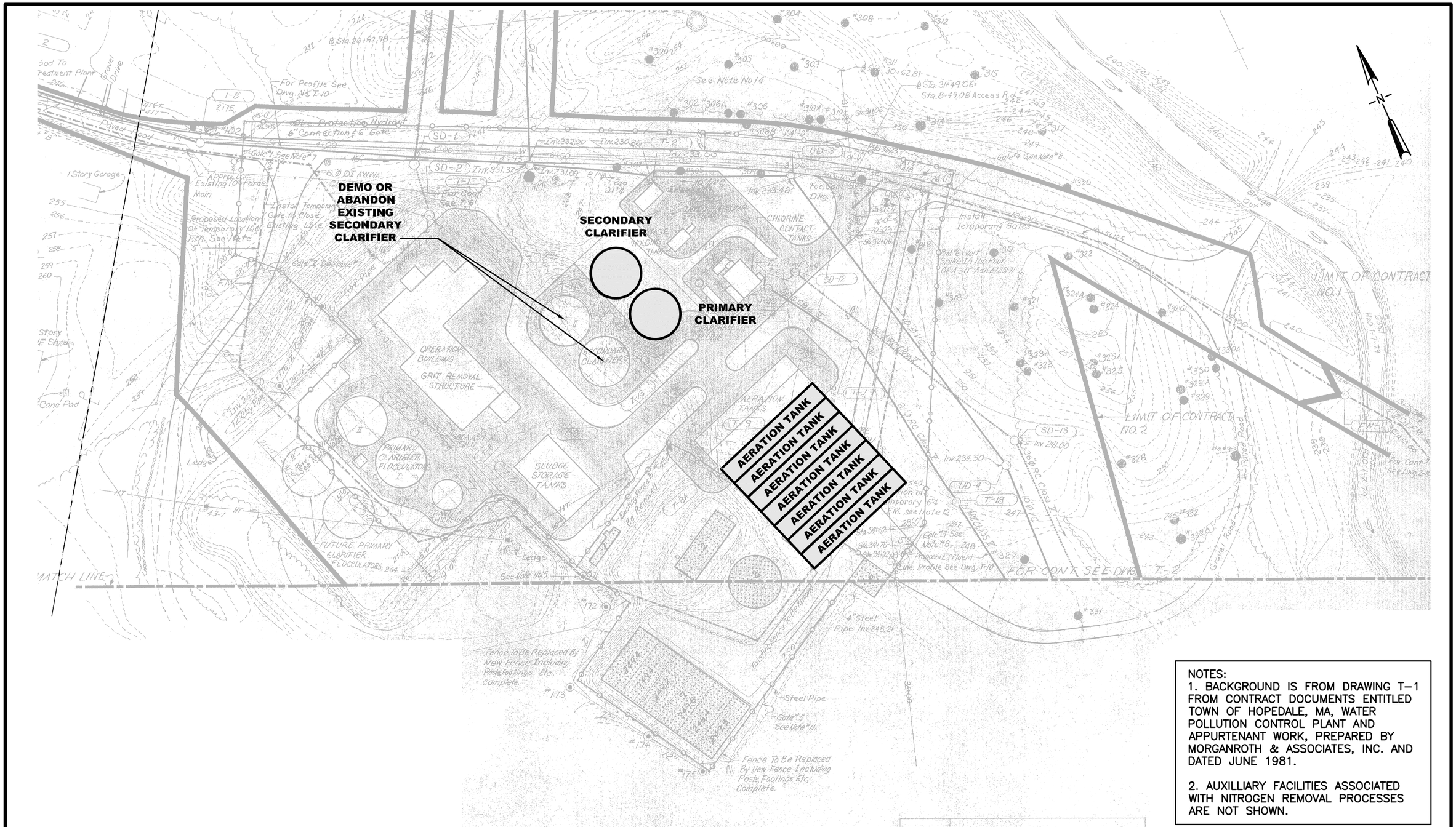


FIGURE 3.8-2: NITROGEN REMOVAL PROCESSES - SEASONAL LIMIT OF 8 mg/L

This process would require a total of 9 aeration tanks - 7 new tanks in addition to the existing two. The new tanks would be the same size as each of the two existing tanks.

