City Of Middletown
Water and Sewer Department

Inter-Municipal Sewerage Feasibility Study
To
The Mattabassett District

October 18, 1999

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City of Middletown
Water & Sewer Department

THE MATTABASSETT DISTRICT
INTER-MUNICIPAL SEWERAGE FEASIBILITY STUDY

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(1) This Chapter includes the study of Connecticut Valley Hospital, Pratt & Whitney & Northeast Utilities facilities

(Chapter 2 - Continued)

(2) This Chapter (Appendices) contains some superseded information - Refer to Executive Summary

Executive Summary

EXECUTIVE SUMMARY

Overview and Objective of the Study

The Mattabassett District is a regional wastewater treatment authority with a treatment facility located in Cromwell, CT. The District is comprised of three constituent members, namely the City of New Britain, the Town of Berlin, and the Town of Cromwell. In addition to the constituent members, the Westfield section of the City of Middletown and minor parts of the Metropolitan District (in Newington and Rocky Hill) contribute flow to the Mattabassett District as contractual members.

In 1998, the City of Middletown received a Clean Water Fund grant from the CT Department of Environmental Protection to study the feasibility of increasing the service area of the Mattabassett District to include three new communities, namely the City of Middletown and the Towns of Plainville and Portland. For each of these three new communities, a ***Local Alternative*** of maintaining and upgrading the existing treatment facilities in each of the three communities was evaluated and compared to an ***Inter-Municipal Alternative*** of conveying wastewater from each of these communities to the Mattabassett District. As part of evaluating the City of Middletown, wastewater flow projections included not only flows from the City's POTW but also projected flows from the existing treatment facilities at Connecticut Valley Hospital, Northeast Utilities, and Pratt & Whitney, all located along River Road in Middletown.

For each of the three new communities, the ***Local Alternative*** evaluated issues involved with what would be necessary for the local existing plant to remain in operation and continue to serve the needs of their respective individual communities in the next twenty years. This evaluation included implementing treatment process upgrades needed to meet the CT DEP sponsored "Long Island Sound Study" goals for denitrification.

For the ***Inter-Municipal Alternative,*** this report contains an evaluation of both the wastewater conveyance costs of each community to get its wastewater to the Mattabassett facility as well as the cost of improvements and upgrades that would be needed at the Mattabassett District in order to accommodate the additional wastewater flows from the three new communities and to also meet the CT DEP established denitrification goals and other possible water quality related improvements.

As part of the ***Inter-Municipal Alternative*** evaluation, the cost to each of the three new communities to buy-into the Mattabassett District was developed under the assumption that each of the three new communities would be a "contractual" member of the District, not a "constituent" member, as are Berlin, Cromwell and New Britain. What this means is that the current "constituent" members, who have historically held "equity" in the District facility, would be the only members to maintain equity ownership of the District facilities.

Therefore, the costs that have been developed in this Study for the City of Middletown, as the only remaining interested party to this Study, were prepared under the premise that Middletown would remain a "contractual" member of the District, as it is today for its flows from the Westfield section of the City which are currently being treated at the Mattabassett Facility.

Because Middletown will remain a "contractual" member, no costs have been developed for Middletown to buy-into its proportional share of the existing Mattabassett facilities, only its fair share cost for new or expanded treatment facilities at the Mattabassett District Plant.

Final Outcome

After the Study was completed in draft form (dated June 4, 1998), the Towns of Portland and Plainville decided to withdraw. As a result of those decisions, the findings contained in the draft report needed to be revised to reflect the fact that only the City of Middletown would be a final participant in the Study. These findings were revised and are described in the **Epilogue** section of this Executive Summary. The findings reflected in the draft report for Portland and Plainville remain unchanged in Chapters 3 and 4 respectively.

Epilogue

The first part of this Epilogue contains a summary of costs for the originally planned three new members of the Mattabassett District, even though the Towns of Portland and Plainville have withdrawn from the Study.

The second part of this Epilogue contains a detailed discussion of the Mattabassett District Facility and the improvements needed there to accommodate additional flows from the City of Middletown (only) as well as to meet increasingly stringent water treatment requirements of the CT DEP. In that second part, a cost analysis is provided for each of the several incremental WPCF upgrades that will be required over the next 20 years.

Summary: City of Middletown

For the Local Alternative: Capital Costs to modify and upgrade the existing WPCF on River Road to accommodate future flows and to meet stricter effluent criteria established by the CT DEP would be approximately **$8,500,000** (1999 dollars) to meet year 2009 goals and an additional **$8,000,000** (1999 dollars) to meet 2014 goals, for a total of **$16,500,000** (1999 dollars). Annual Operations and Maintenance Costs are estimated to be **$2,800,000** (1999 dollars).

The additional cost to Middletown to further upgrade and expand its existing treatment facility to accommodate any additional flows from the Northeast Utilities facility, the Connecticut Valley Hospital facility, and the Pratt and Whitney treatment facilities were not evaluated as part of the local alternative during the course of this study.

For the Inter-Municipal Alternative: The City of Middletown would need to construct a forcemain between the existing East Main Street pump station, north along the CT Route 9 corridor (immediately west of the Connecticut River) to the Mattabassett District facility in Cromwell. A significant portion of this proposed forcemain would need to be constructed in, or adjacent to, the CT Route 9 highway right-of-way.

The existing pump station facility, which can be considered the head of the plant, is actually located on East Main Street. The station would be modified, existing equipment upgraded, and additional equipment added to redirect the City wastewater to the Mattabassett District. As part of this work, there is a single 42" sanitary sewer interceptor that bypasses the pump station and flow by gravity to the Middletown plant. This interceptor would need to be redirected to the new pump station as part of this alternative.

The Capital Costs required to reconfigure the existing pumping station into a regional pumping facility, to demolish the existing treatment facility, to redirect the 42" interceptor to the regional pumping station, and to install the force main to the Mattabassett WPCF are estimated to be approximately **$5,850,000** (1999 dollars). Annual Operations and Maintenance Costs associated with the regional wastewater conveyance facilities are estimated to be **$120,000.**

In addition to the Capital Costs and O&M costs associated with the regional wastewater conveyance facilities to be built in Middletown and Cromwell (force main from the Middletown-Cromwell town line to the Mattabassett WPCF), Middletown will be assessed its fair-share of costs to upgrade the Mattabassett WPCF to allow the plant to receive additional flows from the City of Middletown.

Tables ES-8 through ES-17 provide a comparative analysis for both the "*Inter-municipal Alternative*" and the "*Local Alternative*" for design year 2020 flows under a scenario which assumes that CT DEP Clean Water Act (CWA) funding is available for this project and under a scenario which assumes that CWA funding is not available

Tables ES-10 through ES -13 show that to meet the Year 2009 goals under a "Funding Available" scenario, the City of Middletown is projected to realize a first year savings of slightly more than **$1,000,000** (1999 dollars) by opting for the "*Inter-municipal Alternative*", and a first year savings of slightly more than **$1,100,000** that to meet the Year 2014 goals. Total (Net Present Value) savings to Middletown under the "*Inter-municipal Alternative*" is estimated to be between **$21,000,000** and **$22,000,000** (1999 dollars) when compared to continued operation of the existing Middletown POTW on River Road.

Tables ES-14 through ES-17 show that to meet the Year 2009 goals under a "No State Funding Available" scenario, the City of Middletown is projected to realize a first year savings of approximately **$451,000** (1999 dollars) by opting for the "***Inter-municipal Alternative***", and a first year savings of **$598,000** to meet the Year 2014 goals. With "No State Funding Available", the total (Net Present Value) savings to Middletown under the "***Inter-municipal Alternative***" is estimated to be between **$14,500,000** and **$16,300,000** (1999 dollars) when compared to continued operation of the existing Middletown POTW on River Road.

As requested by the City of Middletown, an estimated initial "buy-in" cost to accommodate current flows under the District's current permit conditions was also developed. As shown in Table ES-18, the annual costs associated with Middletown's conveyance facilities and service fees from the Mattabassett Facility to cover facility improvements and operations are estimated to be approximately **$1,500,000**. This represents a savings of over **$1,000,000** compared to Middletown's current costs. The feasibility of constructing this alternative is dependent on negotiations with the Connecticut DEP on whether the need to meet future permit conditions as part of an upgrade would be required under this scenario.

Outcome: Based on the findings of this report, there appears to be significant economic advantage to both the City of Middletown and to the existing members of the Mattabassett District to pursue the possibility of Middletown conveying all of its untreated wastewater to the District facility in Cromwell, and discontinue its current independent wastewater treatment operations at its WPCF on River Road. Additionally, it was found that there would be a significant advantage to the City in pursuing Clean Water Act Funding for the project.

Summary: Town of Plainville

For the Local Alternative: Capital Costs to modify and upgrade the existing Plainville WWT to accommodate future flows and to meet stricter effluent criteria set by the CT DEP would be approximately **$6,400,000** (1999 dollars) to meet 2009 goals and an additional **$6,480,000** (1999 dollars) to meet 2014 goals, for a total of **$12,880,000** (1999 dollars). Annual Operations and Maintenance Costs to maintain the existing (and upgraded) treatment plant are estimated to be **$2,000,000.**

For the Inter-Municipal Alternative: The Town of Plainville would need to construct a forcemain between its existing treatment facility, through the eastern part of the Town of Plainville and the western part of the City of New Britain to where an existing trunk sewer to the Mattabassett District facility exists.

A significant portion of this proposed forcemain would need to be constructed in city streets and State highways as well as along a railroad right-of-way. The existing wastewater treatment facility in Plainville would be converted to a pumping station to convey Town wastewater to the Mattabassett District. Under this alternative, the existing inlet structure at the Plant would need to be rebuilt and modified and some of the existing tankage at the facility would need to altered to serve as holding facility for the new pumping station.

The Capital Cost required to reconfigure the treatment plant to a pumping station and to install the force main are estimated to be approximately **$8,100,000** (1999 dollars). Annual Operations and Maintenance Costs are estimated to be **$240,000**.

In addition to the Capital and O&M Costs, the Town of Plainville would also have to invest significant additional monies and time in acquiring a Diversion Permit from the State of Connecticut, with no assurance of being successful.

Outcome: Based on the determination made by the governing body of the Town, the Town of Plainville has decided not to work toward conveying its sewage to the Mattabassett District.

Summary: Town of Portland

For the Local Alternative: A study separate from this Report was conducted by a engineering consultant working directly for the Town of Portland determined that capital cost for modifications to upgrade the existing Portland WPCF would be approximately **$5,090,000** (1998 dollars). That estimate was not independently verified as part of this Study.

For the Inter-Municipal Alternative: The Town of Portland would need to construct a forcemain between its existing treatment facility and the Mattabassett District facility; a large portion of which would be constructed under the Connecticut River. Placing the proposed forcemain on the CT DOT Arrigoni Bridge (CT Route 66) was investigated and not found to be viable. The existing wastewater treatment facility in Portland would be converted to a main pumping station to convey all of the Town's wastewater to the Mattabassett District. Under this alternative, the existing inlet structure at the Plant would need to be upgraded and the existing tankage at the facility would need to modified to serve as holding facility.

The Capital Costs required to reconfigure the Portland treatment plant to a regional wastewater pumping station and to install the force main to the Mattabassett District are estimated to be approximately **$3,600,000** (1999 dollars). Annual Operations and Maintenance Costs are estimated to be **$120,000**.

Outcome: Based on the determination made by the governing body of the Town, the Town of Portland has decided not to work toward conveying its sewage to the Mattabassett District.

Summary: The Mattabassett District

This Section of the Epilogue supersedes the respective sections of Chapter 5.

Revised Flow Projections

The Preliminary flow history and flow projections, as represented in the Draft report of June 8, 1998, were based on numerous discussions and meetings with each of the current constituent member communities of the District as well as the planned three new members of the District.

Since that draft report, not only have the Towns of Portland and Plainville withdrawn from the study, numerous other minor adjustments in flow projections have been made, the result of which is a final estimate of flow projections from all interested communities, as represented in Table ES-1 below.

Table ES-1
THE MATTABASSETT DISTRICT WPCF
Summary of Flow Projections
(with Plainville & Portland NOT part of the District)
(flows in millions of gallons per day)

Name of Town	Current Year ADF	Initial Year 2000			Design Year 2020		
		ADF	SWWF	PEAK	ADF	SWWF	PEAK
Berlin	2.00	3.11	3.74	10.90	3.29	3.96	9.50
Cromwell	2.50	3.32	3.76	15.20	3.50	4.02	12.40
New Britain	14.00	14.02	16.80	54.20	13.50	15.95	42.10
MDC	0.50	2.11	2.65	5.70	3.17	4.13	7.80
Middletown (Westfield)	1.00	2.36	2.70	9.70	3.00	3.64	9.10
Subtotal	20.00	24.92	29.65	95.70	26.46	31.70	80.90
Middletown (POTW)	5.00	4.97	5.71	22.30	4.93	5.81	19.50
Middletown (River Road)	0.00	0.73	0.98	1.56	0.96	0.98	1.66
Plainville	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portland	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	25.00	30.62	36.34	119.56	32.35	38.49	102.06
BASIS OF DESIGN	25.00	30.00	35.00	120.00	32.00	38.00	100.00

With the above updated flow projection information as a reference, the "BASIS-OF-DESIGN" flows for the evaluation of the Mattabassett WPCF upgrade alternatives were established and are presented in Table ES-2.

Table ES-2
THE MATTABASSETT DISTRICT WPCF
"Basis-of-Design" Flow Rates
(flows in millions of gallons per day)

Design Parameter	Current Flow (1999)	Design Flow (2020)
Average Daily Flow	25	32
Sustained Wet Weather Flow	29	38
Peak Hour Flow	100	120

In arriving at these flow projections, two conditions were evaluated.

The first condition, termed **"Current Flows"**, was based on the most recent flow information at both the Mattabassett WPCF and the City of Middletown POTW. These flow projections are based on the average of the last three years' flow data from both of the respective WPCFs. These flow parameters were used to determine how the treatment process at the Mattabassett WPCF would need to be modified "today" to accept flows from the City of Middletown POTW. "Today", for terms of this study, is defined as the year 1999. For this reason, the flows used **DO NOT** reflect growth, increased flow allocations for existing members, or changes in flow from continued deterioration of piping nor from the implementation of I/I improvements by either the City of Middletown or the current members of the Mattabassett District.

The second condition, termed **"Design Flows"**, provides for the management of the anticipated 2020 flows and was used in Alternatives 2,3, and 4 in the *Revised Alternatives Analysis* below. With the exception of the Peak Hour design flow, these flows **DO** anticipate the implementation of I/I improvements throughout the communities listed above. The peak hour flows were derived from the "Initial Year 2000" condition determined during earlier stages of this study. This flow data differs from the "Current Flows" definition above in that it includes the flow allocations based on what the individual communities requested for their "initial" year flows - it is a calculated value and is higher in value then the actual value recorded at the facilities. The higher peak hour flow is included in anticipation of needing capacity to accept the largest possible flow until each of the communities has completed their I/I improvements.

Revised Description of Alternatives

The analyses done in Chapter 5 for the *local alternative* remain unchanged. However, four *inter-municipal* alternatives were evaluated as part of this revised analysis of the Mattabassett WPCF:

1. Current Flow	BOD_5 removal only
2. Design Flow	BOD_5 removal only
3. Design Flow	A/O Process
4. Design Flow	A/O Process followed by denitrification filters

Both Alternative No. 1 and No.2 ("BOD_5 removal only") were evaluated to determine what unit processes would be required to provide the same level of treatment the Mattabassett WPCF currently provides. The first alternative was evaluated for the purpose of determining potential capital and operating costs for the City of Middletown under "current conditions" (i.e. current flow and permit conditions). The feasibility of constructing this alternative would depend upon negotiations with the CT DEP and their decision as to whether the need to meet expected future permit conditions would be required as part of any facility upgrade.

Alternative No. 2 was developed for design flow conditions to apportion costs between Middletown and the existing Mattabassett constituent and contractual members based on their capacity requirements beyond their current allocation. This alternative also includes odor control improvements as well as upgrades needed to continue to meet current permit conditions.

For the remaining two alternatives, the A/O process was used to provide the treatment required to achieve an effluent total nitrogen (TN) of 6 to 8 mg/L (the 2009 DEP target). The A/O process followed by denitrification filters was used as the required unit process to achieve an effluent TN of 3 to 4 mg/L (the 2014 DEP target).

Each alternative was evaluated based on the methodology used to perform the hydraulic analysis, process analysis, and odor management analysis conducted on the Mattabassett WPCF as part of the original phase of this feasibility study. A general discussion of each of these analyses is presented in the remainder of this report.

<u>1. Current Flows - BOD_5 Removal Only</u>

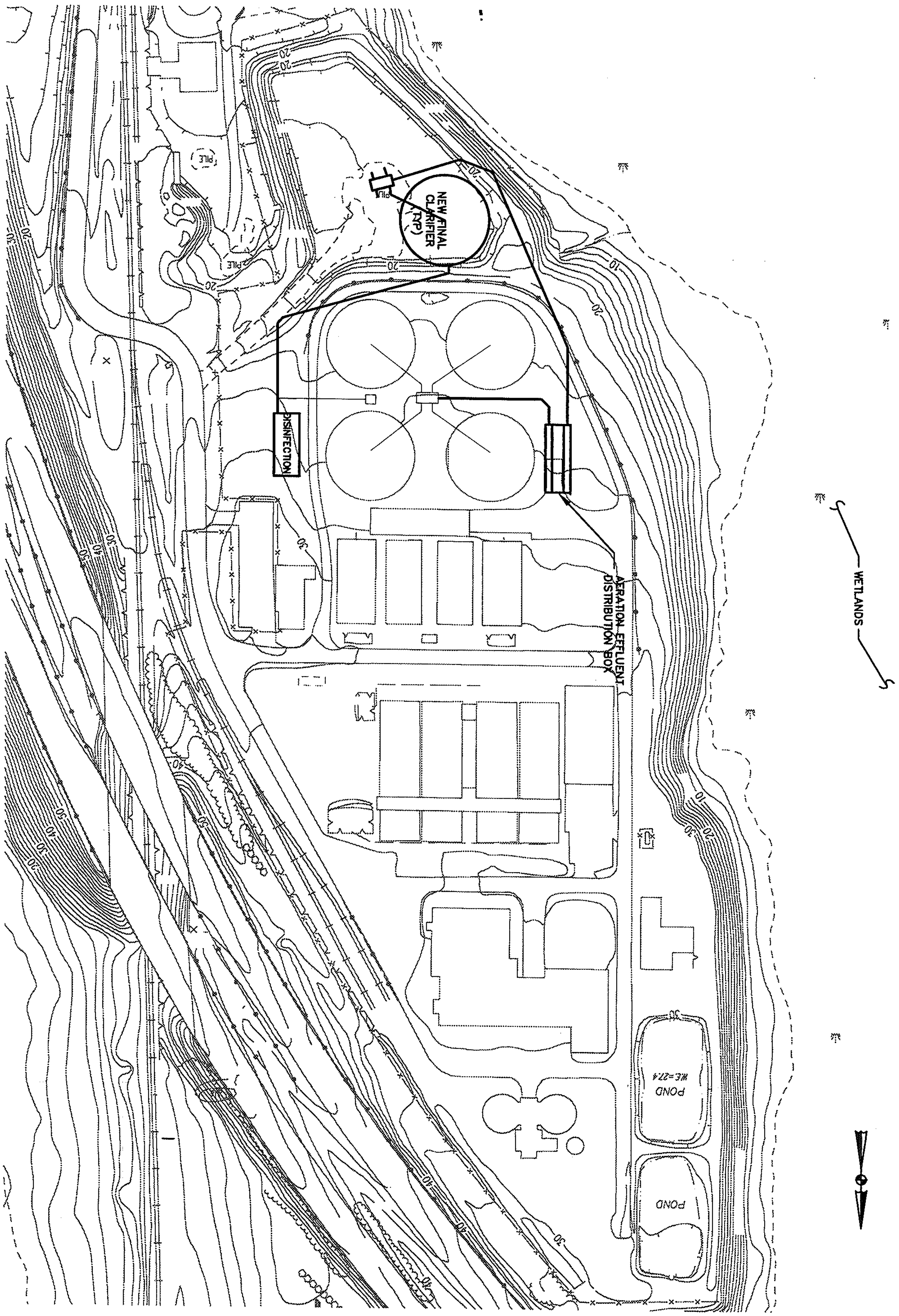
As described above, the BOD_5 removal only alternative was evaluated to determine potential capital and operating costs for the City of Middletown under current conditions. Therefore, these modifications include only those necessary to provide the same level of treatment with the current projected average daily flow rate of 25 mgd which includes the Middletown POTW flows. The required Mattabassett WPCF modifications have been laid out in a manner that would easily facilitate any future modifications required to address future design flows, the anticipated regulatory issues of nitrogen removal, peak flow management, odor control improvements and dechlorination. Modifications to the existing outfall chamber would be required at this time. For example, piping modifications have been sized and laid out to accommodate future flows and layouts. This alternate would also require the addition of a chlorine contact tank to provide adequate hydraulic capacity at peak flows (120 mgd) and to provide an equivalent chlorine contact time to that currently provided.