In addition to the new aeration tanks and in accordance with Section 2, the existing secondary clarifiers are too shallow (eight feet deep) and will require replacement. Two 13 ft deep clarifiers of the same diameter as the existing will suit the future flows and loads of the facility.

As shown in the site plan in Figure 3.8-3, the site has enough space for the additional aeration tanks and new clarifiers. Specific information regarding the results of this analysis is shown in Table 3.8-5 below.



NOTES:
1. BACKGROUND IS FROM DRAWING T–1 FROM CONTRACT DOCUMENTS ENTITLED TOWN OF HOPEDALE, MA, WATER POLLUTION CONTROL PLANT AND APPURTENANT WORK, PREPARED BY MORGANROTH & ASSOCIATES, INC. AND DATED JUNE 1981.

2. AUXILLIARY FACILITIES ASSOCIATED WITH NITROGEN REMOVAL PROCESSES ARE NOT SHOWN.

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Filename: HOPEDALE–CH3.dwg
Latest Revision: Friday, April 04, 2008

SITE PLAN
SCALE: 1"=80'–0"

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ENGINEERING FEASIBILITY AND COST ANALYSES OF NITROGEN REDUCTION FROM SELECTED POTWS IN MASSACHUSETTS

HOPEDALE, MASSACHUSETTS
FIGURE 3.8–3

Table 3.8-5

RESULTS FOR SEASONAL LIMIT OF 8 mg/L TN

PARAMETER	VALUE
Aerobic SRT	9.5 days
Total SRT	15 days
First Anoxic Fraction	18%
Total Anoxic Fraction	38%
Reaeration HRT	1 hr
RAS Rate	100%
Total Volume	1.0 MG
Nitrate Recycle Rate	300%
Max MLSS at loading rate	3400 mg/L
Effluent TN	8 mg/L
Methanol Addition	Yes
Fixed Film Required?	No
Clarifiers?	Existing clarifiers are too shallow, construct new ones
Effluent Filtration Required?	No

The modifications related to the proposed upgrades described above do not appear to require any structure demolition. The new aeration tanks and clarifiers can be constructed in portions of the site that are currently unused.

Other plant modifications may be needed including upgrades to sludge handling to accommodate the higher sludge production. However, all facilities outside of the activated sludge process are outside of the scope of this study.

b. **Annual Average.** As indicated above, at the assumed influent TN levels for this facility, an MLE process will not accomplish an average annual effluent TN level of 8 mg/L. The MLE process will yield an annual average effluent TN of about 16 mg/L. Thus, the Bardenpho process with methanol addition is recommended as shown in the BioWin model in Figure 3.8-4 as follows.

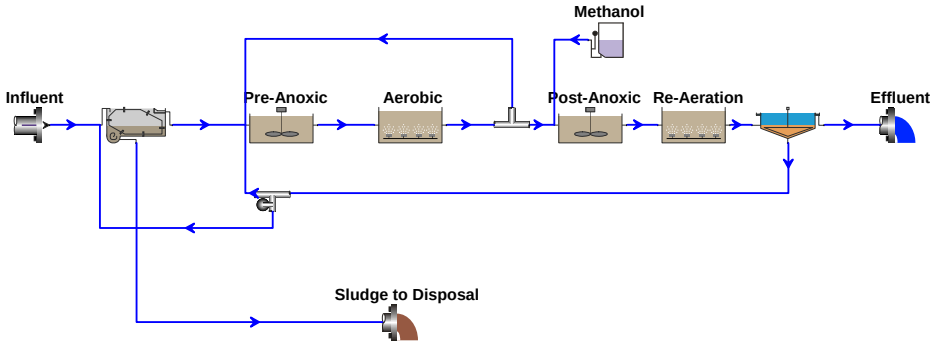


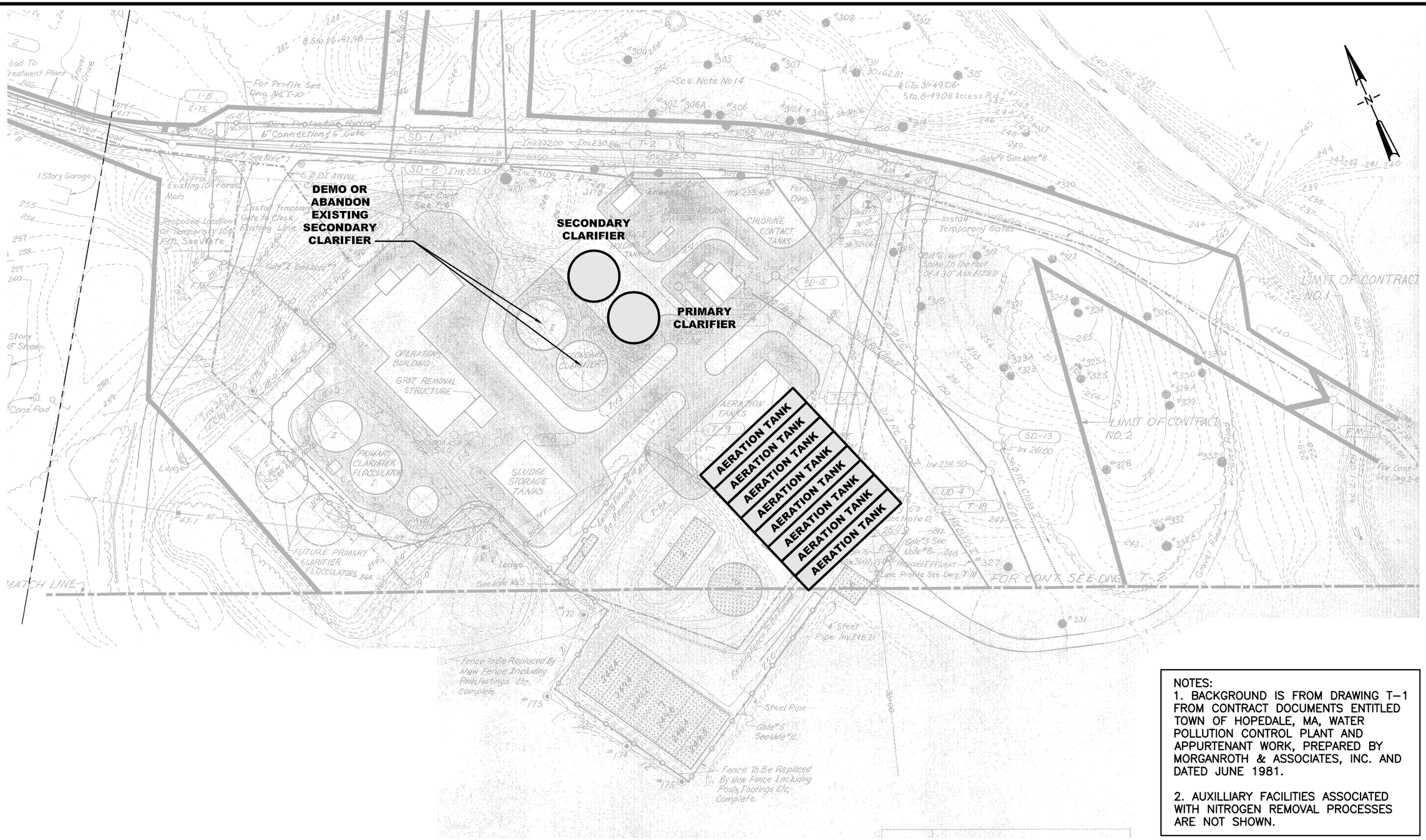
FIGURE 3.8-4: NITROGEN REMOVAL PROCESSES – ANNUAL AVERAGE LIMIT OF 8 mg/L

This process would require a total of ten aeration tanks - eight new tanks in addition to the existing two. The new tanks would be the same size as each of the existing tanks.