The existing Mattabassett WPCF reportedly provides secondary treatment for flows up to 40 mgd, flows in excess of 40 mgd receive primary treatment and are blended with secondary effluent prior to chlorination and discharge and bypasses primary effluent flow in excess of 40 mgd. Based on a design average flow rate of 20 mgd, the existing secondary treatment facilities provide for a peaking factor of 2.0. Therefore, for this alternative, it was assumed that the expanded secondary facilities would also provide for a peaking factor of 2.0 or a peak hour flow rate of 50 mgd.

The modifications required to provide the same level of treatment as the existing WPCF at the current average flow rate of 25 mgd, including Middletown POTW flows include:

- Install one new comminutor in one of the channels provided for "future" comminutors.
- Modify the piping between the primary clarifiers and aeration tanks and eliminate the venturis.
- Raise the effluent weirs in the aeration tanks by approximately one foot.
- Install an aeration tank effluent distribution chamber and new piping to the final clarifier distribution chambers.
- Install one additional final clarifier.
- Install a chlorine contact tank to provide 15 minutes detention time at 50 mgd.
- Modify the outfall structure to eliminate the overflow/vertical piping section.
- Install a new 84-inch diameter outfall diffuser or a parallel 60-inch diffuser to discharge the peak hour flow rate of 100 mgd.

A conceptual site plan which shows the proposed modifications is presented in Figure ES-1.



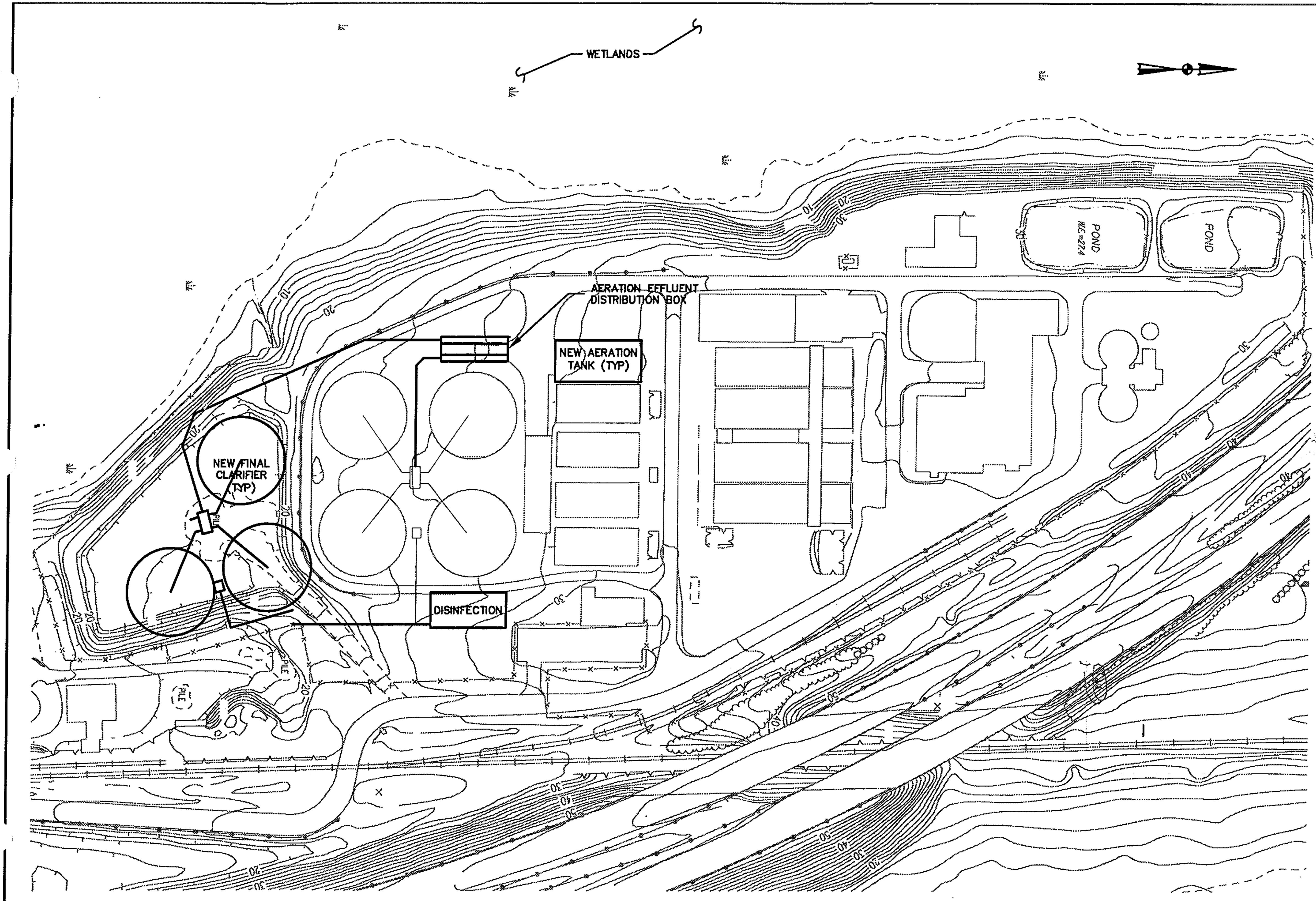
MATTABASSETT INTER-MUNICIPAL STUDY	SCALE: Not To Scale
MATTABASSETT DISTRICT WPCP SITE PLAN	DATE: October 8, 1999
CURRENT FLOWS – BOD REMOVAL ONLY	**Figure ES-1**

2. Design Flows - BOD_5 Removal Only

The modifications required to provide the same level of treatment as the existing WPCF at the year 2020 design average flow rate of 32 mgd, including Middletown POTW flows include:

- Modify the raw sewage pumps to provide peak flow capacity with a pump out of service.
- Install two new comminutors in the channels provided for "future" comminutors.
- Modify the piping between the primary clarifiers and aeration tanks and eliminate the venturis.
- Raise the effluent weirs in the aeration tanks be approximately one foot.
- Install one new aeration tank to provide a total aeration volume of 4.4 million gallons.
- Install an aeration tank effluent distribution chamber and new piping to the final clarifier distribution chambers.
- Install three additional final clarifiers.
- Odor control improvements would be provided including:
    - Covering the existing and new aeration tanks and venting the space beneath the covers through a biofilter odor control system.
    - Covering the existing and new secondary clarifier effluent launders and venting the space beneath the covers through a biofilter odor control system.
- Install a chlorine contact tank to provide 15 minutes detention time at 70 mgd.
- Modify the outfall structure to eliminate the overflow/vertical piping section.
- Install a new 84-inch diameter outfall diffuser or a parallel 60-inch diffuser to discharge the peak hour flow rate of 120 mgd.

A conceptual site plan which illustrates the proposed modifications is presented in Figure ES-2.



MATTABASSETT INTER-MUNICIPAL STUDY

MATTABASSETT DISTRICT WPCP SITE PLAN

DESIGN FLOWS – BOD REMOVAL ONLY

SCALE: Not To Scale

DATE: October 8, 1999

Figure ES-2

3. Design Flows -A/O Process (DEP 2009 total nitrogen reduction target)

To convert the existing Mattabassett WPCF to an A/O process with the capacity to treat 32 mgd including the Middletown POTW flows under year 2020 conditions would require the following modifications:

- Modify the raw sewage pumps to provide peak flow capacity with one pump out of service.

- Install two new comminutors in the channels provided for "future" comminutors.

- Provide a total aeration system volume of 10 million gallons:

    - The existing aeration tanks have a water depth of approximately 20 feet. The walls on the existing aeration tanks would be raised to provide a total water depth of 25 feet. The existing tanks would be converted to four-pass, plug-flow aeration tanks which could be operated in the contact stabilization, step feed mode. This would be accomplished by installing baffles to create an anoxic zone in each pass and installing submersible mixers in each pass. The existing diffused aeration equipment would be modified to provide fine bubble diffused aeration in each of the passes of each tank.

    - In addition, five new four-pass, plug-flow aeration tanks of slightly larger dimensions than the existing tanks would be installed with a water depth of 25 feet. The tanks would be designed to operate in the contact stabilization, step feed mode.

- As discussed in the hydraulic analysis, a primary effluent pumping station/flow distribution chamber would be installed to split the flow proportionately between all in-service aeration tanks.

- Because of the increased discharge pressures associated with increasing the water depth in the aeration tanks to 25 feet, it would be necessary to replace (or upgrade, if possible), the existing blowers with new blowers than can operate at the higher discharge pressures.

- Four new secondary clarifiers with the same dimensions as the existing final clarifiers would have to be installed.

- A chlorine contact tank which provides 15 minutes detention time at 120 mgd would be required.

- A dechlorination system, such as a sodium bisulfite system would be required.

- The outfall chamber would be modified to eliminate the standpipe.

- Install a new 84-inch diameter outfall diffuser or a parallel 60-inch diffuser to discharge the peak hour flow rate of 120 mgd.

- Four gravity thickeners would be installed for WAS thickening.

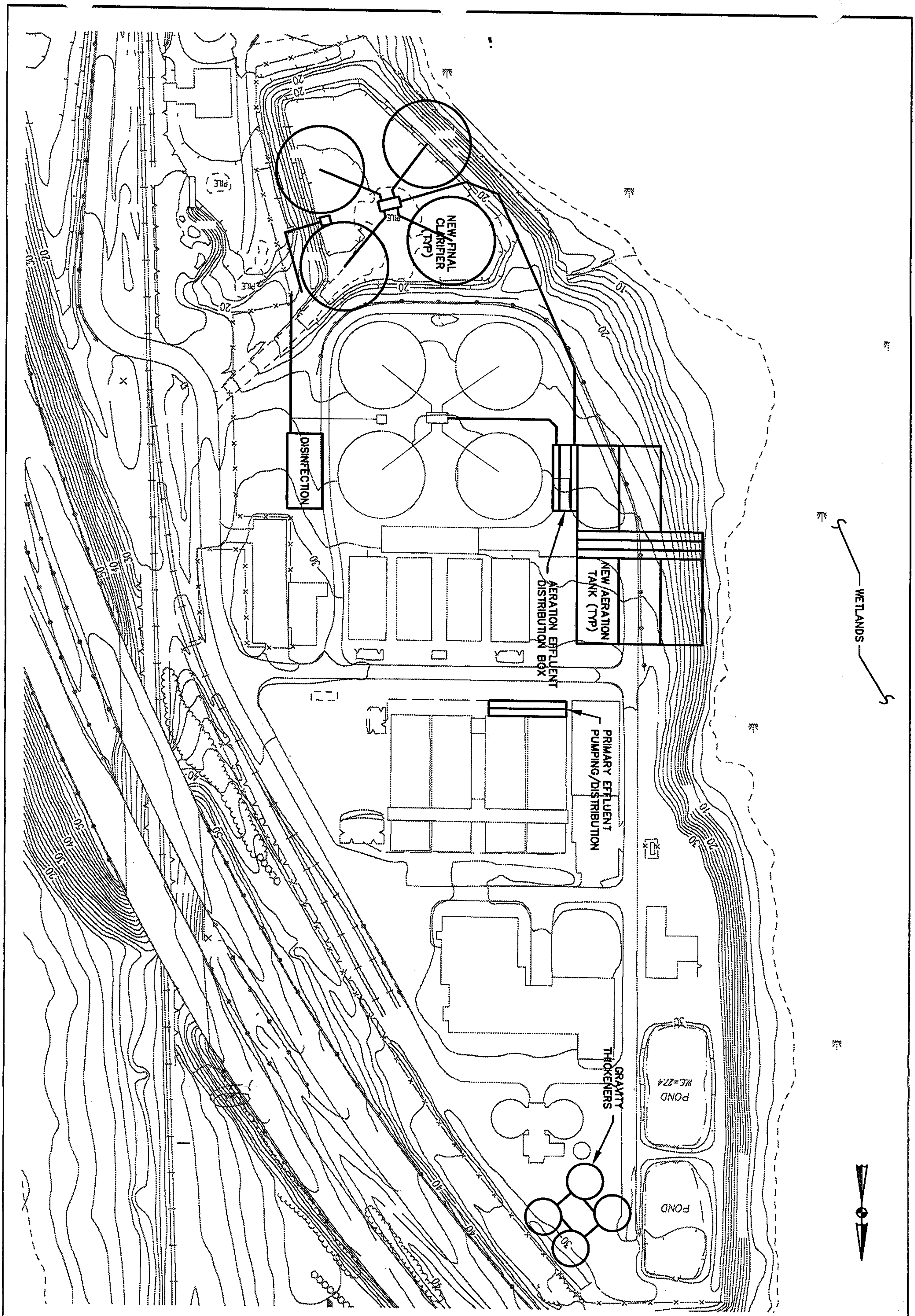
- Odor control improvements would be provided including:

    - Covering the existing and new aeration tanks and venting the space beneath the covers through a biofilter odor control system.

    - Covering the existing and new secondary clarifier effluent launders and venting the space beneath the covers through a biofilter odor control system.

    - Covering the new WAS gravity thickener tanks and venting the space beneath the covers through a biofilter odor control system.

A preliminary site plan which shows the proposed modifications is presented in Figure ES-3.



MATTABASSETT INTER MUNICIPAL STUDY

MATTABASSETT DISTRICT WPCP SITE PLAN

DESIGN FLOWS – A/O PROCESS (DEP 2009 TARGET)

SCALE: Not To Scale

DATE: October 8, 1999

Figure ES-3

4. Design Flows - A/O Process Followed by Denitrification Filters (DEP 2014 total nitrogen reduction target)

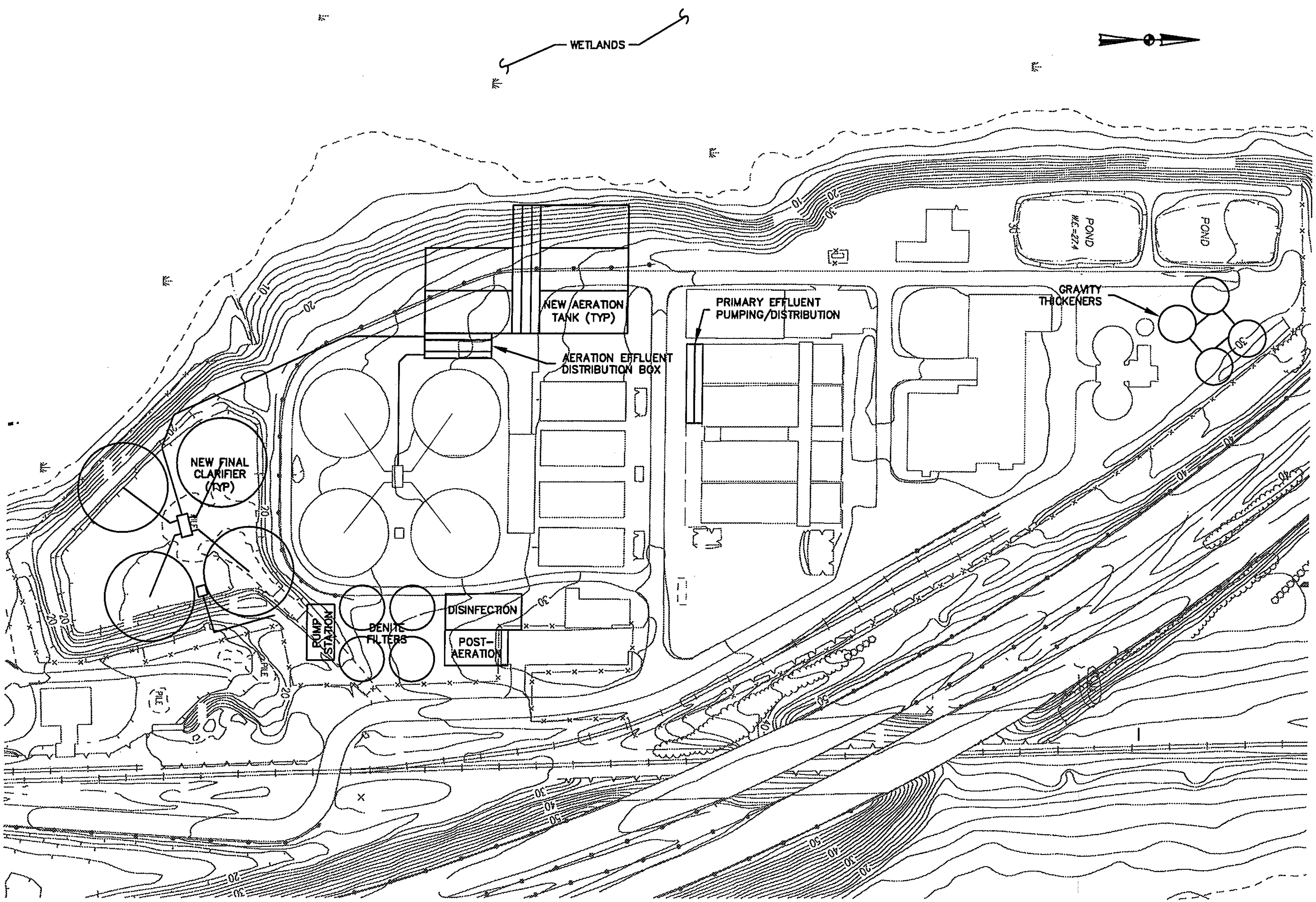
The modifications required for this alternative would include all those listed above for the A/O Process above and, in addition, the following modifications would also be necessary:

- Install a secondary effluent pump station with a peak capacity of 87.5 mgd to lift secondary effluent up to new denitrification filters. Flows in excess of 87.5 mgd would bypass the denitrification system.

- Install four new packed bed denitrification filters (approximately 60 feet in diameter).

- Install a post aeration system designed to re-aerate only flows that pass through the denitrification filters.

A preliminary site plan which shows the proposed modifications is presented in Figure ES-4.



MATTABASSETT INTER MUNICIPAL STUDY

MATTABASSETT DISTRICT WPCP SITE PLAN

DESIGN FLOWS – A/O, DENITE FILTER (DEP 2014 TARGET)

SCALE: Not To Scale

DATE: October 8, 1999

Figure ES-4

Revised Capital Costs

Based on the process and hydraulic analyses presented in the original report, preliminary "order-of-magnitude" capital costs for each of the four revised alternatives were developed. In addition, preliminary annual operating costs were developed. The annual operating costs were developed by determining "order-of-magnitude" costs for the additional unit processes for each alternative and are based on additional power costs and chemical costs for sodium hypochlorite, sodium bisulfite, and methanol when appropriate. In addition, annual labor costs were included for the alternative which include denitrification filters. So that these O&M costs can be compared to others throughout this document, these additional annual costs were then added to the actual fiscal year 1997 costs at the Mattabassett District WPCF.

The capital costs include a 15 percent contingency and 20 percent for technical services (design engineering, construction administration, resident engineering, and start-up services) and are presented in 1999 dollars. The costs do not include any administrative, legal, or other fiscal costs incurred by the Mattabassett District associated with the design or construction of these modifications.

The specific modifications required for each of the four alternatives are outlined above. A summary of the preliminary, order-of-magnitude capital and annual operation and maintenance (O&M) costs for each of the four alternatives are presented in Table ES-3.

More detailed costs are presented in Tables ES-4 through ES-7.