In addition to the new aeration tanks and in accordance with Section 2, the existing secondary clarifiers are too shallow and will require replacement. Two 13 ft deep clarifiers of the same diameter as the existing will suit the future flows and loads of the facility.

As shown in the site plan in Figure 3.8-5, the site appears to have enough space for the additional aeration tanks. Specific information regarding the results of this analysis is shown in Table 3.8-6 as follows.

(continued)



NOTES:
1. BACKGROUND IS FROM DRAWING T–1 FROM CONTRACT DOCUMENTS ENTITLED TOWN OF HOPEDALE, MA, WATER POLLUTION CONTROL PLANT AND APPURTENANT WORK, PREPARED BY MORGANROTH & ASSOCIATES, INC. AND DATED JUNE 1981.

2. AUXILLIARY FACILITIES ASSOCIATED WITH NITROGEN REMOVAL PROCESSES ARE NOT SHOWN.

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SITE PLAN
SCALE: 1"=80'–0"

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ENGINEERING FEASIBILITY AND COST ANALYSES OF NITROGEN REDUCTION FROM SELECTED POTWS IN MASSACHUSETTS

HOPEDALE, MASSACHUSETTS
FIGURE 3.8–5

Table 3.8-6

RESULTS FOR ANNUAL AVERAGE LIMIT OF 8 mg/L TN

PARAMETER	VALUE
Aerobic SRT	11 days
Total SRT	18 days
First Anoxic Fraction	18%
Total Anoxic Fraction	37%
Reaeration HRT	1 hr
RAS Rate	100%
Total Volume	1.12 MG
Nitrate Recycle Rate	300%
Max MLSS at loading rate	3600 mg/L
Effluent TN	8 mg/L
Methanol Addition	Yes
Fixed Film Required?	No
Clarifiers?	Existing clarifiers are too shallow, construct new ones
Effluent Filtration Required?	No

The modifications related to the proposed upgrades described above do not appear to require any structure demolition. The new aeration tanks and clarifiers can be constructed in portions of the site that are currently unused.

Other plant modifications may be needed including upgrades to sludge handling to accommodate the higher sludge production. However, all facilities outside of the activated sludge process are outside of the scope of this study.

3. **Modifications Required to Meet a TN of 5 mg/L.** The modifications to the facility that are required to meet an effluent TN of 5 mg/L on a seasonal and annual average basis are as follows.

a. **Seasonal.** At the assumed influent TN levels for this facility, Bardenpho process with methanol addition is recommended to achieve a seasonal effluent TN of 5 mg/L as shown in the BioWin model in Figure 3.8-6.

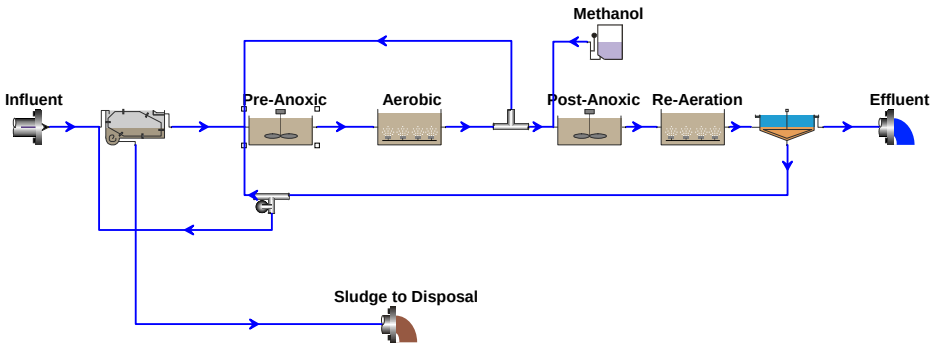

FIGURE 3.8-6: NITROGEN REMOVAL PROCESSES – SEASONAL LIMIT OF 5 mg/L

This process would require a total of 9 aeration tanks - 7 new tanks in addition to the existing two. The new tanks would be the same size as each of the two existing tanks.

In addition to the new aeration tanks and in accordance with Section 2, the existing secondary clarifiers are too shallow and will require replacement. Two 13 ft deep clarifiers of the same diameter as the existing will suit the future flows and loads of the facility.