Table ES-3
THE MATTABASSETT DISTRICT
Summary of Preliminary, Order-of-Magnitude Costs

Alternative	Capital Cost (1999 Dollars)	O&M Cost (1997 Dollars)
Current Flows – BOD_5 Removal Only	$8,600,000	$4,147,000
Design Flows – BOD_5 Removal Only	$28,000,000	$4,328,000
Design Flows - A/O Process (2009 Target)	$57,800,000	$4,912,000
Design Flows - A/O–Denite Filter Process (2014 Target)	$91,000,000	$5,562,000

Table ES-4
THE MATTABASSETT DISTRICT WPCF
Current Flows - BOD5 Removal Only

		Est. Component Cost	Est. Total Cost
Headworks			
New comminutor (1)		$135,000	
			$135,000
Aeration Tank Effluent Distribution Box			
Effluent distribution/piping to existing & new clarifiers		$972,000	
			$972,000
Final Clarifiers			
Clarifiers		$2,088,000	
Distribution box/piping		$260,000	
			$2,348,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,290,000	
Tank effluent piping		$125,000	
			$1,415,000
Outfall Modifications			
Outfall structure modifications		$280,000	
Outfall diffuser piping modifications		$546,000	
			$826,000
	SUBTOTAL		$5,700,000
INSTRUMENTATION	5%		$285,000
ELECTRICAL	5%		$285,000
	SUBTOTAL		$6,300,000
CONTINGENCY	15%		$900,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$7,200,000
ENGINEERING, CONSTRUCTION ADMINISTRATION AND OBSERVATION	20%		$1,400,000
	TOTAL PROJECT COST =		***$8,600,000***

Annual O&M Costs		
FY 97 Actual Expenditures	$4,019,222	
Additional Electrical Costs	$94,400	
Additional Chemical Costs	$33,500	
Additional Labor Costs	$0	
TOTAL ANNUAL O&M COSTS		**$4,147,000**

Table ES-5
THE MATTABASSETT DISTRICT WPCF
Design Flows - BOD5 Removal Only

		Est. Component Cost	Est. Total Cost
Headworks			
Modify raw sewage pumps		$660,000	
New comminutors (2)		$270,000	
			$930,000
Aeration Tank Modifications			
Raise walls 2 feet		$244,000	
Modify diffusers in two tanks		$60,000	
Install fine bubble diffusers in two tanks		$180,000	
			$484,000
New Aeration Tank			
Aeration tank		$1,287,000	
Aeration equipment		$90,000	
Effluent distribution/piping		$1,112,000	
			$2,489,000
Final Clarifiers			
Clarifiers		$5,529,000	
Distribution box/piping		$300,000	
			$5,829,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,793,000	
Tank effluent piping		$180,000	
			$1,973,000
Outfall Modifications			
Outfall structure modifications		$280,000	
Outfall diffuser piping modifications		$546,000	
			$826,000
Odor Control			
Aeration Tanks		$3,740,000	
Final Clarifiers		$650,000	
			$4,390,000
	SUBTOTAL		$16,900,000
INSTRUMENTATION	10%		$1,690,000
ELECTRICAL	10%		$1,690,000
	SUBTOTAL		$20,300,000
CONTINGENCY	15%		$3,000,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$23,300,000
ENGINEERING, CONSTRUCTION ADMINISTRATION AND OBSERVATION	20%		$4,700,000
		TOTAL PROJECT COST =	**$28,000,000**

Annual O&M Costs		
FY 97 Actual Expenditures	$4,019,222	
Additional Electrical Costs	$228,700	
Additional Chemical Costs	$80,400	
Additional Labor Costs	$0	
TOTAL ANNUAL O&M COSTS		$4,328,000

Table ES-6
THE MATTABASSETT DISTRICT WPCF
Design Flows - A/O Process (Target Year 2009)

		Est. Component Cost	Est. Total Cost
Headworks			
Modify raw sewage pumps		$660,000	
New comminutors (2)		$270,000	
			$930,000
Primary Effluent Pumping/Distribution			
Pumps		$400,000	
Distribution Box		$644,000	
Piping		$124,000	$1,168,000
Aeration Tank Modifications			
Raise walls, create four-pass configuration		$2,196,000	
Aeration modifications		$180,000	
Baffles and mixers for A/O		$960,000	$3,336,000
New Aeration Tanks			
Five new aeration tanks		$7,412,000	
Aeration equipment		$673,000	
Replace existing blowers		$900,000	
Baffles and mixers for A/O		$1,200,000	
Aeration tank effluent distribution/piping		$1,112,000	$11,297,000
Final Clarifiers			
Clarifiers		$7,372,000	
Distribution Box/Piping		$300,000	
Density Current Baffles		$412,000	$8,084,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,793,000	
Dechlorination		$351,000	
Tank effluent piping		$180,000	$2,324,000
Outfall Modifications			
Outfall structure modifications		$280,000	
Outfall diffuser piping modifications		$546,000	$826,000
Odor Control			
Aeration Tanks		$3,366,000	
Final Clarifiers		$743,000	
Gravity Thickeners		$518,000	$4,627,000
WAS Thickening			
Gravity thickeners		$1,800,000	
Pump building/pumps		$440,000	
WAS pumping/piping modifications		$100,000	$2,340,000
	SUBTOTAL		$34,900,000
INSTRUMENTATION	10%		$3,490,000
ELECTRICAL	10%		$3,490,000
	SUBTOTAL		$41,900,000
CONTINGENCY	15%		$6,300,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$48,200,000
ENGINEERING, CONSTRUCTION ADMINISTRATION AND OBSERVATION	20%		$9,600,000
	TOTAL PROJECT COST =		*$57,800,000*
Annual O&M Costs			
FY 97 Actual Expenditures		$4,019,222	
Additional Electrical Costs		$707,700	
Additional Chemical Costs		$185,300	
Additional Labor Costs		$0	
	TOTAL ANNUAL O&M COSTS		$4,912,000

Table ES-7

THE MATTABASSETT DISTRICT WPCF

Design Flows - A/O Process - Denitrification Filters (Target Year 2014)

		Est. Component Cost	Est. Total Cost
Headworks			
Modify raw sewage pumps		$660,000	
New comminutors (2)		$360,000	$1,020,000
Primary Effluent Pumping/Distribution			
Pumps		$400,000	
Distribution Box		$644,000	
Piping		$124,000	$1,168,000
Aeration Tank Modifications			
Raise walls, create four-pass configuration		$2,196,000	
Aeration modifications		$180,000	
Baffles and mixers for A/O		$960,000	$3,336,000
New Aeration Tanks			
Five new aeration tanks		$7,412,000	
Aeration equipment		$673,000	
Replace existing blowers		$900,000	
Baffles and mixers for A/O		$1,200,000	
Aeration tank effluent distribution/piping		$1,112,000	$11,297,000
Final Clarifiers			
Clarifiers		$7,372,000	
Distribution Box/Piping		$300,000	
Density Current Baffles		$412,000	$8,084,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,793,000	
Dechlorination		$351,000	
Tank effluent piping		$180,000	$2,324,000
Denitrification			
Denitrificaiton filter pump station		$2,070,000	
Denitrificaiton filters		$16,650,000	
Post Aeration		$1,142,000	$19,862,000
Outfall Modifications			
Outfall structure modifications		$280,000	
Outfall diffuser piping modifications		$546,000	$826,000
Odor Control			
Aeration Tanks		$3,366,000	
Final Clarifiers		$743,000	
Gravity Thickeners		$518,000	$4,627,000
WAS Thickening			
Gravity thickeners		$1,800,000	
Pump building/pumps		$440,000	
WAS pumping/piping modifications		$100,000	$2,340,000
	SUBTOTAL		$54,900,000
INSTRUMENTATION	10%		$5,490,000
ELECTRICAL	10%		$5,490,000
	SUBTOTAL		$65,900,000
CONTINGENCY	15%		$9,900,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$75,800,000
ENGINEERING, CONSTRUCTION ADMINISTRATIO AND OBSERVATION	20%		$15,200,000
	TOTAL PROJECT COST =		***$91,000,000***
Annual O&M Costs			
FY 97 Actual Expenditures		$4,019,222	
Additional Electrical Costs		$974,000	
Additional Chemical Costs		$418,900	
Additional Labor Costs		$150,000	
	TOTAL ANNUAL O&M COSTS		$5,562,000

Summary: Cost Analysis

This Section of the Epilogue supersedes the respective sections of Chapter 6.

Introduction

A financial analysis of the Inter-municipal Alternative as compared to the Local Alternative was performed to assess the economic feasibility of connecting the Middletown (POTW) to the Mattabassett District Water Pollution Control Facility (WPCF). The capital and operations and maintenance (O&M) costs at the Mattabassett WPCF for the Inter-municipal Alternative were revised as described previously to include only Middletown POTW flows. The Local Alternative capital and O&M costs did not change from the analysis presented in Section 5.0. The methodology and assumptions used for this financial analysis were the same as that originally utilized to assess the economic feasibility of connecting Plainville, Portland, and Middletown, unless otherwise noted.

Inter-municipal vs. Local Alternative Cost Comparison

The Capital and O&M costs associated with the continued operation of the Middletown wastewater treatment facility are presented in Chapter 2. The capital and O&M costs associated with the expansion of the Mattabassett District Facilities to meet the current level of treatment (BOD_5 removal requirements) as well as to meet the State's 2009 goal for total nitrogen removal (A/O Process) and 2014 goal for total nitrogen removal (Level III Total Nitrogen Removal) are presented in Section 5.0 and as revised in the Epilogue.

These capital and O&M costs were proportionally allocated to all members based on their capacity allocations (including a share of costs to manage peak flows based on estimated FY 2010 peak hour capacity needs) and annual average daily flow allocations, respectively. Each member's capacity allocations and annual average daily flows, as revised in the Epilogue, are presented above.

The following presents our findings with respect to the financial modeling results comparing the Inter-municipal Alternative to the Local Alternative.

<u>Middletown (POTW)</u>

As illustrated in Table ES-8, under the Inter-municipal Alternative Middletown would be required to invest approximately $5.85 million in capital and approximately $120,000 per year in O&M costs for construction, operation and maintenance of conveyance facilities to the Mattabassett WPCF. Based on a capital recovery factor of approximately 0.0872 (6% interest for 20 years) the

20 years) the estimated annual costs for these conveyance facilities would be approximately $630,000 per year. In addition, Middletown would be required to pay an annual service charge to the Mattabassett District for its share of the cost of WPCF expansion, operation and maintenance to meet 2009 and 2014 total nitrogen reduction goals. As illustrated in Table ES-8, the annual service charge to meet the 2009 goal is estimated to be approximately $2,999,000 annually. The total annual cost to Middletown for the Inter-municipal Alternative to meet the 2014 goal is estimated to be $3,629,000 annually.

Table ES-9 presents the estimated annual capital and O&M costs to Middletown for the Local Alternative. The estimated Local Alternative costs to meet the 2009 and 2014 goals are $3,441,000 and $4,227,000, respectively. A comparison of the annual costs presented in Tables ES-14 and ES-15 for the Inter-municipal Alternatives, illustrates that the Inter-municipal Alternative would provide Middletown with an annual savings of approximately $451,000 and $598,000 for the 2009 and 2014 goals, respectively.

Mattabassett District Members

Tables ES-14 and ES-15 present the estimated first year annual capital and O&M costs for the Inter-municipal and Local Alternatives to meet 2009 and 2014 goals respectively for the existing Mattabassett District members as well as Middletown. As illustrated in these tables, the majority of the District members will realize an annual savings under the Inter-municipal Alternative beginning with the first year. It is estimated that the total Inter-Municipal Alternative savings realized in the first year would be on the order of $986,000 to meet 2009 total nitrogen reduction goals and $1,165,000 to meet the 2014 total nitrogen reductions goals in 1999 dollars. The exceptions are the Town of Cromwell and the Hartford MDC.

The Town of Cromwell's first year costs were identified to increase under the Inter-municipal Alternative due to costs associated with increasing their current allocation from 2.0 mgd to 3.5 mgd (a 75% increase in allocation). The Town of Cromwell's first year costs were also identified to increase as a result of the allocation of costs associated with handling peak flows. Specifically, the Town of Cromwell's average daily flow allocation represents less than 11% of the total average daily flow to the WPCF, but their peak flow represents more than 16% of the total peak flow to the WPCF.

The Hartford MDC costs were also identified to increase under the Inter-municipal Alternative due to the costs associated with increasing their current allocation from 1.6 mgd to 3.17 mgd (almost a 100% increase in allocation).

It should be noted, however, that the initial costs for both Cromwell and the Hartford MDC are later offset by the O&M savings realized over the 20 year planning period (see discussion below).

NPV Analysis

A net present value (NPV) comparison of the capital and O&M costs, based on a 20 year planning period and 6 percent NPV discount factor, is presented in Tables ES-16 and ES-17. Specifically, Table ES-16 summarizes the NPV costs, in 1999 dollars associated with meeting the 2009 total nitrogen reduction goals and Table ES-17 summarizes the NPV costs, in 1999 dollars associated with meeting the 2014 total nitrogen reduction goals. As identified in Tables ES-16 and ES-17, it appears that all members would realize an economic benefit under the Inter-municipal Alternative over the 20 year planning period.

Clean Water Act Funding

The capital improvements contemplated for both the Inter-municipal and Local Alternative may be eligible for funding through the Connecticut Clean Water Fund. Typically a 20 percent grant and 80 percent loan (at 2% interest) is provided to grant-eligible portions of projects.

Tables ES-10 through ES-13 were prepared to assess the potential impacts that this low cost funding mechanism may have on the findings. As illustrated in these tables, the economics under the Inter-municipal Alternative continue to be more favorable than those under the Local Alternative, especially for those communities which require a greater capital investment under the Inter-municipal Alternative than that under the Local Alternative. For example, the Town of Cromwell and Hartford MDC, which experience increased capital costs under the Inter-municipal Alternative as a result of increases in capacity allocations, would realize an increase in their savings if low cost funding were available to offset these capital cost increases.

With respect to Middletown, the increase in savings under the Inter-municipal Alternative is dramatic. A comparison of the annual savings for Middletown as identified in Tables ES-15 and ES-11, illustrate that the annual savings to meet 2014 goals would increase from $598,000 annually to $1,111,000 annually. A review of the capital costs to meet 2014 goals under the two alternatives reveals that the capital costs comprise 30 percent of the total annual cost for the Local Alternative and 70 percent of the annual cost for the Inter-municipal Alternative. As a result a 20% grant and 2% interest loan would serve to proportionately decrease these capital costs, thereby substantially increasing the savings to Middletown under the Inter-municipal Alternative.

Current Flow Analysis

In addition to the 2009 and 2014 alternatives, an analysis of the cost for an upgrade at the Mattabassett facility to accommodate current District and Middletown flows (25 mgd) under current permit conditions was performed. The scope and extent of these modifications are discussed previously in the Epilogue. The costs to Middletown would include the capital and operations costs associated with the new transmission facilities and a Mattabassett service fee that would include its share of the operations costs and the debt service on the required facility upgrades. As presented in Table ES-18, the annual cost to Middletown under this scenario is $1,507,000. This represents a savings in excess of $1,000,000 compared to the current Middletown treatment facility operating costs presented in Section 2.0. This alternative was evaluated for the purpose of determining potential capital and operating costs for the potential new members under current conditions. The feasibility of construction of this alternative would depend upon negotiations with the CT DEP and the need to meet expected future permit conditions as part of any facility upgrade. Modifications required to address the regulatory issues of nitrogen removal, peak flow management, odor control improvements and dechlorination were not included in this alternative.

Summary

The results indicate that for all communities the economics are more favorable under the Inter-municipal Alternative than under the Local Alternative. Although the capital costs associated with the Inter-municipal Alternative are generally higher than that under the Local Alternative, the O&M costs are significantly lower and more than offset these capital costs. These O&M savings are primarily due to the economies of scale associated with inter-municipal treatment at a single facility, rather than at individual local facilities. The overall savings associated with the Inter-municipal Alternative over the 20-year planning period is projected to be on the order of $31.82 million in 1999 dollars ($15.5 million for the existing Mattabassett District members and $16.32 million for Middletown) based on the NPV analysis.

In addition, because the capital costs associated with the Inter-municipal Alternative are generally higher than that for the Local Alternative, low cost funding alternatives such as the Connecticut Clean Water Fund would serve to proportionately decrease the annual cost of debt service on the capital costs for both alternatives. As such, the Inter-municipal Alternative would continue to be less costly than the Local Alternative under any lower cost funding alternative and in many instances will serve to increase the magnitude of the savings to be realized. In addition, the General Assembly has recently passed legislation allowing for a 30 percent grant / 70 percent low interest loan for those portions of eligible projects related to nitrogen reduction. This would make the Inter-municipal Alternative even more favorable.

TABLE ES-8

Middletown (POTW)
PRELIMINARY COSTS
for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSETT (meeting 2009 goals)				
		Local O&M	Local CAPITAL	Annual Cost (1) (1999 Dollars)
1.	Regional Pump Station, Force Main and STP Demolition/Site Restoration Capital Cost and O&M	$120,000	$5,850,000	$630,000
2.	Estimated Annual Service Charge to meet 2009 goals at the Mattabassett District (2)	-	-	$2,360,000
	TOTAL ANNUAL COST	$120,000	$5,850,000	$2,990,000

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)				
		Local O&M	Local CAPITAL	Annual Cost (1) (1999 Dollars)
3.	ADDITIONAL Annual Service Charge to Meet 2014 goals at the Mattabassett District (2)	-	-	$639,000

TOTAL ANNUAL COST (3)	$3,629,000

(1) Capital Recovery Factor (CRF) = .0872 at 6% interest for 20 years

(2) Estimated Annual Service Charge include communities share of annual O&M Costs and prorated share of annual debt service for capital improvements.

(3) Please note: these costs do not include any pre-exisiting debt service payment requirements.

TABLE ES-9

Middletown (POTW)
PRELIMINARY COSTS (1)(2)
for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (to meet 2009 goals)		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$2,700,000	$8,500,000
	ANNUAL SUBTOTAL	$2,700,000	$741,000
	ANNUAL COST (to meet 2009 goals)	$3,441,000	

ADDITIONAL LOCAL FACILITY UPGRADE COSTS (to meet 2014 goals)		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$100,000	$7,870,000
	ANNUAL SUBTOTAL	$100,000	$686,000
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$786,000	

TOTAL ANNUAL COST	**$4,227,000**

(1) Capital Recovery Factor (CRF) = .0872 at 6% interest for 20 years
(2) Please note, these costs do not include any pre-existing debt service payment requirements.

TABLE ES-10

COMPARISON SUMMARY OF COST ESTIMATES
FY 2000 ANNUAL COST TO MEET 2009 GOALS
- ASSUMES I/I REHABILITATION -

CWA FUNDING

(Values x's $1,000)

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Est. First Year Savings
	O&M	Capital (1)	Total	O&M	Capital (1)	Total	
1. New Britian	$1,015	$910	$1,925	$1,412	$1,096	$2,508	$583
2. Berlin	$225	$180	$405	$313	$253	$566	$162
3. Cromwell	$240	$367	$608	$334	$297	$631	$23
4. Middletown (Westfield)	$322	$209	$531	$388	$232	$620	$90
5. Hartford MDC	$287	$280	$568	$347	$226	$574	$6
District Subtotal	$2,089	$1,947	$4,036	$2,796	$2,104	$4,899	$863

6. Middletown (POTW+)							Estimated First Year Savings
Local O&M & Capital Costs	$120	$286	$406	$2,700	$416	$3,116	
Mattabassett Service Charge	$790	$881	$1,671	N/A	N/A	N/A	
Subtotal Middletown (POTW+)	$910	$1,167	$2,078	$2,700	$416	$3,116	$1,038

(1) Capital Recovery Factor (CRF) = .0612 at 2% interest for 20 years (assuming 20% grant and 80% loan)

TABLE ES-11

COMPARISON SUMMARY OF COST ESTIMATES
FY 2000 ANNUAL COST TO MEET 2014 GOALS
- ASSUMES I/I REHABILITATION -

CWA FUNDING

(Values x's $1,000)

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Est. First Year Savings
	O&M	Capital (1)	Total	O&M	Capital (1)	Total	
1. New Britian	$1,312	$1,589	$2,900	$1,637	$1,862	$3,499	$598
2. Berlin	$291	$345	$636	$363	$440	$803	$167
3. Cromwell	$311	$543	$854	$388	$495	$883	$29
4. Middletown (Westfield)	$371	$360	$731	$426	$402	$828	$97
5. Hartford MDC	$332	$439	$772	$381	$406	$787	$16
District Subtotal	$2,617	$3,277	$5,893	$3,195	$3,606	$6,800	$907

6. Middletown (POTW+)							Estimated First Year Savings
Local O&M & Capital Costs	$120	$286	$406	$2,800	$801	$3,601	
Mattabassett Service Charge	$913	$1,171	$2,084	N/A	N/A	N/A	
Subtotal Middletown (POTW+)	$1,033	$1,457	$2,490	$2,800	$801	$3,601	$1,111

'(1) Capital Recovery Factor (CRF) = .0612 at 2% interest for 20 years (assuming 20% grant and 80% loan)

TABLE ES-12

COMPARISON SUMMARY OF COST ESTIMATES
NET PRESENT VALUE
OVER THE 20 YEAR PLANNING PERIOD TO MEET 2009 GOALS
- ASSUMES I/I REHABILITATION -

CWA FUNDING

(Values x's $1,000)

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated Total Savings
	O&M NPV	Capital NPV	Total NPV	O&M NPV	Capital NPV	Total NPV	
1. New Britian	$16,837	$10,441	$27,279	$23,188	$12,570	$35,758	$8,479
2. Berlin	$3,904	$2,061	$5,965	$5,375	$2,900	$8,275	$2,311
3. Cromwell	$4,161	$4,215	$8,376	$5,729	$3,400	$9,129	$753
4. Middletown (Westfield)	$6,033	$2,399	$8,432	$7,252	$2,660	$9,912	$1,479
5. Hartford MDC	$5,862	$3,213	$9,074	$7,044	$2,595	$9,639	$565
District Subtotal	$36,797	$22,329	$59,126	$48,588	$24,125	$72,713	$13,587

6. Middletown (POTW+)							Estimated Total Savings
Local O&M & Capital Costs	$1,978	$5,850	$7,828	$44,508	$4,770	$49,278	
Mattabassett Service Charge	$12,608	$7,540	$20,148	N/A	N/A	N/A	
Subtotal Middletown (POTW+)	$14,586	$13,390	$27,976	$44,508	$4,770	$49,278	$21,302

'(1) Capital Recovery Factor (CRF) = .0612 at 2% interest for 20 years (assuming 20% grant and 80% loan)

TABLE ES-13

COMPARISON SUMMARY OF COST ESTIMATES
NET PRESENT VALUE
OVER THE 20 YEAR PLANNING PERIOD TO MEET 2014 GOALS
- ASSUMES I/I REHABILITATION -

CWA FUNDING

(Values x's $1,000)

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated Total Savings
	O&M NPV	Capital NPV	Total NPV	O&M NPV	Capital NPV	Total NPV	
1. New Britian	$18,237	$13,049	$31,286	$24,236	$15,520	$39,756	$8,470
2. Berlin	$4,240	$2,696	$6,936	$5,627	$3,620	$9,247	$2,311
3. Cromwell	$4,519	$4,891	$9,410	$5,997	$4,160	$10,157	$747
4. Middletown (Westfield)	$6,331	$2,979	$9,310	$7,475	$3,310	$10,785	$1,475
5. Hartford MDC	$6,169	$3,825	$9,994	$7,274	$3,285	$10,559	$566
District Subtotal	$39,496	$27,440	$66,936	$50,610	$29,895	$80,505	$13,568

6. Middletown (POTW+)							Estimated Total Savings
Local O&M & Capital Costs	$1,978	$5,850	$7,828	$45,015	$6,920	$51,935	
Mattabassett Service Charge	$13,203	$8,653	$21,855	N/A	N/A	N/A	
Subtotal Middletown (POTW+)	$15,181	$14,503	$29,683	$45,015	$6,920	$51,935	$22,251

'(1) Capital Recovery Factor (CRF) = .0612 at 2% interest for 20 years (assuming 20% grant and 80% loan)

TABLE ES-14

COMPARISON SUMMARY OF COST ESTIMATES
FY 2000 ANNUAL COST TO MEET 2009 GOALS
- ASSUMES I/I REHABILITATION -

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated First Year Savings
	O&M (X1000)	Capital (1) (X1000)	Total (X1000)	O&M (X1000)	Capital (1) (X1000)	Total (X1000)	
1. New Britain	$1,015	$1,622	$2,637	$1,412	$1,952	$3,365	$728
2. Berlin	$225	$320	$545	$313	$451	$764	$219
3. Cromwell	$240	$655	$895	$334	$529	$863	-$32
4. Middletown (Westfield)	$322	$373	$694	$388	$413	$802	$108
5. Hartford MDC	$287	$499	$787	$347	$403	$750	-$36
District Subtotal	$2,089	$3,469	$5,558	$2,796	$3,749	$6,545	$986

6. Middletown (POTW+)							Estimated First Year Savings
Local O&M & Capital Costs	$120	$510	$630	$2,700	$741	$3,441	
Mattabassett Service Charge	$790	$1,570	$2,360	N/A	N/A	N/A	
Subtotal Middletown (POTW+)	$910	$2,080	$2,990	$2,700	$741	$3,441	$451

(1) Capital Recovery Factor (CRF) = .087 at 6% interest for 20 years

TABLE ES-15

COMPARISON SUMMARY OF COST ESTIMATES
FY 2000 ANNUAL COST TO MEET 2014 GOALS
- ASSUMES I/I REHABILITATION -

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated First Year Savings
	O&M (X1000)	Capital (1) (X1000)	Total (X1000)	O&M (X1000)	Capital (1) (X1000)	Total (X1000)	
1. New Britain	$1,312	$2,831	$4,143	$1,637	$3,318	$4,955	$812
2. Berlin	$291	$615	$906	$363	$784	$1,147	$241
3. Cromwell	$311	$968	$1,279	$388	$883	$1,270	-$8
4. Middletown (Westfield)	$371	$641	$1,013	$426	$717	$1,143	$130
5. Hartford MDC	$332	$783	$1,115	$381	$724	$1,105	-$10
District Subtotal	$2,617	$5,839	$8,456	$3,195	$6,426	$9,620	$1,165

6. Middletown (POTW+)							Estimated First Year Savings
Local O&M & Capital Costs	$120	$510	$630	$2,800	$1,427	$4,227	
Mattabassett Service Charge	$913	$2,086	$2,999	N/A	N/A	N/A	
Subtotal Middletown (POTW+)	$1,033	$2,596	$3,629	$2,800	$1,427	$4,227	$598

(1) Capital Recovery Factor (CRF) = .0872 at 6% interest for 20 years

TABLE ES-16

COMPARISON SUMMARY OF COST ESTIMATES
NET PRESENT VALUE
OVER THE 20 YEAR PLANNING PERIOD TO MEET 2009 GOALS
- ASSUMES I/I REHABILITATION -

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated Total Savings
	O&M NPV (X1000)	Capital NPV (X1000)	Total NPV (X1000)	O&M NPV (X1000)	Capital NPV (X1000)	Total NPV (X1000)	
1. New Britain	$16,837	$18,606	$35,444	$23,188	$22,390	$45,578	$10,134
2. Berlin	$3,904	$3,672	$7,576	$5,375	$5,180	$10,555	$2,979
3. Cromwell	$4,161	$7,511	$11,672	$5,729	$6,060	$11,789	$117
4. Middletown (Westfield)	$6,033	$4,275	$10,308	$7,252	$4,740	$11,992	$1,683
5. Hartford MDC	$5,862	$5,725	$11,587	$7,044	$4,624	$11,669	$82
District Subtotal	$36,797	$39,789	$76,586	$48,588	$42,994	$91,582	$14,996

6. Middletown (POTW+)							Estimated Total Savings
Local O&M & Capital Costs	$1,978	$5,850	$7,828	$44,508	$8,500	$53,008	
Mattabassett Service Charge	$12,608	$18,011	$30,619	N/A	N/A	N/A	
Subtotal Middletown (POTW+)	$14,586	$23,861	$38,447	$44,508	$8,500	$53,008	$14,561

(1) Capital Recovery Factor (CRF) = .0872 at 6% interest for 20 years

TABLE ES-17

COMPARISON SUMMARY OF COST ESTIMATES
NET PRESENT VALUE
OVER THE 20 YEAR PLANNING PERIOD TO MEET 2014 GOALS
- ASSUMES I/I REHABILITATION -

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated Total Savings
	O&M NPV (X1000)	Capital NPV (X1000)	Total NPV (X1000)	O&M NPV (X1000)	Capital NPV (X1000)	Total NPV (X1000)	
1. New Britain	$18,237	$23,254	$41,491	$24,236	$27,640	$51,876	$10,385
2. Berlin	$4,240	$4,804	$9,045	$5,627	$6,460	$12,087	$3,043
3. Cromwell	$4,519	$8,716	$13,234	$5,997	$7,420	$13,417	$183
4. Middletown (Westfield)	$6,331	$5,308	$11,639	$7,475	$5,910	$13,385	$1,746
5. Hartford MDC	$6,169	$6,816	$12,985	$7,274	$5,854	$13,129	$144
District Subtotal	$39,496	$48,898	$88,394	$50,610	$53,284	$103,894	$15,500

							Estimated Total Savings
6. Middletown (POTW+)							
Local O&M & Capital Costs	$1,978	$5,850	$7,828	$45,015	$12,330	$57,345	
Mattabassett Service Charge	$13,203	$19,993	$33,196	N/A	N/A	N/A	
Subtotal Middletown (POTW+)	$15,181	$25,843	$41,024	$45,015	$12,330	$57,345	$16,320

(1) Capital Recovery Factor (CRF) = .0872 at 6% interest for 20 years

TABLE ES-18

Middletown (POTW)

PRELIMINARY COSTS

for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSETT (meeting BOD5 goal @25 MGD)		Local O&M	Local CAPITAL	Annual Cost (1) (1999 Dollars)
1.	Regional Pump Station, Force Main and STP Demolition/Site Restoration Capital Cost and O&M	$120,000	$5,850,000	$630,000
2.	Estimated Annual Service Charge to meet BOD5 goals at the Mattabassett District (2)	-	-	$877,900
	TOTAL ANNUAL COST	$120,000	$5,850,000	$1,507,900

(1) Capital Recovery Factor (CRF) = .0872 at 6% interest for 20 years
(2) Estimated Annual Service Charge include communities share of annual O&M Costs and prorated share of annual debt service for capital improvements.
(3) Please note: These costs do not include any pre-existing debt service payment requirements.

Chapter 1

CHAPTER 1 INTRODUCTION

Background

The major components of wastewater treatment facilities approach their useful life every twenty to thirty years, on average. Prior to the end of its useful life, the facility owner must evaluate which processes need to be upgraded, replaced, removed, or added to be able to treat current flows, as well as the flow anticipated over the next twenty years. Typically, a study will also look at the cost effectiveness of the available alternates for treatment; this sometimes includes evaluating the possibility of transporting the untreated sewage to another treatment facility in an adjacent community.

Some of the upgrades needed for the treatment process may be due to new or more stringent water quality mandates imposed by either the federal or local government. The CT Department of Environmental Protection (DEP) has issued Nitrogen Reduction Goals to all of the wastewater treatment facilities in Connecticut. A total reduction by approximately seventy percent (70%) from 1990 levels will be phased in over a fifteen (15) year period.

The treatment facilities at the Town of Plainville, the City of Middletown, and the Town of Portland are in need of upgrades. These upgrades are not only necessary because of the age of the facility, but also because of the nitrogen reduction goals issued by DEP.

The Town of Plainville constructed their treatment facility in the mid 1960's and has had one upgrade in the mid 1970's. Since this time, no other major renovations have taken place. Plainville has to start planning for the future, including the need for nitrogen reduction. In doing so, Plainville is looking at the possibility of conveying their sewage to the Mattabassett District and comparing this alternative to upgrading their local plant and continuing to treat their own sewage.

The City of Middletown's wastewater treatment facility had its most recent upgrade in 1977. Like Plainville, much of the equipment at the facility is in need of repair or replacement. With the additional requirements of nitrogen reduction and other potential water quality based treatment requirements, the City is looking at comparing the same two alternatives: sending their wastewater to the Mattabassett District or upgrading their treatment facility and continuing to treat their own sewage.

In addition, the study includes a discussion on transporting the wastewater from Pratt & Whitney (both pretreated industrial and domestic flows), Connecticut Valley Hospital, and Northeast Utilities to the proposed regional pump station that would be constructed to pump Middletown's wastewater to the Mattabassett District. In general, these three components would become part of Middletown's waste stream. Any arrangements for such an option would have to be held between the City of Middletown and the respective entity.

The Town of Portland has conducted multiple studies on determining the most cost effective means of handling their wastewater flow. The findings of these studies have been incorporated into this study. They, too, have investigated the options of sewering to Mattabassett versus upgrading their own treatment facility.

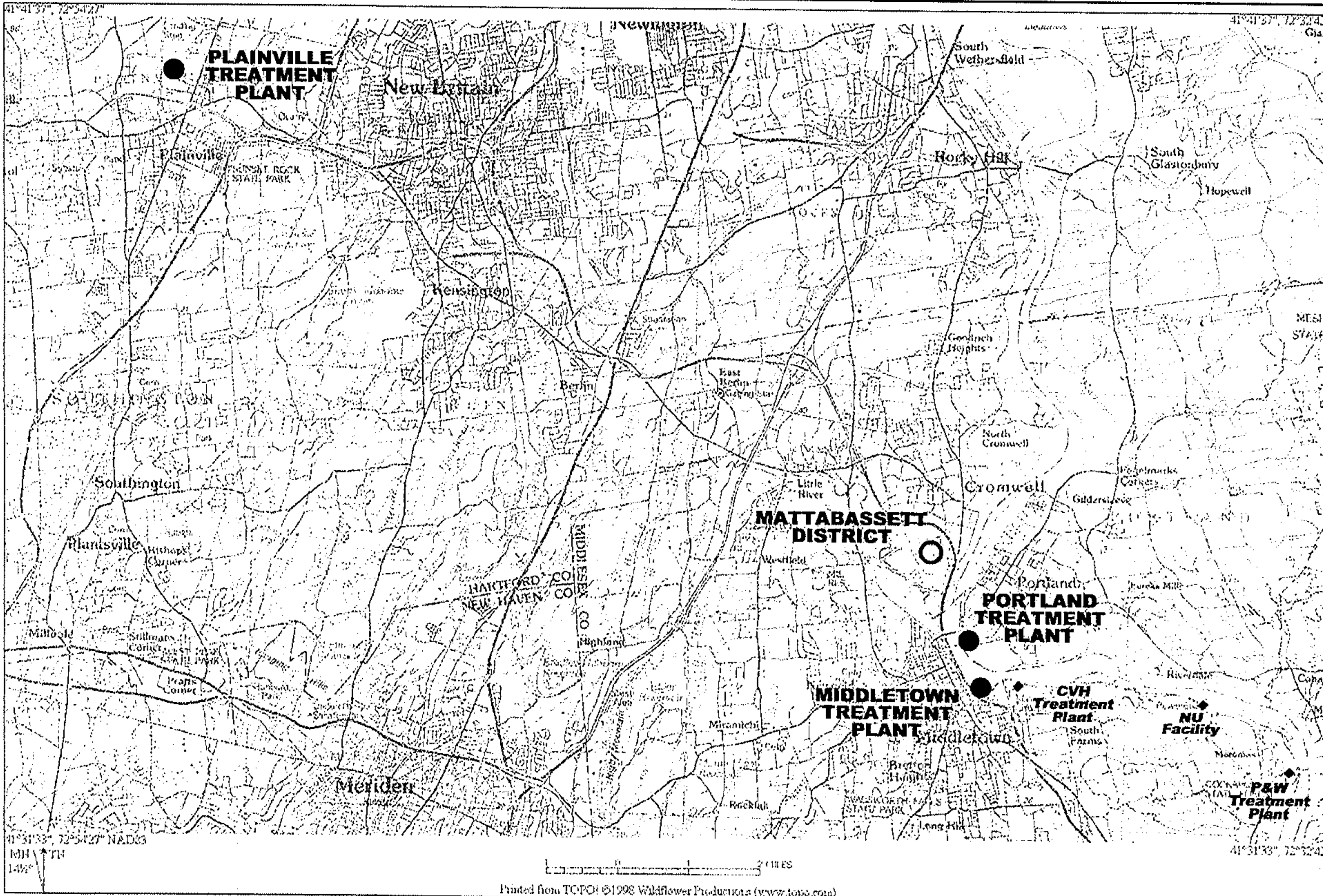
The Mattabassett District treatment facility was authorized by State Legislature and signed into law in 1961. The facility was constructed and placed in operation in December of 1968 to service the wastewater treatment needs of the municipalities of Berlin, Cromwell, and New Britain. These members are referred to as the "Constituent Members"; these members are the only entities that have representation on the Board of Directors. It is currently design to treat an average wastewater flow of 20 million gallons per day and a peak flow in excess of 40 MGD. The most recent upgrade to the facility was completed in 1990.

Over the years, contractual arrangements have been made with various outlying municipalities and entities to bring their wastewater and/or sludge to the Mattabassett District. The wastewater from the Westfield section of Middletown currently flows to the Mattabassett facility. In addition, sludge from the Middletown treatment facility is conveyed to Mattabassett for incineration via railway. The Metropolitan District sewers relatively small portions of their Rocky Hill and Newington wastewater drainage systems to Mattabassett. Finally, the facility accepts sludge for incineration from a number of outside sources.

Purpose and Scope

This report is being prepared to outline the general wastewater treatment needs of the existing member towns of the Mattabassett District (Berlin, Cromwell, and New Britain) and, in addition, the wastewater treatment needs of the municipalities of Middletown, Plainville, and Portland through the year 2020.

This study will explore the feasibility of transporting sewage from these three additional municipalities to the Mattabassett District Wastewater Treatment Facility, located in Cromwell Connecticut (Figure 1-1). This option will be compared with what is termed the "Local Alternative", which identifies the modifications needed for the respective municipalities to continue to treat their own wastewater. The impact of the additional flows at the Mattabassett treatment facility will also be investigated. In turn, the distribution of the resulting capital and operation costs to the users will be outlined.



MATTABASSETT INTER-MUNICIPAL STUDY

LOCATION PLAN

SCALE:	As Noted
DATE:	October 8, 1999

Figure 1-1

Methodology

The first part of this report discusses the existing wastewater flows and characteristics for the interested parties and establishes what the future flow would be through the year 2020. For the Mattabassett District, this included both the existing Constituent members (Berlin, Cromwell, and New Britain) and the District's Contractual members (MDC and the Westfield section of Middletown).

This forecast was done differently for each municipality, the specifics of which are included in Appendix E and are also discussed in the individual chapters. In some instances, the municipality provided the numbers they felt would best represent their future needs. This data was used in conjunction with common engineering practices to develop the necessary information.

Secondly, an issue dictating the sizing of each design concept was whether the peak flows needed to go through the full treatment process or whether the proposed peak flows would only need to receive primary treatment. A peaking factor of 2.5 was globally applied to the individual parties. Any flows that would enter the Mattabassett District greater than the allotted amount would be assessed a fine. This would encourage the individual contributors to keep their infiltration and inflow to a minimum.

The projected flow numbers were used to determine other components of this study. First, the individual numbers were used to determine the pump capacities needed to pump the sewage to Mattabassett. The flow information was also used to size the force mains. The combined sum of the projected flows was used to determine what processes at the Mattabassett District needed to be upgraded and to what capacity. Likewise, the individual projected flows were used to size future upgrades and processes at the respective local facilities under the "Local Alternative". Lastly, the projected flow numbers were used to allocate the cost of modifications to the District's facility among the users of the facility.

The existing treatment systems were inventoried to determine what processes needed to be upgraded or replaced under the local alternative. Likewise, new processes were identified to be implemented in order to meet the nitrogen reduction goals and other potential water quality based treatment objectives set forth by CT DEP. Costs for such upgrades were generated and used in the cost analysis of Chapter 6.

Several conveyance alternatives were developed for transporting the sewage from each respective municipality to the Mattabassett District. These alternatives were studied for the best route and a cost was developed to be used in the Cost Analysis. The implications of constructing these routes are discussed in the Environmental and Permitting Issues portion of the respective chapters.

Environmental concerns and issues where also identified. The largest issue that would take the most time and money, and that would yield an uncertain outcome, would be the need for

Plainville to acquire a Diversion Permit. The wastewater treatment facility at Plainville currently discharges their effluent to the Pequabuck River. The inter-municipal alternative sends this water to the Mattabassett District, which discharges to the Connecticut River. Thus, a Diversion Permit from the Connecticut DEP would be required. A discussion on what this involves is included in the Environmental and Permitting Issues portion of Chapter 3.

Report Organization

The Executive Summary, preceding this chapter, summarizes information gathered and subsequent decisions made throughout the duration of this study. This section also discusses the question "What do we do next? which has been raised by various individuals during the final phases of this document.

In general, the body of the report is organized so that with the exception of the cost analysis, each chapter talks specifically about all of the aspects of one municipality. Chapter 2 discusses of the issues related to the City of Middletown, Chapter 3 holds a discussion on the Town of Plainville, Chapter 4 outlines information for the Town of Portland, and Chapter 5 discusses the Mattabassett District.

These chapters are organized in the following fashion. After a brief introduction, the existing treatment systems are identified and any deficiencies and deficiencies noted. Project sewage flows are discussed, followed by a brief discussion on the regulatory issues pertaining to the study period. Next, a description of alternatives is discussed; this includes both a Local Alternative and a Inter-municipal alternative for each municipality. Finally, any environmental and permitting issues are discussed in the last portions of the chapter. Chapter 4, which discusses the Town of Portland, is organized in a more general fashion.

Chapter 6 provides the Cost Analysis for the alternatives generated in this study. There is a discussion on the local cost summary, the inter-municipal cost summary, and a cost comparison.

Public Participation Program

When inter-municipal projects are being studied and being funded with State funds, a public participation program is not only essential in obtaining input from the effected participants. Each municipality or entity related to the project has its own concerns about the potential of the project going through. A public participation program allows these individuals or groups to express their concerns as well as criticize or commend the efforts of those providing the study.

For the purposes of this study, Percival Communications of Avon, Connecticut, was hired to create such a program. The major tool used to allow the public to participate was a series of

“Public Participation Sessions”. Three sessions were held: one session each in Middletown, Cromwell, and Plainville. Each of these sessions focused on the issues related to the host community. A final session is planned in Cromwell to present the findings of the study.

In addition to these public sessions, press conferences were held. These conferences promoted the facts about the study and allowed the public to keep informed of the developing details. Articles appeared in several newspapers as a result of these conferences. The newspaper was also used as medium in which to inform the communities of the details of the public session, including the date, location, and time.

On a more personal note, several letters of invitation were sent to key local and environmental officials prior to the first meeting. This was done to ensure that these individuals were aware of the study being done during the earlier stages of the project.

Chapter 2

CHAPTER 2 CITY OF MIDDLETOWN

Introduction

The existing Middletown POTW facility is designed to treat an average daily flow (ADF) of 6.1 mgd and a peak flow rate of 15.25 mgd. The actual ADF for 1996 was 4.71 mgd, 3.96 mgd for 1997, and 4.41 mgd for 1998. Flows to the plant are presently bypassed around secondary treatment when flows exceed a sustained flow of 8.4 mgd. In the past, peak flow rates during severe storm events have been as high as 24 mgd. The City has been and remains in process of reducing its combined sewers to relieve the high peak flow rates.