As shown in the site plan in Figure 3.8-3, the site appears to have enough space for the additional aeration tanks. Specific information regarding the results of this analysis is shown in Table 3.8-7 as follows.

(continued)

Table 3.8-7

RESULTS FOR SEASONAL LIMIT OF 5 mg/L TN

PARAMETER	VALUE
Aerobic SRT	9.5 days
Total SRT	15 days
First Anoxic Fraction	18%
Total Anoxic Fraction	38%
Reaeration HRT	1 hr
RAS Rate	100%
Total Volume	1.0 MG
Nitrate Recycle Rate	300%
Max MLSS at loading rate	3400 mg/L
Effluent TN	5 mg/L
Methanol Addition	Yes
Fixed Film Required?	No
Clarifiers?	Existing clarifiers are too shallow, construct new ones
Effluent Filtration Required?	No

The modifications related to the proposed upgrades described above do not appear to require any structure demolition. The new aeration tanks and clarifiers can be constructed in portions of the site that are currently unused.

Other plant modifications may be needed including upgrades to sludge handling to accommodate the higher sludge production. However, all facilities outside of the activated sludge process are outside of the scope of this study.

b. **Annual Average.** At the assumed influent TN levels for this facility, an MLE process is recommended to achieve an average annual effluent TN of 5 mg/L as shown in the BioWin model in Figure 3.8-7.

(continued)

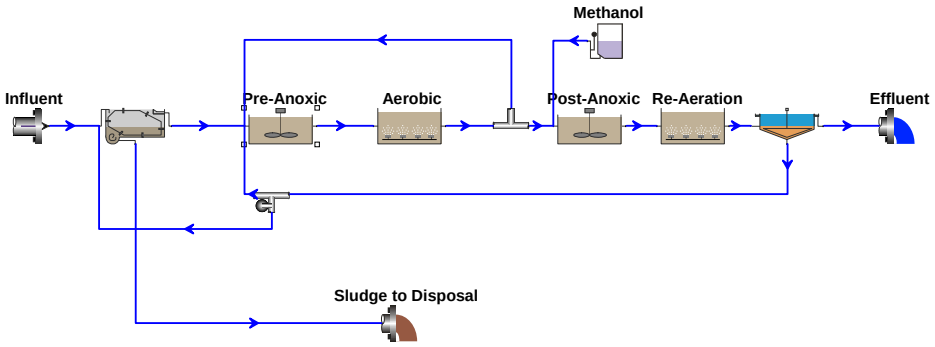

FIGURE 3.8-7: NITROGEN REMOVAL PROCESSES – ANNUAL AVERAGE LIMIT OF 5 mg/L

This process would require a total of ten aeration tanks - eight new tanks in addition to the existing two. The new tanks would be the same size as each of the existing tanks.

In addition to the new aeration tanks and in accordance with the QA/QC procedures in Section 2, the existing secondary clarifiers are too shallow and will require replacement. Two 13 ft deep clarifiers of the same diameter as the existing will suit the future flows and loads of the facility.

As shown in the site plan in Figure 3.8-5, the site appears to have enough space for the additional aeration tanks. Specific information regarding the results of this analysis is shown in Table 3.8-8 as follows.

(continued)

Table 3.8-8

RESULTS FOR ANNUAL AVERAGE LIMIT OF 5 mg/L TN

PARAMETER	VALUE
Aerobic SRT	11 days
Total SRT	18 days
First Anoxic Fraction	18%
Total Anoxic Fraction	37%
Reaeration HRT	1 hr
RAS Rate	100%
Total Volume	1.12 MG
Nitrate Recycle Rate	300%
Max MLSS at loading rate	3600 mg/L
Effluent TN	5 mg/L
Methanol Addition	Yes
Fixed Film Required?	No
Clarifiers?	Existing clarifiers are too shallow, construct new ones
Effluent Filtration Required?	No

The modifications related to the proposed upgrades described above do not appear to require any structure demolition. The new aeration tanks and clarifiers can be constructed in portions of the site that are currently unused.