If the treatment plant were to continue as a local facility, it would need to be expanded to accommodate only the present service area. Flows from Pratt and Whitney Aircraft, Northeast Utilities and Connecticut Valley Hospital and the estimated growth in the areas tributary to River Road are only included in the regional alternative. The flows from the Westfield section of Middletown which now are treated at Mattabassett District, would continue to be treated at Mattabassett. The ADF from the Westfield area of Middletown is about 2.3 mgd with peaks as high as 13 mgd. Currently, all of the sludge generated at the Middletown facility is transported, via railroad tanker, to the Mattabassett District. For the comparative purposes of this study, this practice is continued under the local alternative.

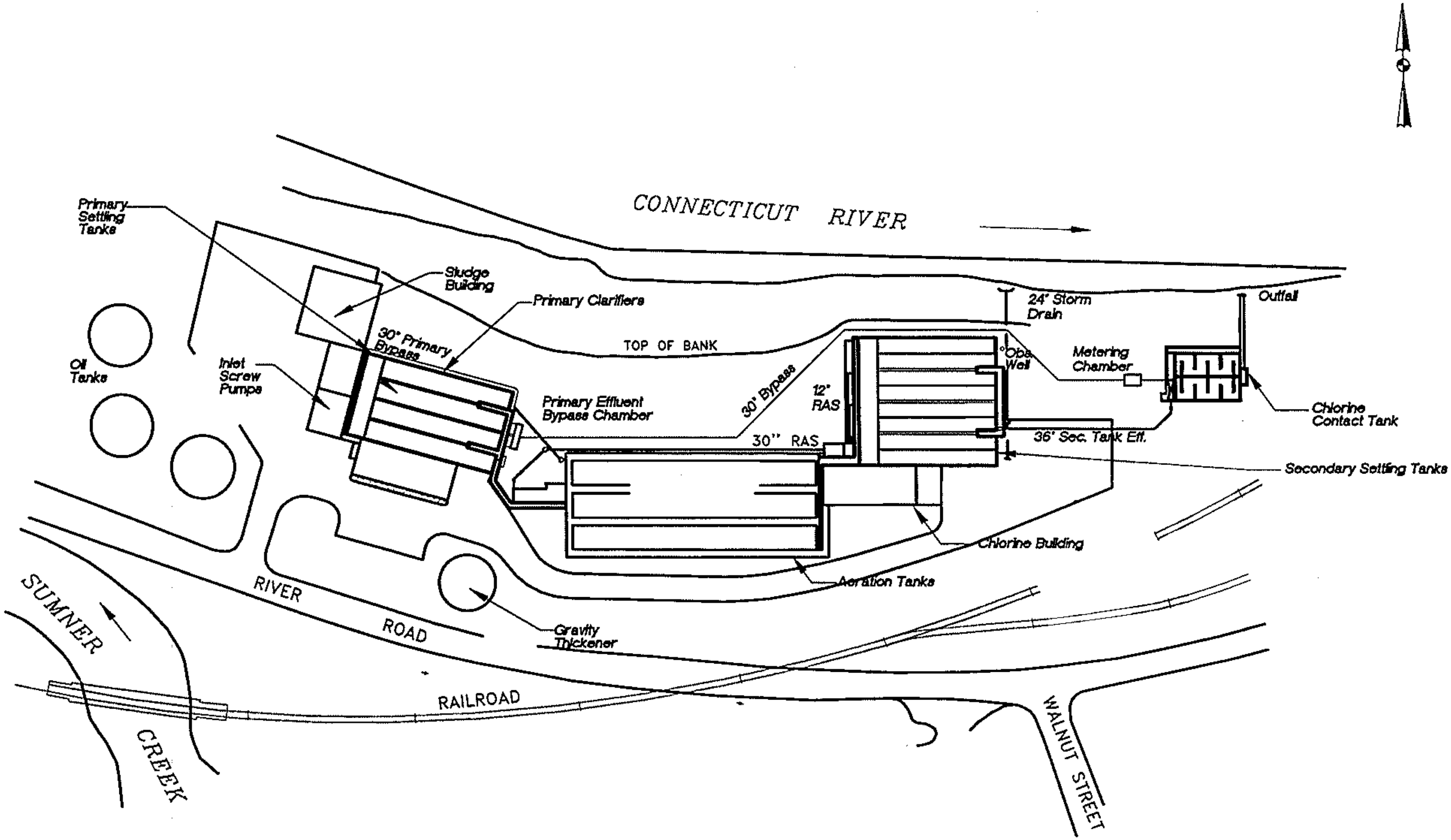
Existing Treatment Systems

A plan view of the existing wastewater treatment plant processes is shown on Figure 2-1. The following discussion will provide an evaluation of the existing unit processes, including the condition of the equipment. More details on the extent of expansion/upgrade of equipment will be provided in subsequent sections, which describe improvements needed to the existing plant as well as the necessary upgrades to meet the DEP nitrogen reduction requirements.

Since the last plant upgrade in 1976, most of the original equipment has reached the end of its useful life and is in need of replacement. Almost all of the electrical control panels are corroded and in a deteriorated state and in need of complete replacement. Generally, the concrete tankage is in good condition except for a few areas where there is spawled concrete and expansion joint leakage.

Headworks

Flow is received at the influent screw pumping station which has three helical screw pumps (open design) with an original design capacity of 7.6 mgd each (22.8 mgd total). With age, the clearances along the concrete channel has increased and this has significantly reduced the capacity of the screws. Two screws are now used most of the time to meet the peak daily needs. One screw is inoperable and is in the process of being repaired at this time. It is recommended that the screw pumps be replaced in their entirety.



INTER-MUNICIPAL SEWERAGE STUDY CITY OF MIDDLETOWN	SCALE: 1"=120'
	DATE: October 8, 1999
EXISTING WASTEWATER TREATMENT FACILITY	FIGURE 2-1

The screw pumps convey the sewage to an aerated grit tank. The collector screw bucket elevator and washer/dewatering screw are inoperable and have historically been subject to numerous mechanical failures due to original design limitations. Because of the non performance of the equipment originally installed at this facility, collected grit must be manually removed from the tank. All of the mechanical equipment must be replaced. Flow from the grit tank is conveyed to a channel where a relatively new sewage grinder was installed ("auger monster"). This is in good condition.

Primary Clarifiers

From here the sewage flows to two primary clarifiers. The clarifier dimensions are 118 feet long by 33 feet wide and have a 12.5 foot side water depth. The surface area is 3,894 square feet. The design surface overflow rate is 783 gal/day/sf at average flow and 1,958 gal/day/sf at peak flow rate. There is ample room adjacent to the existing two tanks to add a third primary clarifier in the future, if required. All of the mechanical system should be replaced with plastic chain and flights. Cosettled secondary and primary sludge is pumped to the holding tank in the sludge building prior to being pumped to the railroad tanker cars which transport the sludge (2-1/2 to 3% solids) to the Mattabassett treatment facility. No further thickening is provided.

Aeration System

The flow is then conveyed to the aeration tanks. There are three aeration tanks each with dimensions of 200 feet long by 25 feet wide and with a sidewater depth of 14.75 feet. Each tank has a capacity of 551,650 gallons, or 73,750 cubic feet. The hydraulic detention time of the design average flow, including 30% return flow, is about 5 hours using all three aeration tanks. This will be too short a detention time to meet DEP's nitrogen reduction for the year 2009. Additional tankage will be required in the future to meet the CT DEP nitrogen reduction goals. The aeration tanks presently have coarse bubble aeration. This type of aeration is inefficient and should be replaced with a fine bubble aeration system. Generally, the fine bubble aeration system will reduce power usage by about 45% with a payback in 7 to 10 years. The blowers should also be replaced with blowers that include variable speed control and dissolved oxygen sensor control to further improve the efficiency of the operation. The air filtration system for the blowers also needs to be replaced.

Screw pumps are utilized to lift return activated sludge to the aeration tanks. These should be replaced with variable speed pumps and automated controls. The valves, which provide for step feed of the primary effluent, must also be redesigned and replaced. Spawled concrete in all of these tanks must also be repaired.

Secondary Clarifiers

The mixed liquor from the aeration tanks flows by gravity to four secondary clarifiers.

To relieve short-circuiting in the clarifiers and to prevent solids washouts, the plant staff installed baffles in the aeration tanks. These appear to work very well. The only suggestion for improvements in the baffle system is to install additional baffles at the far end of the clarifiers near the weirs. It appears that during the normal diurnal peak flow events there can be some solids carryover, which is more prominent at the weirs closest to the effluent end of the tank.

The secondary clarifiers measure 110 feet long by 25 feet wide and have a sidewater depth of 11.5 feet. The surface area is 2,750 square feet each or a total of 11,000 square feet. The design overflow rates are 555 gal/day/sf at average flow and 1,385 gal/day/sf at peak flow. All the existing chain and flights should be replaced with plastic chain and flights. At the present time, one clarifier is out of operation for maintenance and needs to have the chain and flights replaced in the very near future.

The return sludge is controlled with telescoping valves which convey the sludge to a screw pump at the head of the aeration tanks. Here any excess sludge can be wasted to the head of the plant and cosettled in the primary clarifier. The wasted sludge can also be directed to the gravity thickener, but this option is not used at this time due to the limited size of the original thickener.

Disinfection

The effluent from the secondary clarifiers is conveyed to the chlorine contact tanks. There are two tanks which measure 50 feet long by 18 feet wide with a 12 foot sidewater depth. The detention time at the design peak flow is 29 minutes. The two tanks are presently used in series. During extreme high flow periods (greater than 8.4 mgd), sewage is conveyed by gravity from the effluent end of the primary clarifiers directly to the chlorine contact tank. The plant achieves good bacterial kill even with a low residual chlorine concentration (usually around 0.10 mg/l).

Discharge to River

The final effluent is discharged to the Connecticut River. The CT DEP has issued criteria to all municipalities regarding the need to upgrade the level of treatment for nitrogen reduction.

Staffing

The original staffing plan proposed when the plant was constructed was 9 persons as shown below:

1 - Superintendent
1 - Assistant Superintendent
4 - Operator II
2 - Operator I
1 - Lab Assistant

The present staff includes a Superintendent, a Chemist/Assistant Superintendent, two (2) Operator IIs, and one Utility Worker I. The plant is in need of additional help in the Utility I category to take care of the everyday cleanup needs at the plant and has posted this position.

Flow Projections

Table 2-1 provides the wastewater flow projections for both the existing sewered areas as well as the proposed additional sewered areas of the City of Middletown. The information is broken down into flows received at the City's treatment plant and the future services along River Road.

The latter includes flow from Northeast Utilities (domestic waste only), Pratt and Whitney (domestic and pre-treated industrial), Connecticut Valley Hospital and potential future development along River Road. We have assumed that the City will have their combined sewer flows reduced and that the City will continue with its program to remove excessive infiltration/inflow.

TABLE 2-1
CITY OF MIDDLETOWN - FLOW PROJECTIONS
(with Year 2020 flows reflecting completion of Inflow/Infiltration Rehabilitation)

Source	Average Daily Flow (MGD)		Peak Hourly Flow (MGD)	
	Year 2000	Year 2020	Year 2000	Year 2020
POTW	4.97	4.93	22.30	19.50
River Rd. Sewer System Ext.[1]				
Pratt & Whitney				
- Domestic	0.15	0.18	0.50	0.60
- Industrial (pre-treated)	0.10	0.12	0.10	0.10
CT Valley Hospital	0.24	0.42	0.72	0.72
Northeast Utilities[3]	0.003	0.01	0.01	0.01
Future Development [2]	0.24	0.24	.24	0.24
TOTALS	**5.70**	**5.90**	**23.90**	**21.20**

[1] Not included in "Local Alternative".

[2] Proposed development not expected until at least the year 2010.

[3] Domestic waste only.

The Westfield section of Middletown is currently treated at Mattabassett Treatment Plant. The future growth in this area of City is included in the projected growth associated with the existing members of the Mattabassett facility (Chapter 5).

Regulatory Issues

The CT DEP has issued phased total nitrogen effluent requirements for the City's treatment facility. Table 2-2 provides the allowable loadings. The mg/l concentration is based on an average daily flow of 4.26 mgd, which does not include future River Road flows. These effluent requirements would be imposed if the City choose to continue with their own treatment facility for the next 20 year planning period. These limits are extremely low on a concentration basis.

TABLE 2-2
CITY OF MIDDLETOWN - TOTAL NITROGEN GOALS

YEAR	lbs/day	mg/l
Baseline (1990)	334	9.4
2004	243	6.8
2009	163	4.6
2014	106	3.0

Description of Alternatives

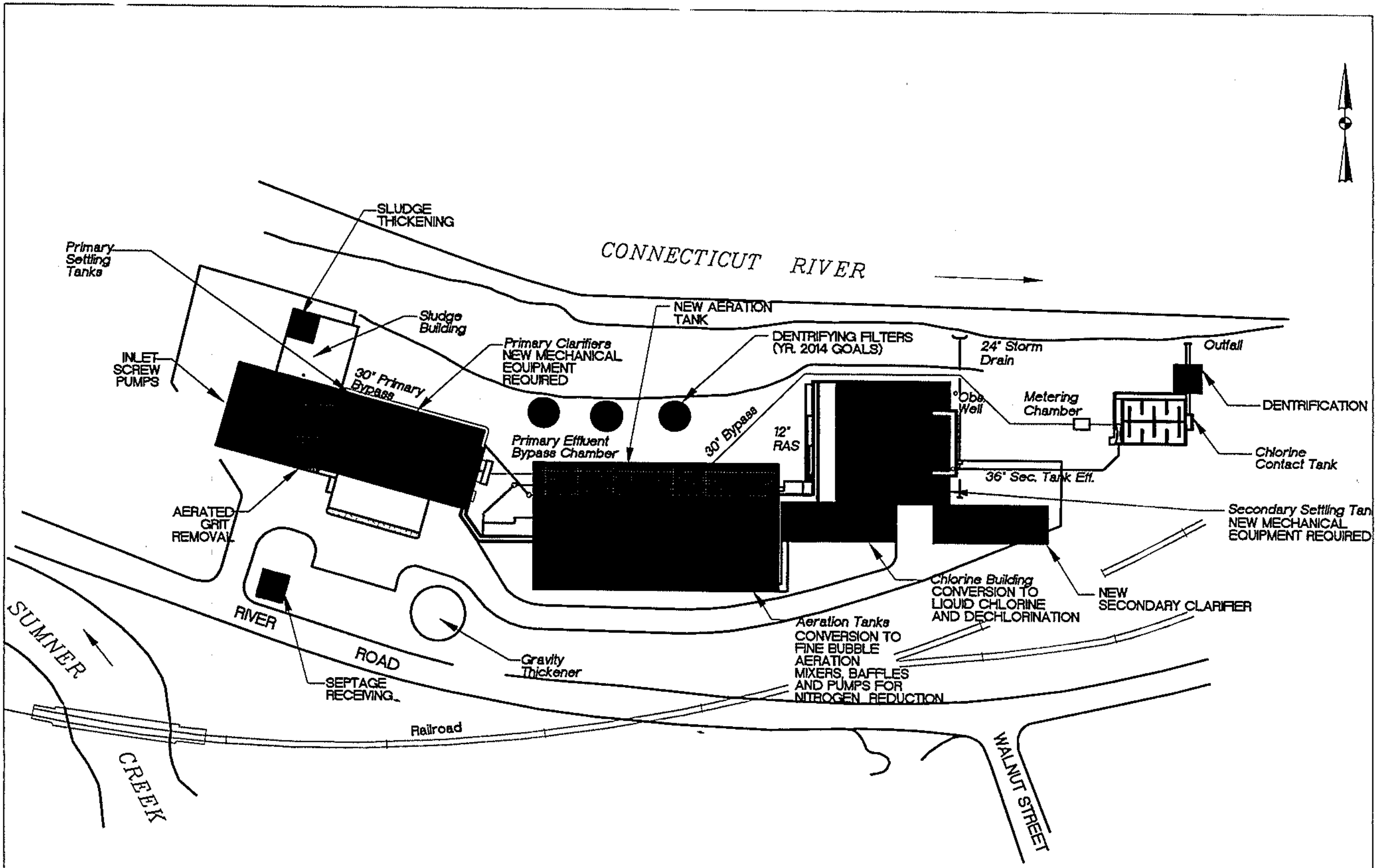
Local Alternative

General

If the City of Middletown chooses to continue with operation of its own plant, there are a number of improvements which will have to be made at the plant just because of it's age and many of the components have reached, or currently exceed, their useful life. There is also the additional equipment and tankage that will be required to meet DEP's nitrogen reduction goals.

This chapter will discuss the capital improvements required and their estimated cost. An estimate of the operation and maintenance costs for the treatment plant and sewage collection system are also provided.

A plan view of the Middletown wastewater treatment plant showing the various processes that will require upgrade in the 20 year planning period is contained in Figure 2-2.



INTER--MUNICIPAL SEWERAGE STUDY CITY OF MIDDLETOWN	SCALE: 1"=100'
	DATE: Ocotber 8, 1999
UPGRADE OF MIDDLETOWN WASTEWATER TREATMENT PLANT	FIGURE 2-2

Headworks

The influent screw pumps need to be replaced. In lieu of replacing these with other screw pumps, consideration should be given to replacing these with conventional pumps with variable speed drives. The aerated grit mechanical equipment is in need of complete replacement. The existing septage receiving station is in need of upgrade. The cost of improvements needed at the headworks is shown in Table 2-3.

Primary Clarifiers

The entire mechanical/electrical system of the primary clarifiers needs to be replaced. Plastic chain and flights should be utilized. The cost of improvements needed at the Primary Clarifiers is shown in Table 2-3.

Aeration Tanks

The plants aeration system has coarse bubble diffusers which are inefficient by today's standards. We recommend conversion to a fine bubble diffuser system. This conversion should reduce power usage by 40% to 45%. The existing blowers and air filtration system must also be replaced. To improve the process capabilities the inoperable valves that control the ability to step feed the primary effluent to the aeration tanks should be replaced. There is some structural repair need to one of the aeration tanks which has spawled concrete. The cost of improvements at the aeration tanks is shown in Table 2-3.

This cost does not include the upgrade cost to meet the DEP nitrogen reduction goals. These are itemized separately in Table 2-3 under Denitrification to meet 2009 and 2014 goals.

Secondary Clarifiers

Wooden baffles have been installed which have worked very effectively to reduce solids carryover from the clarifiers. The mechanical/electrical components are in need of replacement. As with primary clarifiers, plastic chain and flights should be used. The waste sludge pumps and return activated sludge pumps and associated controls/electrical should also be replaced. A new, fifth clarifier would bring the average daily surface overflow rate to 418 gal/day/sf, the sustained flow overflow rate would be 487 gal/day/sf and the peak overflow rate to 1540 gal/day/sf. The average and sustained rates are well with the guidelines of 400 to 800 gal/day/sf. However, the recommended peak overflow rate is 1000 gal/day/sf. The baffles will help reduce the solids carryover at peak flows. Before final design is initiated, an evaluation of the clarifiers should be done, coupled with inflow and infiltration reduction to compare the predicted effluent quality to the NPDES permit levels. For the purposes of this regionalization study, the addition of one new clarifier has been assumed.

Denitrification to Meet 2009 Goals

The denitrification goals set by DEP are defined by the 1990 baseline flows for Middletown; this is a lower design average flow than is currently projected. The concentrations are extremely low. If the City pursues the local treatment alternative, these goals should be reassessed with CT DEP. To meet the DEP denitrification goals through the year 2009, it will be necessary to add one aeration tank and install a mixer baffle and submersible pump in each of the four tanks. The estimated cost of this equipment and tankage is shown on Table 2-3.

Disinfection Upgrade and Sampling/flow Metering

The treatment plant presently uses ton cylinders of gaseous chlorine. The safety hazard for workers, and risk of gaseous chlorine leakage to the surrounding area, are well documented. We suggest conversion to liquid sodium hypochlorite for disinfection. New storage tanks, instrumentation, and metering equipment will be required. Although dechlorination is not required in the present permit, it is likely that the next NPDES permit will require it. Additional storage tanks instrumentation and metering equipment will also be required for dechlorination. The cost of improvements needed is shown in Table 2-3.

New influent and effluent sampling equipment will also be required as well as new influent and effluent meters. The existing influent parshall flume and effluent weir can be utilized in the upgrade. The cost of improvements needed for influent/effluent sampling and metering is shown in Table 2-3.

Plant Computer System - Supervisory Control and Data Acquisition (SCADA)

The monitoring of the wastewater treatment plant and outlying pumping stations with a modern computerized system is recommended. This will allow for local and remote control and monitoring of the major components of the system. The SCADA system cost is partially offset by lower staff requirements and reduced overtime associated with responding to off-hour alarms. Some of these alarms may not need response if the SCADA system is used to document the cause for alarm. The new instrumentation would be directed to the computer which will log the information and facilitate reporting and process analysis. The estimated cost of a new SCADA system is shown in Table 2-3.

Miscellaneous Plant Renovations and Upgrades

Numerous other plant renovations and upgrades are required. Of major emphasis, the Belt Filter Press should be converted to a Flat Bed Thickener, and an Odor Control System should be added. Architecturally, plant building windows, doors, and most of the roofs need to be replaced. There is also a lot of interior painting and maintenance required. The existing generator has reached its useful life and must also be replaced. The estimated cost of miscellaneous plant upgrades and improvements needed is shown in Table 2-3.