Other plant modifications may be needed including upgrades to sludge handling to accommodate the higher sludge production. However, all facilities outside of the activated sludge process are outside of the scope of this study.

D. **Plant and Cost Summary.**

Table 3.8-9 presents flow data for the Hopedale WWTF as well as the current nitrogen removal performance of the plant.

(continued)

Table 3.8-9
PLANT FLOW AND EFFLUENT LIMIT SUMMARY

PARAMETER	VALUE
Permitted Flow (mgd)	0.588
Existing Flow (2004-6)	0.4
% of existing capacity	68
Current average seasonal effluent TN (mg/L)	Only ammonia is measured
Current average annual effluent TN (mg/L)	Only ammonia is measured
Permit Limits Seasonal Nitrification (mg/L) Year-round nitrification (mg/L) Seasonal TN Limit Annual TN Limit	 Yes (2-5) Yes (2-11) No No

Table 3.8-10 presents the nitrogen removal processes identified in this section to achieve the four different permit conditions considered. Based on the loading conditions established for this facility and the subsequent BioWin modeling performed using this data, the facility improvements include adding a number of additional aeration tanks and replacing the existing shallow clarifiers. It should be noted that the BOD loads at this facility are relatively high and as a result the assumed influent nitrogen values were also high.

Table 3.8-10
NITROGEN REMOVAL PROCESS SUMMARY FOR HOPEDALE WWTF

MINOR/ MODIFICATIONS OR RETROFITS	PROCESS TO ACHIEVE SEASONAL TN OF 8 MG/L	PROCESS TO ACHIEVE ANNUAL AVERAGE TN OF 8 MG/L	PROCESS TO ACHIEVE SEASONAL TN OF 5 MG/L	PROCESS TO ACHIEVE ANNUAL AVERAGE TN OF 5 MG/L
None	Bardenpho with methanol addition	Bardenpho with methanol addition	Bardenpho with methanol addition	Bardenpho with methanol addition

The modifications required at Hopedale to convert to a new nitrogen removal process are summarized in Table 3.8-11.

Table 3.8-11
REQUIRED MODIFICATIONS SUMMARY FOR HOPEDALE WWTF

MODIFICATIONS TO ACHIEVE SEASONAL TN OF 8 MG/L	MODIFICATIONS TO ACHIEVE ANNUAL AVERAGE TN OF 8 MG/L	MODIFICATIONS TO ACHIEVE SEASONAL TN OF 5 MG/L	MODIFICATIONS TO ACHIEVE ANNUAL AVERAGE TN OF 5 MG/L	SPECIAL CONDITIONS
7 new aeration tanks and 2 new clarifiers	8 new aeration tanks and 2 new clarifiers	7 new aeration tanks and 2 new clarifiers	8 new aeration tanks and 2 new clarifiers	None

The cost estimating procedures established in Section 2 were used to estimate capital, annual O&M, and 20-year present worth costs associated with the process changes and facility modifications summarized above. The cost estimates are included in Table 3.8-12.

Table 3.8-12
COST SUMMARY FOR NITROGEN REMOVAL AT HOPEDALE WWTF[1]

LIMIT	CAPITAL COSTS (IN MILLIONS)	TOTAL ANNUAL COSTS[2] (IN THOUSANDS)	20-YR PRESENT WORTH (IN MILLIONS)
Minor Modifications/Retrofits	None	n/a	n/a
Seasonal Effluent TN of 8 mg/L	$23	$150	$24
MLE Configured Tanks	$18	$150	$20
Annual Average Effluent TN of 8 mg/L	$25	$180	$27
Seasonal Effluent TN of 5 mg/L	$23	$150	$24
MLE Configured Tanks	$20	$180	$22
Annual Average Effluent TN of 5 mg/L	$25	$180	$27

1. It should be noted that these costs represent one method by which this facility can achieve the stated TN goals. It is not intended to be the most cost effective method nor the recommended method, but it represents a planning tool for MassDEP to estimate the fiscal impacts of establishing total nitrogen limits.
2. Represents incremental increase over current conditions.

Section 3c

Blackstone River Watershed