Sludge Thickening

The plant presently sends 2-1/2% to 3% sludge solids, via railroad car, to Mattabassett District Plant for incineration. The Middletown plant has a belt filter press which could be converted to a flat-bed thickener to increase the dry solids to 6%. This will reduce the number of loads and reduce the disposal cost. The existing gravity thickener was originally designed to thicken primary and secondary sludge and scum. It is presently used only for scum thickening. The collection mechanism will need to be replaced. The estimated cost of the sludge/scum thickening upgrade is shown on Table 2-3.

Summary of Costs

The **total estimated construction cost** to upgrade the plant, including nitrification, to meet DEP's goals through the year 2009 is **$7,080,000**, including a 15% contingency. The **total estimated project cost** to upgrade the plant, including nitrification, to meet DEP's goals for the year 2009, is **$8,500,000**, including a 15% contingency and 20% technical services budget. Table 2-3 contains the details of the costs for the various plant upgrades described above for the Local Alternative. This cost is separated out from the year 2014 goals since many communities will only install the 2009 goal equipment now and wait to see what level of treatment is needed after DEP's evaluation of the effectiveness of its nitrogen reduction program. Table 2-3 also shows that the cost for adding denitrifying filters to be $8,000,000, which includes contingencies and technical services.

The **total estimated project cost to upgrade the Middletown wastewater treatment plant** to meet future flow requirements and the CT DEP 2009 and 2014 nitrogen reduction program is approximately **$16,500,000**, including contingencies and technical services.

Operation Costs

In the mid 1990's, the annual operation and maintenance costs of the Middletown wastewater collection and treatment system, combined, were approximately $2,900,000 (1998 dollars). Of this total amount, approximately $2,650,000 was for O&M of the treatment plant and $250,000 was for O&M of the collection system, including the pumping stations. An additional $150,000 ($50,000 for 2009 & $100,000 for 2014) in annual O&M costs at the treatment plant will be required to provide for additional labor and other expenses related to new or upgraded treatment processes. Energy savings related to the fine bubble diffuser system have been factored in this additional O&M cost.

Total estimated annual O&M costs at the upgraded WWTP is estimated to be **$2,800,000.**

Further discussion of costs, including a comparison of continuing operations of the local treatment plant versus terminating treatment operations at the Middletown POTW and conveying wastewater from the Middletown POTW to the Mattabassett treatment plant, is contained in Chapter 6

TABLE 2-3

CITY OF MIDDLETOWN

SUMMARY OF COSTS - LOCAL ALTERNATIVE

WASTEWATER TREATMENT PLANT UPGRADE

		Est. Component Cost	Est. Total Cost
Headworks			
Influent Pumps (3)		$550,000	
Grit Removal System		$200,000	
Septage Receiving		$65,000	$815,000
Primary Clarifiers			
Plastic chain and flights/Mechanical Equipment			$225,000
Aeration Tanks			
Fine bubble aeration, Blowers, filtration & controls		$600,000	
Structural repairs; Valve Replacement		$100,000	
One new tank (req'd. for 2009 denitrification)		$250,000	$950,000
Secondary Clarifiers			
Plastic chain and flights/Mechanical Equipment		$250,000	
New WAS and RAS Pumps with VFD's		$230,000	
WAS & RAS meters		$30,000	
One new tank		$250,000	$760,000
Denitrification to meet 2009 goals			
Baffles, mixers, pumps, instrumentation, controls, piping & accessories			$400,000
Sludge Thickening & Storage			
Thickener and gravity thickener upgrade		$360,000	
Sludge Pump repl., holding tanks, mixers & paddles		$180,000	$540,000
Disinfection Upgrade			
Liquid Sodium hypochlorite & dechlorination system		$185,000	
Effluent Sampling and Flow Metering		$55,000	$240,000
Plant Computer System (SCADA)			
Plant Automation w/alarms, including outlying Pumping Stations			$900,000
Miscellaneous Plant Renovations and Upgrades			
BFP Conversion, Odor Control, Architectural & Miscellaneous Work			$1,325,000
		Construction Subtotal:	$6,155,000
Construction Contingency	15%		$923,000
TOTAL ESTIMATED CONSTRUCTION COST			$7,080,000
Technical Services	20%		$1,420,000
Total Estimated Project Cost (for Year 2009)			**$8,500,000**
FUTURE ADDED TREATMENT PLANT COST			
Denitrification to meet 2014 goals			
Denitrifying filter and accessories		Construction Subtotal:	$5,800,000
Construction Contingency	15%		$870,000
TOTAL ESTIMATED CONSTRUCTION COST			$6,670,000
Technical Services	20%		$1,330,000
Total Estimated Added Project Cost (for Year 2014)			**$8,000,000**
TOTAL ESTIMATED PROJECT COST			**$16,500,000**

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Inter-Municipal Alternative

General

The concept of eliminating the City's existing wastewater treatment plant on River Road and conveying the City's wastewater that presently flows to the River Road plant to the Mattabassett treatment plant has been evaluated. Under this alternative, the existing wastewater treatment facility would be decommissioned and a new pumping station and force main constructed between the River Road WWTP and the Mattabassett District plant in Cromwell. As part of the evaluation for this alternative, the future wastewater flows from the River Road area of Middletown have been included in the total projected flows for which the Mattabassett District upgrade is sized for.

Under this alternative, it is proposed to locate a new regional wastewater pumping station at the City's existing maintenance facility off East Main Street. Piping that now is directed to the treatment plant, including the major 42-inch interceptor which runs along deKoven Drive, will have to be rerouted to the new East Main Street Pumping Station. Figure 2-3 provides an overall force main layout from this proposed regional pumping station to Mattabassett District Facility. The proposed force main route is approximately 13,250 linear feet long. The force main that has been preliminarily sized at 30-inches in diameter.

The force main is proposed to run along deKoven Drive and then between the railroad tracks and Route 9 all the way to Mattabassett District, crossing State Highways and Railroad lines along the way.

During most of the study, there was also the potential for a second force main along this corridor from the Town of Portland, who was also studying the alternate of sewering to Mattabassett, with the force main to be installed under the Connecticut River just south of the Arrigone Bridge. Both the Middletown and Portland force mains would be installed in the same trench. Portland subsequently withdrew from the program.

Since use of either railroad right-of-way or the State right-of-way would have about the same construction costs and environmental impacts, the choice may largely depend on which rights-of-way will require the least time to acquire or whether the rights-of-way will have conditions that would not be in the City's best interests. Those determinations should be made during the design phase of this project.

Construction and O & M Costs

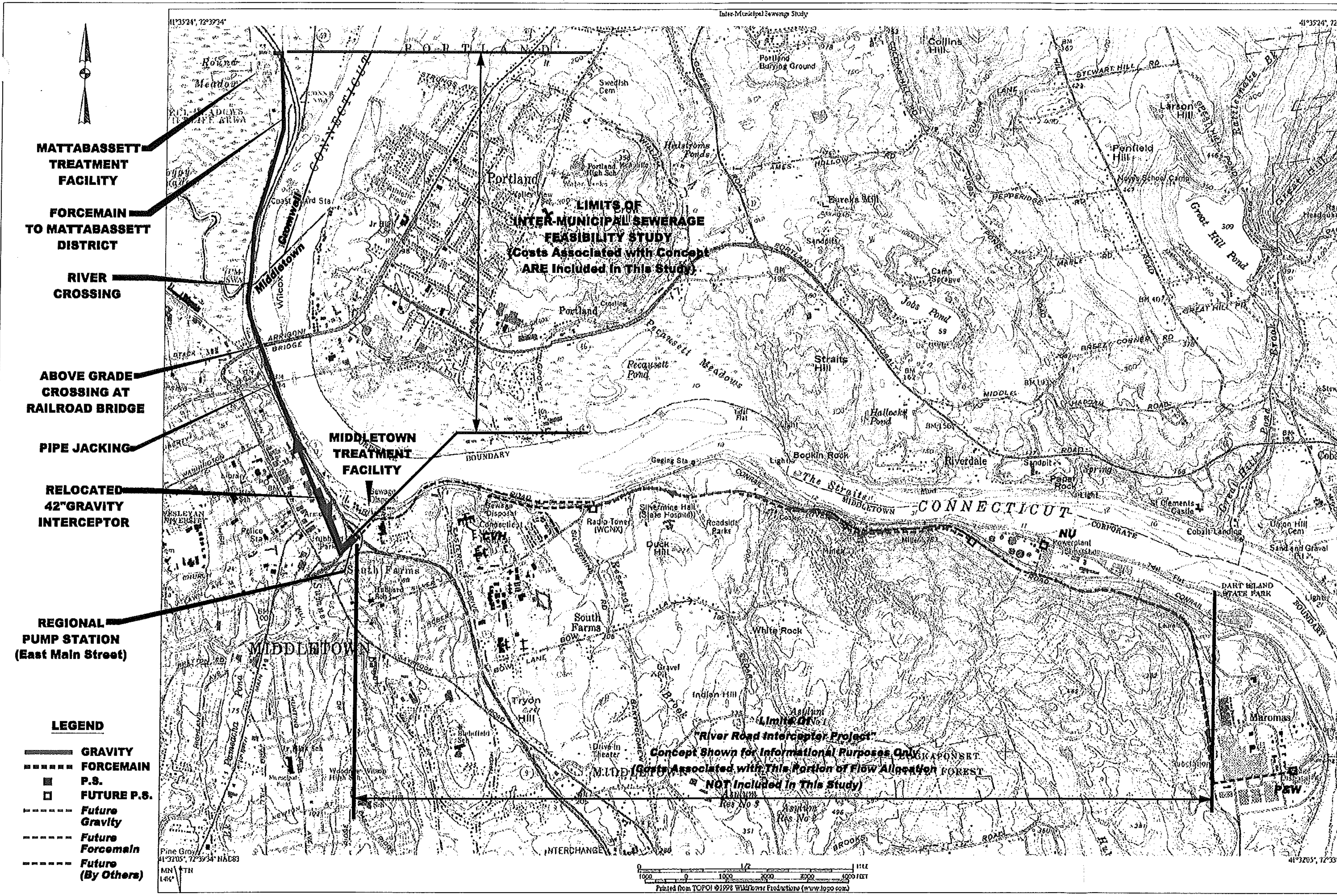
The construction cost for the new regional pumping station, the force main to the Mattabassett District facility, additional piping to redirect sewage flows from the Middletown treatment plant to the new regional pumping station, decommissioning the Middletown treatment plant, along with Contingencies and Engineering Costs is estimated to be approximately **$5,850,000.**

With this inter-municipal alternative, the City will still have to maintain its sewage collection system, the new pumping station and force main, and administer the program. The total estimated annual cost for the O&M of the regional facilities is **$120,000,** which does not include Middletown's costs for their fair share of the annual O&M costs associated with operating the Mattabassett facility.

Summary

Table 2-4 contains a summary of costs associated with the construction of the inter-municipal alternative.

Further discussion of costs, including a comparison of continuing operations of the local treatment plant versus terminating treatment operations at the Middletown POTW and conveying wastewater from the Middletown POTW to the Mattabassett treatment plant, is contained in Chapter 6



MATTABASSETT INTER-MUNICIPAL STUDY

MIDDLETOWN INTER-MUNICIPAL ALTERNATIVE

SCALE: As Noted
DATE: October 8, 1999

Figure 2-3

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TABLE 2-4

CITY OF MIDDLETOWN

SUMMARY OF COSTS - INTERMUNICIPAL ALTERNATIVE

WASTEWATER CONVEYANCE SYSTEM (to Mattabassett)

Concept Stage: Engineer's Opinion of Probable Project Cost

Item No.	Work Item Description	Unit of Measure	Approximate Quantity	All-inclusive Unit Price	ESTIMATED COST
	East Main St. Wastewater Pumping Station	(Preliminary Station Sizing: 21 mgd)			
1	Building Architectural and Structural	L.S.	1	$650,000	$650,000
2	Pumps & Motors, Piping & Valving	L.S.	1	$850,000	$850,000
3	HVAC and plumbing	L.S.	1	$25,000	$25,000
4	Pump Control System	L.S.	1	$75,000	$75,000
5	Site Work and Landscaping	L.S.	1	$50,000	$50,000
	Gravity Sewer Lines				
6	15 inch PVC	L.F.	200	$110	$22,000
7	18 inch PVC	L.F.	200	$120	$24,000
8	42 inch RCP/PCCP	L.F.	500	$130	$65,000
	Force Mains				
9	30 inch DIP	L.F.	13,250	$135	$1,788,800
	Force Main Special Construction				
10	Crossing P&W RR Bridge Trestle	L.S.	1	$150,000	$150,000
11	River Crossing	L.S.	1	$100,000	$100,000
12	Jacking/Tunneling under RR Crossing	L.S.	1	$100,000	$100,000
	WWTP Deactivation/Demolition				
13	Selective Demolition of Structures	L.S.	1	$100,000	$100,000
14	Equipment Removal & Disposal	L.S.	1	$120,000	$120,000
15	Piping & Valving Removal	L.S.	1	$50,000	$50,000
16	Yard Piping Alterations	L.S.	1	$66,000	$66,000
17	Site Restoration	L.S.	1	$50,000	$50,000

A.	**TOTAL ESTIMATED CONSTRUCTION COST (1999 dollars)**			**$4,286,000**
B.	TECHNICAL SERVICES		20.00%	$857,200
C.	LEGAL AND FISCAL	(City of Middletown Legal & Financial)	0.50%	$21,430
D.	ADMINISTRATION	(City of Middletown Project Administration)	1.00%	$42,860
E.	CONSTRUCTION CONTINGENCY		15.00%	$642,900
F.	INTEREST	(see note #1)		$0
G.	SITE	(see note #2)		$0

TOTAL ESTIMATED PROJECT COST (1999 dollars) $5,850,000

Notes 1 No Temporary and Permanent Borrowing costs have been included in this Project Cost Estimate.
2. No Property costs included; it is assumed that the work will be on State/City Property or cost will come from Contingency

River Road Sewers

If Middletown selects the Intermunicipal Alternative to convey its wastewater to the Mattabassett Treatment facility, the potential exists for flows from the Connecticut Valley Hospital, Northeast Utilities, Pratt and Whitney Aircraft (both domestic and pre-treated industrial waste), and an allotment for future development in the east portion of Middletown (along the Connecticut River) to be conveyed by a series of gravity sewer, pumping stations, and forcemain to the East Main Street pumping station.

A 1994 report prepared by Maguire Group Inc. entitled ***"Water and Sewer Utility Study, United Technologies - Pratt & Whitney"***, studied the feasibility of reconfiguring the water and sewer utility functions at the Pratt & Whitney plant. Half of that study focused on the feasible alternatives available for handling sewage at the P&W plant. Of the five (5) alternatives discussed in that study, one alternative was eliminated due to the high cost. The report went on to recommend that final selection (from the remaining four alternatives) would depend on the importance placed on some of the intangible criteria outlined in the report. If the alternative selected were to involve sending Pratt & Whitney wastewater (domestic and pre-treated industrial) to the Middletown Wastewater Treatment Facility, a section of gravity sewer, forcemain and two (2) pumping stations could be constructed on River Road to convey the sewage from the farthest location (Pratt and Whitney complex) to the modified East Main Pumping Station. This concept allows for the anticipated future development in the immediate area to be served by sewers. See Figure 2-3 for a general layout of this proposed wastewater collection system extension.

It should be noted that there are already three (3) existing pumping stations along the north end of River Road that pump wastewater to an interceptor sewer located at the future location of the East Main Street pump station. This current pumping configuration will not change in with the Inter-municipal Alternative.

The estimated cost of construction for the above described River Road wastewater collection system extension is $6,750,000. So that this figure can be compared to the other projected costs listed throughout this document, the Total Estimated Project Cost (in 1999 dollars) is $8,800,000 (Refer to Table 2-5). Although the projected wastewater <u>flows</u> from this area were considered for the year 2020 design analysis, **NONE** of the River Road sewer system extension <u>costs</u> discussed above are included in Middletown's Inter-Municipal sewerage alternative described in this Study but are provided so that the reader can understand additional advantages to the Inter-Municipal alternative.

In addition to the public sewer system improvements described above, separate (private) wastewater pumping stations and related forcemains will be needed at both the Pratt and Whitney and Northeast Utilities facilities to pump their respective wastewaters to the proposed municipal River Road conveyance system. Likewise, the Connecticut Valley Hospital would connect to the proposed River Road system, by gravity, at one of the intermediate pump stations, east of the CVH site.

TABLE 2-5

CITY OF MIDDLETOWN

SUMMARY OF COSTS

RIVER ROAD WASTEWATER COLLECTION SYSTEM

Concept Stage: Engineer's Opinion of Probable Project Cost

Item No.	Work Item Description		Unit of Measure	Approximate Quantity	All-inclusive Unit Price	ESTIMATED COST
1	**Wastewater Pumping Station No. 1**	(see note #1)	L.S.	0	$500,000	$0
2	**Wastewater Pumping Station No. 2**		L.S.	1	$825,000	$825,000
3	**Wastewater Pumping Station No. 3**		L.S.	1	$1,000,000	$1,000,000
	Gravity Sewer Lines					
4	8 inch PVC		L.F.	0	$90	$0
5	12 inch PVC		L.F.	1,511	$105	$158,700
6	15 inch PVC		L.F.	12,000	$110	$1,320,000
7	18 inch PVC		L.F.	8,400	$120	$1,008,000
8	21 inch PVC		L..F.	3,350	$130	$435,500
	Force Mains					
9	8 inch DIP		L.F.	0	$80	$0
10	12 inch DIP		L.F.	0	$105	$0
11	15 inch DIP		L.F.	6,400	$110	$704,000
12	18 inch DIP		L.F.	2,700	$120	$324,000
13	21 inch DIP		L..F.	7,500	$130	$975,000
14	24 inch DIP		L..F.	0	$140	$0
15	**P&W Wastewater Pumping Station**	(see note #2)	L.S.	0	$0	$0
	P&W Force Main (DIP)	(see note #2)	L.F.	0	$0	$0
16	**NU Wastewater Pumping Station**	(see note #2)	L.S.	0	$0	$0
	NU Force Main (DIP)	(see note #2)	L.F.	0	$0	$0
17	**CVH Sewer System Ext./Connection**	(see note #3)	L.S.	0	$0	$0

A.	**TOTAL ESTIMATED CONSTRUCTION COST (1999 dollars)**		**$6,750,000**
B.	TECHNICAL SERVICES	(Including Surveying, Geotechnical, Engineering & Permitting)	$1,300,000
C.	LEGAL AND FISCAL	(City of Middletown Legal & Financial)	$25,000
D.	ADMINISTRATION	(City of Middletown Project Administration)	$49,500
E.	PROJECT CONTINGENCY		$675,000
F.	INTEREST	(see note #4)	$0
G.	SITE	(see note #5)	$0

TOTAL ESTIMATED PROJECT COST (1999 dollars) $8,800,000

Notes 1. Pumping Station No. 1 is planned for a future phase and is not included in this Project Cost Estimate.
2. P&W and NU Pump Stations and force mains are to be designed & constructed with private funds.
3. No costs associated with connecting the CVH facility to the municipal system have been included in this Estimate.
4. No Temporary and Permanent Borrowing costs have been included in this Project Cost Estimate.
5. No Property costs included; it is assumed that the work will be on City Property or that the cost will come out of Continge

Environmental and Permitting Issues

The proposed activity would occur along the Connecticut and Mattabassett Rivers in Middletown. The Connecticut River and a portion of the Mattabasset River contain tidal wetlands and, therefore, much of the project would come under the purview of the Connecticut Department of Environmental Protection's (CTDEP) Office of Long Island Sound Programs (OLISP). However, certain portions of the project may occur landward of the high tide line, in inland wetland areas. These portions would be regulated at the local level.

It is recommended that a pre-application meeting be held with the Army Corps of Engineers (Corps) and CT Department of Environmental Protection's (CTDEP) Inland Water Resources Division and Office of Long Island Sound Programs (OLISP) units to discuss permit streamlining strategies.

A key determination will be if the activity would occur within, or affect tidal wetlands or inland wetlands. The Connecticut River is a tidal wetland, however, tributaries to the River or wetlands/watercourses isolated from the river may not be tidal wetlands, by definition. Instead, they would be considered inland wetlands.

Inland wetlands activities are regulated by the Corps and the Middletown Inland Wetlands Commission. Tidal wetlands are regulated by CTDEP OLISP and the Corps.

Section 404 Clean Water Act Permit

Any activity that involves the discharge of dredged or fill materials in waters of the United States requires a permit from the U.S. Army Corps of Engineers (Corps) under Section 404 of the Federal Clean Water Act (33 U.S.C. Sec. 1341). Wetlands, as determined using the 1989 Guidance Manual for Delineating Federal Wetlands, are considered "waters of the U.S."

In Connecticut, the federal and state permitting programs are coordinated in the Connecticut Programmatic General Permit (CT PGP) Program. For **inland wetland** activities, an application is submitted to the Corps and they, in turn, coordinate with the Connecticut Department of Environmental Protection (CTDEP) Inland Water Resources Division. However, if a project is within tidal or navigable waters, then the application is submitted to CTDEP's Office of Long Island Sound Programs (OLISP) which, in turn, coordinates with the Corps.

Under the CT PGP, this project would likely by a Category II activity. Category II activities within tidal or navigable waters involve less than 1 acre of disturbance. The application is reviewed jointly by the Corps, CTDEP, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and EPA and a permit is issued by CTDEP OLISP which would cover the state tidal wetland permit, state 401 Water Quality Certification, and federal Section 404 permit. If, during the agency screening process, the activity is determined to require an individual permit, then the aforementioned permits may be issued individually.

Assuming this activity would fall under Category II of the CT PGP, CTDEP OLISP would notify the applicant the applicant of the status of permit review within 45 days of the receipt of a complete application. Additional information, if needed, would be requested at that time.

If the activity falls under the CT PGP, then one permit letter is issued which covers the federal (Section 404) and state (Section 401) and tidal wetlands permit authorizations.

Structures and Dredging Permit

A structures, dredging and fill permit is required for work occurring waterward of the high tide line in tidal, coastal or navigable waters. The placement of the proposed sewer line underneath or across the Mattabassett River may regulated by this permit.

As mentioned above, the application for this permit would be submitted to CTDEP OLISP, which would then distribute it to the other regulatory agencies for screening. Assuming the activity would be classified as Category II under the CT PGP, a permit letter would be issued by CT DEP OLISP which would also cover the federal Section 404 and state Section 401 permits.

Tidal Wetlands Permit

Similar to the Structures and Dredging Permit, the Tidal Wetlands Permit is issued by CTDEP OLISP. This permit is required if the activity affects tidal wetlands (i.e. marshes), whereas, the Structures and Dredging permit is required for work in open water areas. The review process and timeline is the same for these permits, only separate applications need to be completed.

Section 401 Water Quality Certification

As mentioned above, the CTDEP, under the authority of Section 401 of the Federal Clean Water Act, requires applicants to obtain a water quality certificate for activities involving the discharge of dredged or fill material within waters of the U.S. Category I activities are conditionally granted a water quality certificate. Category II activities that exhibit minimal or no impact to water quality are typically granted certification along with the Corps Section 404 permit. A separate application to CT DEP is not required for Category I or II activities.

The timeline for permit approval of Category II activities is concurrent with the state Tidal Wetlands and Stuctures and Dredging permits (see above).

As part of both the Section 404 and 401 permits, coordination with the State Historic Preservation Officer (SHPO) and the Connecticut Natural Diversity Data Base is required to identify any historic/archaeological resources or rare, threatened or endangered species that may be present in the project area.

Inland Wetland Permit

Activities which would occur within, or possibly affect **inland** wetlands or watercourses require a permit from the Middletown Inland Wetlands and Watercourses Commission (tidal wetlands are regulated by CTDEP OLISP) Wetlands under local jurisdiction are based on soil types, which differ slightly from the federal definition, which is based on soils, vegetation and hydrology. Therefore, a delineation of the federal and state wetland limits would be required.

For minor activities, the Commission is required to render a decision within 65 days of the from the receipt date of the application. If the Commission determines that the activity is "significant", then a public hearing may be scheduled and a decision must be rendered within 35 days of the completion of the public hearing.

Stream Channel Encroachment

Any person proposing to place an encroachment or obstruction riverward of stream channel encroachment lines must obtain a permit from the CTDEP. Stream channel encroachment lines have been established for about 270 linear miles of riverine floodplain throughout the State. The Connecticut River in Middletown is a regulated area. The proposed local interceptor which would run along the Connecticut area would require a stream channel encroachment permit.

Other Permits/Approvals

Construction work within the Connecticut Department of Transportation (CTDOT) right-of-way would require permission from CTDOT. The proposed alignment may lie within CTDOT right-of-way (State Route 9).

Any newly constructed or modified pump stations, or other ancillary structures, would need approval from the Middletown Planning and Zoning Commission. The timeline for a decision from the Commission is similar to that of the Inland Wetlands Commission. However, if the structure is located within or near wetlands, then approval from the Inland Wetlands Commission is typically required before approval from the Planning and Zoning Commission.

Chapter 3

CHAPTER 3 TOWN OF PLAINVILLE

Introduction

The Plainville wastewater treatment facility was most recently upgraded in 1977. It was designed to handle an average daily flow (ADF) of 3.8 mgd and a peak flow rate of 9.9 mgd. Present dry weather flows average about 2.2 mgd. Peak hourly flows have been as high as 7.0 mgd. The Town has been in the process of an infiltration/inflow reduction program to reduce the peak flows. On average, the influent BOD_5 is 2900 lbs/day, total suspended solids is 3800 lbs/day and Ammonia nitrogen is 370 lbs/day. Figure 3-1 presents a plan view of the treatment plant which will be used as a point of reference for the description of the plants unit processes. The previous upgrade to the plant was done in 1967 when the secondary treatment plant was installed. Most of the original equipment that was installed 31 years ago, and as well as the equipment that was replaced in the 1977 recent upgrade, have reached their useful life and need to be replaced. In addition, DEP's requirements for nitrogen reduction will require some of the unit processes to be modified and new facilities constructed. This study will outline the work required at the treatment plant to meet the long-term nitrogen reduction goals through the year 2020.

If the alternative of abandoning their plant and conveying wastewater to Mattabassett is selected, any sewage flows from Plainville must also pass through New Britain before reaching the Mattabassett interceptor. This study will also evaluate the most feasible and cost-effective alternative for conveying flows through New Britain to the main interceptor.

Existing Treatment Systems

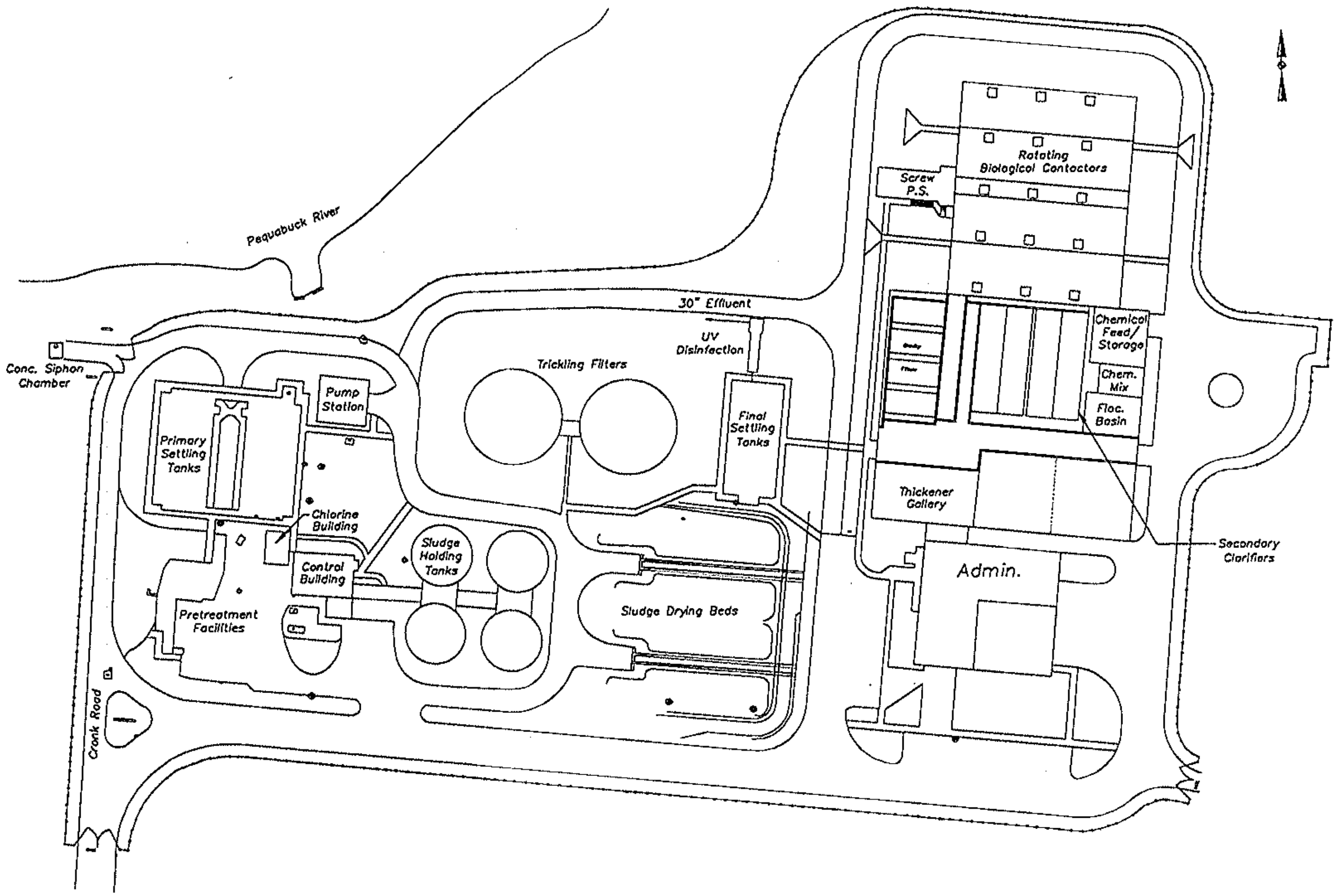
Headworks

The headworks consist of a catenary mechanical bar screen, mechanical grit chamber, Parshall flume, and a manually cleaned fine bar screen which is used as a bypass around the other mechanical equipment in the headworks. Most of the equipment in the headworks has reached its useful life and should be replaced.

Primary Clarifiers

There are four rectangular primary clarifiers with the following dimensions: 70 feet long by 15 feet wide with a 10-foot sidewater depth. The average overflow rate with 4 tanks on-line at the design flow is 905 gal/day/SF and 2360 gal/day/SF at peak flow.

Primary and secondary sludge is cothickened in the primary clarifiers. Thickened sludge is pumped to one of the digesters which is currently used as a sludge storage tank prior to being pumped to tanker trucks for off-site disposal. Collector mechanisms in the primary clarifiers need to be replaced. In addition, the sludge transfer pumps need to be rebuilt or replaced.



INTER-MUNICIPAL SEWERAGE STUDY TOWN OF PLAINVILLE EXISTING WASTEWATER TREATMENT FACILITY	SCALE: 1" = 100' DATE: October 8, 1999 FIGURE 3-1

Roughing Trickling Filters

There are two roughing trickling filters that are 60 feet in diameter and 7.5 foot deep. The filters have a relatively low hydraulic loading rate of 0.27 gal/ft^2-min. but a high BOD loading rate of 66 lb/1100 CF-day. Since they are used as "roughing" filters, the higher BOD loading rate should not be a problem. If, at some point in the future, additional BOD removal is desired, consideration should be given to changing the filter media from 6-inch trap rock to plastic media. The seals and the mechanical arms of the trickling filters rotating mechanism need to be replaced if long-term use of the plant is proposed.

The pump station between the trickling filters contain two 2,800 gpm centrifugal pumps which are used to recirculate flow to the filters. The pumps were refurbished in 1977.

Screw Pumps

The flow from the trickling filters flows by gravity to three Archimedes screw pumps. These pumps lift the sewage approximately 20 feet to the rotating biological contactors (RBCs).

Each pump has a rated capacity of 3,500 gpm or about 5 mgd. Consequently, for most of the time, only one screw is needed to meet the current flow conditions. Since the screw pumps are approximately 21 years old, there will be a need to refurbish and/or replace these pumps if the Town is to continue with the operation of this plant in the future.

Rotating Biological Contactors (RBCs)

The RBCs are arranged in four rows with six stages in each row. The first three stages have 100,000 square feet of media in each unit and the last three stages have 150,000 square feet of media in each unit. The total surface area is 3,000,000 square feet.

The RBCs were designed to operate a two speeds: 1.58 rpm and 1.00 rpm. Based on the current flow and loads, the RBCs are underloaded for BOD_5 and ammonia nitrogen. The plant has consistently met its effluent ammonia nitrogen permit level of 2 mg/l since these units were installed in 1977. Continued use of the plant in the future will require a major investment to replace/refurbish this equipment.

Chemical Feed, Mix and Flocculation

This portion of the unit process was installed during the 1977 upgrade to meet potential phosphorous removal requirements. The plant has no DEP requirement for phosphorous removal at this time. The equipment is used to inject polymer into the effluent stream of the RBCs to enhance the final settling characteristics.

Secondary Clarifiers

There are four concrete rectangular secondary clarifiers that measure 75 feet long by 6 feet wide with a sidewater depth of 8.5 feet. As with the primary clarifiers, continued use of the plant in the future will require replacement of the chain and flights and drive motors. At the present average daily flow rate of 2.2 mgd and peak hour of 6.0 mgd, the surface overflow rates are 458 gal/day/SF and 1250 gal/day/SF, respectively. The peak overflow rate is higher than the recommended rate of 1000 gal/day/SF. Because the process is followed by the rapid sand filter process, the higher surface loading rate at peak flow is not a concern at this time. The polymer added after the RBCs has had a significant beneficial effect on the concentration of the settled solids. Typical values are 2½% solids. Without polymer addition, the normal underflow sludge from secondary clarifiers is only 3/4% to 1% solids.

Rapid Sand Filters

Flow from the secondary clarifiers is conveyed by gravity to four rapid sand filters. Each filter measures 30 feet long, 15 feet wide and has four feet of filter media on top of a tile underdrain system. The media consists of a bottom layer of 12 inches of gravel overlain by 12 inches of sand and 24 inches of anthracite.

The filter is backwashed when the head loss reaches a preset elevation in the filter. The backwashed material goes back to the influent end of the screw pumps (adjacent to the filters). The filters have experienced some clogging which has caused the flow to backup in the secondary clarifiers. In lieu of completely refurbishing the filters and underdrain system, the Town should consider alternatives to this traditional sand filter if the they continue to use the plant in the future.

Disinfection

The effluent from the sand filters is conveyed to an ultraviolet disinfection system which was installed in 1993. Except for frequent cleaning of the quartz sleeves that protect the UV lamps, the system has worked well. While upgrade of the system is not required for near-term operations, the major cost associated with replacement of the equipment would be anticipated within the next 20 years.

Post Aeration

The old chlorine contact tanks were converted to a post aeration tank to meet DEP's requirements of sufficient dissolved oxygen (DO) levels in the final effluent. Based on review of the data, the DO concentration in the effluent (typically 9 to 11 mg/l) is usually well over the 7.0 mg/l requirement. In addition, power savings could be achieved by a changeover to a much smaller blower.

Sludge Handling

The plant was originally designed to have sludge from the secondary clarifiers pumped to one of two aerobic digesters and primary sludge pumped to anaerobic digesters. Neither are used for that purpose now. Secondary sludge is pumped to the primary clarifiers and cosettled. As discussed earlier, the cosettled sludge is pumped to one of the old anaerobic digesters which has been converted to a thickened sludge holding tank. The sludge from this tank is transferred to tanker trucks for disposal off-site. Approximately eight truckloads (6,500 gallons each) of 2% to 4% solids are hauled off-site each week. If the plant is to continue operation, the sludge should be thickened to 6% solids to reduce transport/disposal costs.

Plant Staff

The wastewater collection and treatment system presently has a total staff of 12 persons: 10 to operate the wastewater treatment plant and 2 to maintain the sewage collection system. In addition, one half of the Deputy Director's time is allocated to water pollution control. The Superintendent of the wastewater treatment plant retired in April 1998 and will need to be replaced with a person who has a Class IV license.

Site and Building Renovations

All of the buildings will need to be refurbished for future use. The roofs need to be replaced and energy efficient windows installed. Underground oil tanks also need to be removed. If the plant continues, conversion to natural gas for boilers and generators should be considered.

Flow Projections

The average monthly flow data was used in conjunction with the computed peak infiltration, average sewage flows, and infiltration and inflow numbers to arrive at an average daily flow number representative of the Town of Plainville. The details of how the numbers were arrived at are included in Appendix E. In addition, the appropriate officials at the Town were consulted with in regards to the expected population increases. In addition, the areas of development were identified and the zones of these areas aided in determining the proposed sewage flows associated with any potential development.

The flows were projected to the design year 2020 and using the population as a guide for sewage flows and a collection system deterioration rate of 1.25% for infiltration, the average daily, sustained wet weather average, and peak hour flows were estimated to be 2.50 mgd, 2.76 mgd and 7.50 mgd, respectively without I/I reduction. If I/I reduction was accomplished, using a 40% infiltration and a 34% inflow removal, then the same three values would reduce to 2.10 mgd, 2.24 mgd and 5.00 mgd, respectively.

Regulatory Issues

The primary regulatory issues considered during studying the upgrade of the processes at the wastewater facilities will be the fact that the CT DEP has issued phased nitrogen loading goals for the effluent from every wastewater treatment plant in the state. These goals are the primary basis recommended for treatment plant process upgrades outlined to be accomplished in the local option (i.e., the Town of Plainville) will continue to treat their own wastewater. The goals have been tiered and must be met in the years 2004, 2009 and 2014. Most treatment plants, Plainville included, will be able to meet the goals through the year 2009 without major tankage addition to the plant. However, the 2014 goals will require substantial capital investment either through expansion and upgrade on-site or through purchasing nitrogen credits from another community.

Table 3-1 below provides the total nitrogen allowable in the final effluent for each of the targeted years. The mg/l figures shown in the table are based on an Average Daily Flow of 2.50 mgd.

TABLE 3-1

TOWN OF PLAINVILLE - TOTAL NITROGEN GOALS

YEAR	lbs/day	mg/l
Baseline (1990)	305	14.6
2004	221	10.6
2009	148	7.1
2014	96	4.6

As part of any Inter-municipal Alternative, Town of Plainville will have to deal with the separate issue that pertains to the fact that effluent from the Plainville WWTP, which currently discharges into the Pequabuck River, will be diverted to the Mattabassett District Plant in Cromwell for eventual effluent discharge into the Connecticut River. This redirection of flows will necessitate a diversion permit, the implications of which are outlined later in this chapter.

Other regulatory issues pertaining to the conveyance of sewage from Plainville to Mattabassett are outlined in the later portion of the Chapter. These issues pertain to the force main that will traverse along State highways, New Britain city streets and adjacent to wetlands - permits will be required from the CT DOT, and agencies in both Plainville and New Britain.

Description of Alternatives

Local Alternative

General

If the Town of Plainville chooses to continue with the operation of its own treatment plant, portions of the existing equipment need improvement and additional equipment is needed to meet the DEP's goals for nitrogen reduction. This chapter will discuss the estimated capital costs for both types of improvements required. We will also estimate the operation and maintenance costs for the treatment plant. Figure 3-2 presents a plan view of the plant with the major items required for upgrade.

As outlined previously, the Connecticut DEP has set phased goals for nitrogen reduction. The impacts to the treatment system due to the reduction of nitrogen will be coupled with the upgrade of any mechanical equipment that has, or will have, reached its useful life within the design period from the years 2000 to 2020. The reader is referred to the discussion on the condition of the existing treatment facility which identified processes needed to be upgraded that are not related to nitrogen reduction process. The following discussion identifies those items needed for the nitrogen reduction process.

Headworks

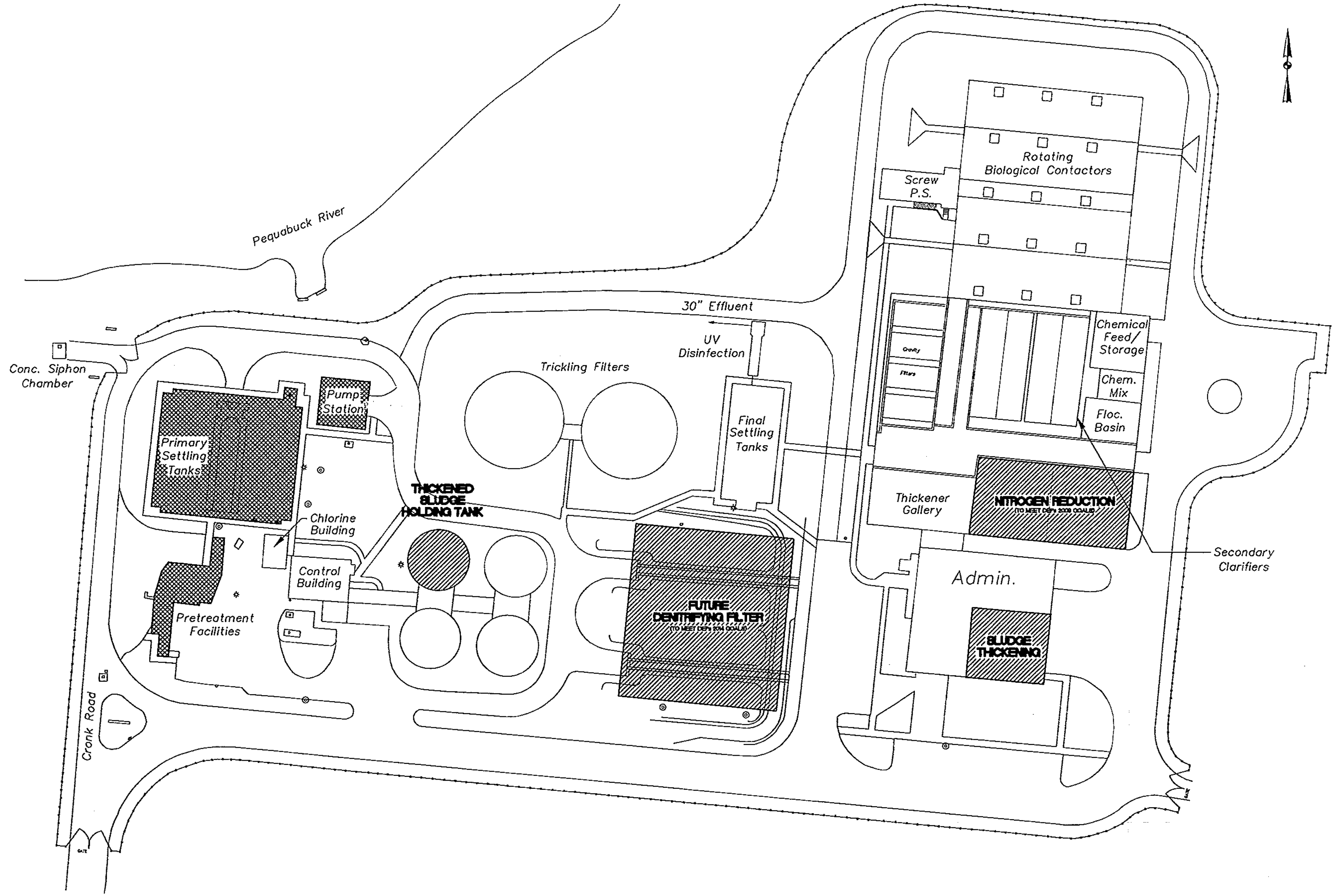
All of the mechanical equipment in the headworks needs to be replaced including the bar screen, grit collection equipment, and flow metering device. None of this equipment requires upgrade due to nitrogen reduction. The estimated cost of Headworks improvements is shown in Table 3-2.

Primary Clarifiers

The projected future flows in the year 2020 are less than the design year flow capacity of the existing treatment plant. Therefore, no new tankage is required. However, the collection mechanism and sludge pumps will need to be replaced. Since the secondary sludge is cosettled in the primaries, it is suggested that baffles be installed in the primary settling tank to aid in the settling of the sludge. The estimated cost of Primary Clarifier improvements is shown in Table 3-2.

Roughing Trickling Filter

It appears that the only renovation required to the roughing trickling filter is to replace the seals in the rotating mechanism and one of the flow distributors. Replacement of the trap rock media with plastic media should only be done if additional BOD removal is required. For both the present and future loading rates, the existing units are achieving excellent BOD removal rates. The estimated cost of Roughing Trickling Filter improvements is shown in Table 3-2.



SCALE: 1" = 60'

DATE: October 8, 1999

FIGURE 3-2

MATTABASSETT REGIONALIZATION FEASIBILITY STUDY

TOWN OF PLAINVILLE

LOCAL ALTERNATIVE – NECESSARY UPGRADES

Screw Pumps

The existing screw pumps have sufficient capacity to meet the 2020 design year peak flows, with one screw as a backup. However, the drums and bearings will need replacement. It is recommended that two of the units be replaced. The estimated cost of Screw Pump improvements is shown in Table 3-2.

Rotating Biological Contractors (RBC's)

The existing RBC's are underloaded for BOD_5 and ammonia nitrogen. They have consistently met their permit levels. No further additions are proposed through the year 2020. However, there will be a need for major components of the equipment to be replaced to last through the design year 2020. It is recommended that 12 of the 24 sets of bearings and 8 of the 24 shafts and drives be replaced. The estimated cost of RBC improvements is shown in Table 3-2.

Secondary Clarifiers

The only concern with the secondary clarifiers is from a hydraulic standpoint. The peak surface overflow flow rate at 7.5 mgd will be 1565 gallons/day/SF which is about 50% higher than the recommended 1000 gallons/day/SF. Because the average overflow rate is 520 gallons/day/SF and this process is followed by filtration, the potential solids carryover at the peak flow is not as great a concern. Without filtration, two additional clarifiers would be needed.

The mechanical equipment, including the plastic chain and flight and drive motors, should be replaced. Polymer is also added to enhance settling of the sludge. Baffles could be installed to reduce the short circuiting during the peak flows. The estimated cost of Secondary Clarifier improvements is shown in Table 3-2.

Denitrification to Meet 2009 Goals

In order to meet the Connecticut DEP goals for nitrogen reduction through the year 2009, it will be necessary to create an anoxic zone (no oxygen) prior to conveying the sewage back to the head of the RBC's. A portion of the existing aerobic digester tankage could be utilized as the anoxic tank. The tanks have mixers already installed in them. The flow could be conveyed back to the head end of the screw pumps and then to the head of the RBC's.

Recycle pumps would have to be installed so that the percentage returned to the head of the screw pumps could be controlled. As an alternative to using the aerobic digesters, the existing chemical mix and flocculation tankage could also be used as the anoxic zone. The sizing requirements and need for recycle for the anoxic zones would be verified during the design phase.

Tertiary Filters

The sand filters have experienced clogging in the past and the underdrain system is in need of replacement. In lieu of this process, we suggest that a different technology, such as the "Aqua Disk", be considered. This is a rotating cloth filter which has a much wider range of flow throughput without much loss of treatment as experienced with the higher flow rates. The cost to partially rehabilitate the existing filters and controls, including engineering, is shown in Table 3-2. The Town has scheduled this in their capital budget for the fiscal year 2000/2001. The cost for the alternative filter system is also shown in table 3-2. This is significantly higher than "partial" rehabilitation of the existing filter. However, at the time the new filters are to be rehabilitated, the scope and cost should again be reevaluated and compared with this alternative technology.

Disinfection

Within the planning period of 20 years, the UV disinfection system will require equipment upgrade. The estimated cost of the Disinfection System upgrade is shown in Table 3-2.

Post Aeration

The existing post aeration system provides a much higher level of dissolved oxygen in the final effluent than is required. The permit requires 7 mg/l dissolved oxygen. Typically the amount measured is in the 9-11 mg/l range. In addition, power savings could be achieved with a smaller blower. The present blower is 100 HP. The estimated cost of Post Aeration system modifications is shown in Table 3-2.

Automated Plant Computer System

To optimize plant performance, reporting, and monitoring of the treatment plant and outlying pumping stations, consideration should be given to installing a Supervisory Control and Data Acquisition (SCADA) system Over a long-term period, most communities are able to justify most of this cost by a reduction in personnel, reduced hours on weekends, and the cost for nighttime call-outs on false alarms. The ability to monitor and/or control treatment plant and pump station functions from a remote location has many benefits. In the past, alarms were generally forwarded to the police station. The people at the police station would then call the superintendent who would ride down to the treatment plant. With the SCADA systems, the Superintendent could decide by monitoring plant functions at his level and then decide whether a trip was warranted. The estimated cost of this system is shown in Table 3-2.

Sludge Thickening

The present practice of the plant is to cothicken primary and secondary sludge in the primary clarifiers. The co-thickened sludge is pumped to one of the digesters, which has been converted to a thickened sludge holding tank.

The sludge (2 to 4% solids) is hauled away by tanker truck for disposal. Approximately eight truckloads (52,000 gallons) are hauled away each week.

Most of the liquid sludge processing plants accept up to 6% solids. We suggest that the Town consider installing a sludge thickener to reduce the sludge processing cost. Since the sludge disposal market prices have become very competitive, a life cycle cost analysis should be done when the town is considers investing in thickening equipment. The estimated cost of Sludge Thickening improvements is shown in Table 3-2.

Miscellaneous Plant Renovations and Upgrades

Odor Control

If the sludge thickening equipment is installed at the plant, an odor control system will be required. The estimated cost of an Odor Control system is shown in Table 3-2.

Building Renovations

A number of building renovations are required including roof and window replacement. The estimated cost of Building renovations is shown in Table 3-2.

Natural Gas/Oil Tank Removal

Some preliminary planning for the conversion of boilers and generators from fuel oil to natural gas. There are also underground oil tanks that have to be removed. The estimated cost of this conversion is shown in Table 3-2, not including removal of possible contaminated soil.

Summary

Table 3-2 summarizes all of the above capital improvements which upgrade the existing plant conditions and meet the DEP goal for nitrogen reduction through the year 2009. The total cost for this phase is estimated to be **$6,400,000,** which includes a 15% contingency and 20% engineering.

Nitrogen reduction costs to meet the DEP goal for 2014 have been shown separately. Most towns will go forward with the construction program to meet the 2009 goals, but will hold back on constructing the equipment for the 2014 goals. The equipment is expensive and the Town will also have the opportunity to purchase nitrogen credits from another community in lieu of building their own improvements. At this stage of the planning, we will assume that the Town will construct their own facility as opposed to participating in a credit exchange program. The additional cost for this last stage of nitrogen reduction is estimated to be **$6,480,000.**

The total project cost of the "Local Alternative" is estimated to be **$12,880,000.**

TABLE 3-2

TOWN OF PLAINVILLE

SUMMARY OF COSTS - LOCAL ALTERNATIVE

WASTEWATER TREATMENT PLANT UPGRADE

		Est. Component Cost	Est. Total Cost
Headworks			
Mechanical Bar Screens & Grit Removal System		$370,000	
Ultrasonic Metering System		$20,000	$390,000
Primary Clarifiers			
Plastic chain & flights/Mech. Equipt., New Sludge Pumps & Baffles			$205,000
Screw Pumps			
Rehabilitate 2 pump drums plus bearings			$595,000
RBC's			
Bearing Replacement (24 of 48 bearings)		$270,000	
Shaft Replacement (8 of 24 shafts)		$650,000	$920,000
Secondary Clarifiers			
Plastic chain and flights/Mechanical Equipment		$130,000	
Baffles		$35,000	$165,000
Sludge Thickening			
Thickener			$220,000
Denitrification to meet 2009 goals			
Baffles, mixers, pumps, instrumentation, controls, piping & accessories			$155,000
Tertiary Filter & Trickling Filter Rehabilitation			
Replace sand filters with rotating disk filter		$750,000	
New Selas and one distributor		$95,000	$845,000
UV Disinfection			
UV System upgrade			$75,000
Post Aeration			
Replace with new, smaller blower			$20,000
Plant Computer System (SCADA)			
Plant Automation w/alarms, including outlying Pumping Stations			$690,000
Miscellaneous Plant Renovations and Upgrades			
Natural Gas Conversion, Odor Control, Architectural & Miscl. Work			$350,000
		Construction Subtotal:	$4,630,000
Construction Contingency	15%		$695,000
TOTAL ESTIMATED CONSTRUCTION COST			$5,330,000
Technical Services	20%		$1,070,000
Total Estimated Project Cost (for Year 2009)			**$6,400,000**
FUTURE ADDED TREATMENT PLANT COST			
Denitrification to meet 2014 goals			
Denitrifying filter and accessories		Construction Subtotal:	$4,697,500
Construction Contingency	15%		$705,000
TOTAL ESTIMATED CONSTRUCTION COST			$5,402,500
Technical Services	20%		$1,077,000
Total Estimated Added Project Cost (for Year 2014)			**$6,480,000**
TOTAL ESTIMATED PROJECT COST			**$12,880,000**

Inter-Municipal Alternative

The major components of the inter-municipal conveyance system include a new pumping station located adjacent to the existing primary clarifiers at the Plainville WWTP and approximately 40,000 feet of force main including 17,000 feet in Plainville and 23,000 feet in the City of New Britain.

Figure 3-3 presents the components of the existing treatment facility that will be modified and used as the regional pumping station configuration. We suggest that a new coarse bar screen be installed in the existing pretreatment facilities (headworks) and that all or a portion of the existing primary settling tanks be converted to a wet well/equalization tank. The Parshall flume would be used to measure the incoming flow. No grit removal facilities would be utilized. The existing primary sludge settling tank would require modifications to the sludge collection mechanism and sludge pumping in order to transfer the settled sewage sludge to the new pump station intake lines.

The existing primary sludge pump building would be converted to the regional pumping station. Pumps would be installed capable of handling the year 2020 peak flow of 7.5 mgd. We would recommend the use of variable speed control to be able to handle a wide range of flows. Consideration should be given to utilizing two small "jockey" pumps to handle the normal dry weather flow and two larger pumps for the peak flow conditions. One pump would be "duty" and one "spare" in each case.

The force main would leave south of the treatment plant along Cronk Road (see Figure 3-4). Two alternative routes between Cronk Road and the New Britain City line were investigated. The first conveyance alternative studied was the concept which would require the use of a portion of the railroad right-of-way beginning at the intersection of East Main Street and Railroad Street and extending to Wooster Street in the City of New Britain. The second alternative that was studied involved running the force main from that same starting point all the way along East Main Street (Route 372) to Wooster Street.

The distance along the railroad right-of-way is shorter than the proposed route along Route 372. Although the distance along Route 372 is slightly greater, the anticipated permits and any costs associated with performing construction within the railroad right-of-way is anticipated to be significant. For these reasons, we would recommend staying within the Route 372 right-of-way and working with the Connecticut DOT.

There are also two alternatives to convey the sewage through the City of New Britain. The first alternative is to tie into the New Britain interceptor sewer which extends from Wooster Street to the Christian Lane metering facility. Unfortunately, many segments of this existing sewer are now surcharged with the existing flow (from New Britain). With infiltration/inflow rehabilitation, this problem will be relieved.

However, with the peak flow from Plainville (7.5 mgd), the interceptor will be surcharged - this is an unacceptable situation. The option of providing a relief sewer to accommodate the additional flow can be done, but a lot of the existing interceptor is constructed in low lying areas where wetlands and high groundwater conditions will be encountered.

The second option is to utilize a new force main the entire length through New Britain to the Christian Lane meter house. With a maximum depth of 5 to 6 feet for the force main (except where obstructions occur), and construction in City streets, this option should have less environmental impacts as compared with a gravity relief sewer along the route of the existing interceptor. Constructing a force main along a new route would require an additional 2,000 linear feet of forcemain as compared to constructing one along the existing interceptor route. However, because a new force main is shallower and easier to access than the existing sewer line, we estimate the unit cost of the force main to be less and will in fact result in a lower overall cost.

The total project cost of the "Inter-Municipal Alternative" is estimated to be **$8,100,000.** A detailed cost breakdown of both the regional pumping station and regional force main through Plainville and New Britain is shown in Table 3-3.

The entire length of force main from the pump station at the Plainville treatment plant along Route 372, to the Christian Lane meter house in New Britain is approximately 40,000 feet. We recommend this alternative for conveying Plainville's sewage to the Mattabassett District Facility if the inter-municipal alternative is selected by the Town.

The existing sewage collection system in Plainville, including pumping stations will still have to be maintained by the Town. The Town will also have to maintain the headworks and the new regional pumping station at the decommissioned treatment plant. The estimated annual operation and maintenance (O&M) costs for the new regional headworks and pumping station are estimated to cost **$240,000.**

Plainville will also be required to pay their fair share of costs associated with the Mattabassett treatment plant. These cost figures have been presented in Chapter 6. Additional discussions on these costs as well as a cost comparison of the local option with the inter-municipal alternative of sewering to Mattabassett is also included in Chapter 6.

Finally, annual O&M costs to maintain the Plainville force main in the City of New Britain will be an added cost for the Town of Plainville.

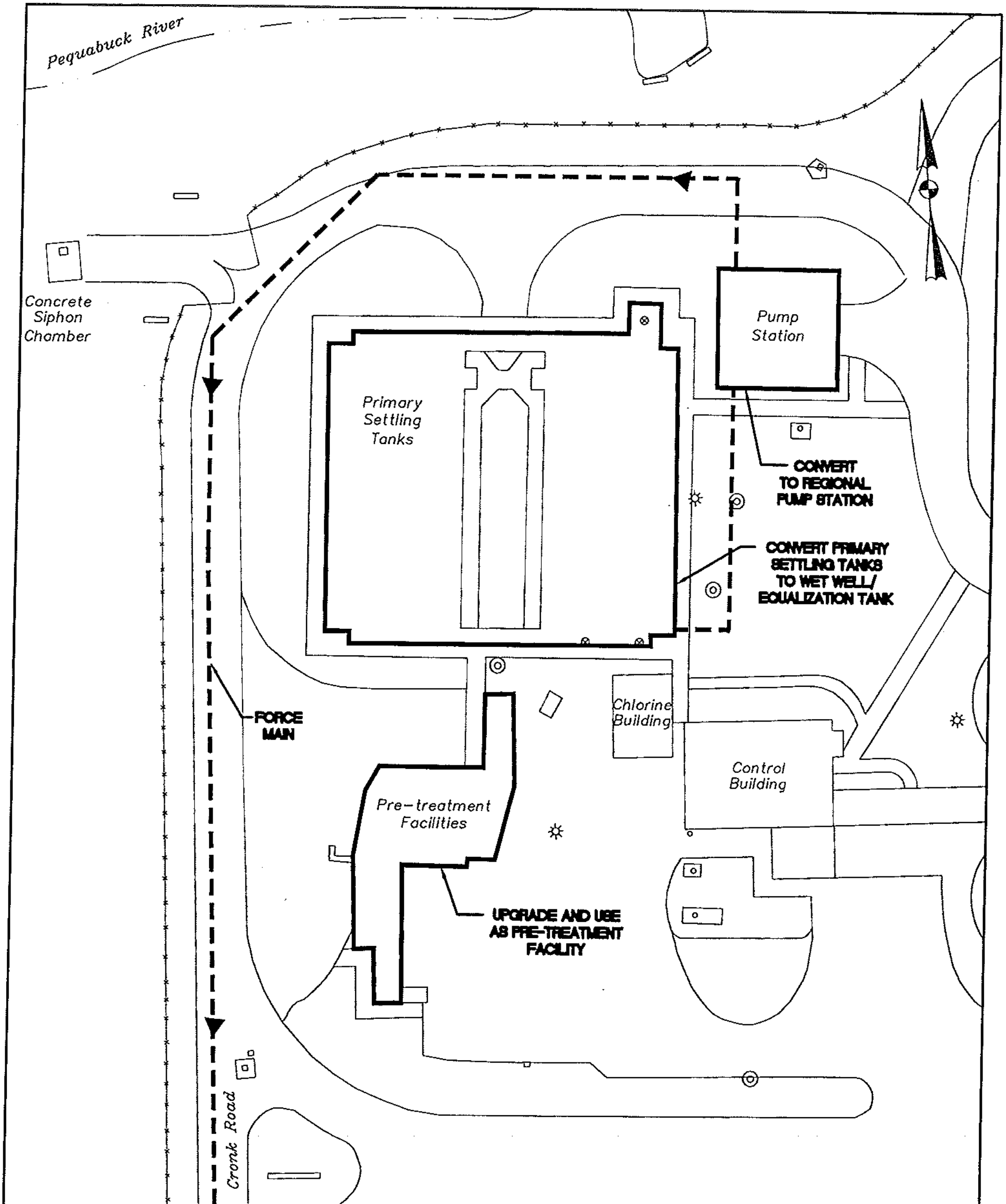
TABLE 3-3
TOWN OF PLAINVILLE
SUMMARY OF COSTS - INTERMUNICIPAL ALTERNATIVE
WASTEWATER CONVEYANCE SYSTEM (to Christian La.)
Concept Stage: Engineer's Opinion of Probable Project Cost

Item No.	Work Item Description	Unit of Measure	Approximate Quantity	All-inclusive Unit Price	ESTIMATED COST
	New Regional Wastewater Pumping Station	(Preliminary Station Sizing: 7.5 mgd)			
1	Building Architectural and Structural	L.S.	1	$300,000	$300,000
2	Pumps & Motors, Piping & Valving	L.S.	1	$600,000	$600,000
3	HVAC and plumbing	L.S.	1	$25,000	$25,000
4	Pump Control System	L.S.	1	$50,000	$50,000
5	Site Work and Landscaping	L.S.	1	$33,640	$33,600
	WWTP Deactivation/Demolition				
6	Selective Structure Conversions & Demo	L.S.	1	$150,000	$150,000
7	Equipment Removal & Disposal	L.S.	1	$100,000	$100,000
8	Piping & Valving Removal	L.S.	1	$25,000	$25,000
9	Yard Piping Alterations	L.S.	1	$40,000	$40,000
10	Site Restoration	L.S.	1	$50,000	$50,000
	Gravity Sewer Lines				
11	8 inch PVC	L.F.	0	$60	$0
12	15 inch PVC	L.F.	0	$70	$0
13	18 inch PVC	L.F.	0	$90	$0
	Force Mains				
14	18 inch DIP	L.F.	40,000	$105	$4,200,000
	Force Main Special Construction				
15	Selective Tunneling/Jacking Location	Each	4	$15,000	$60,000
16	Building Service Lateral Relocations	Each	200	$500	$100,000
17	Utility Relocations (Water Mains, Gas Mains, etc.)	L.S.	1	$200,600	$200,600

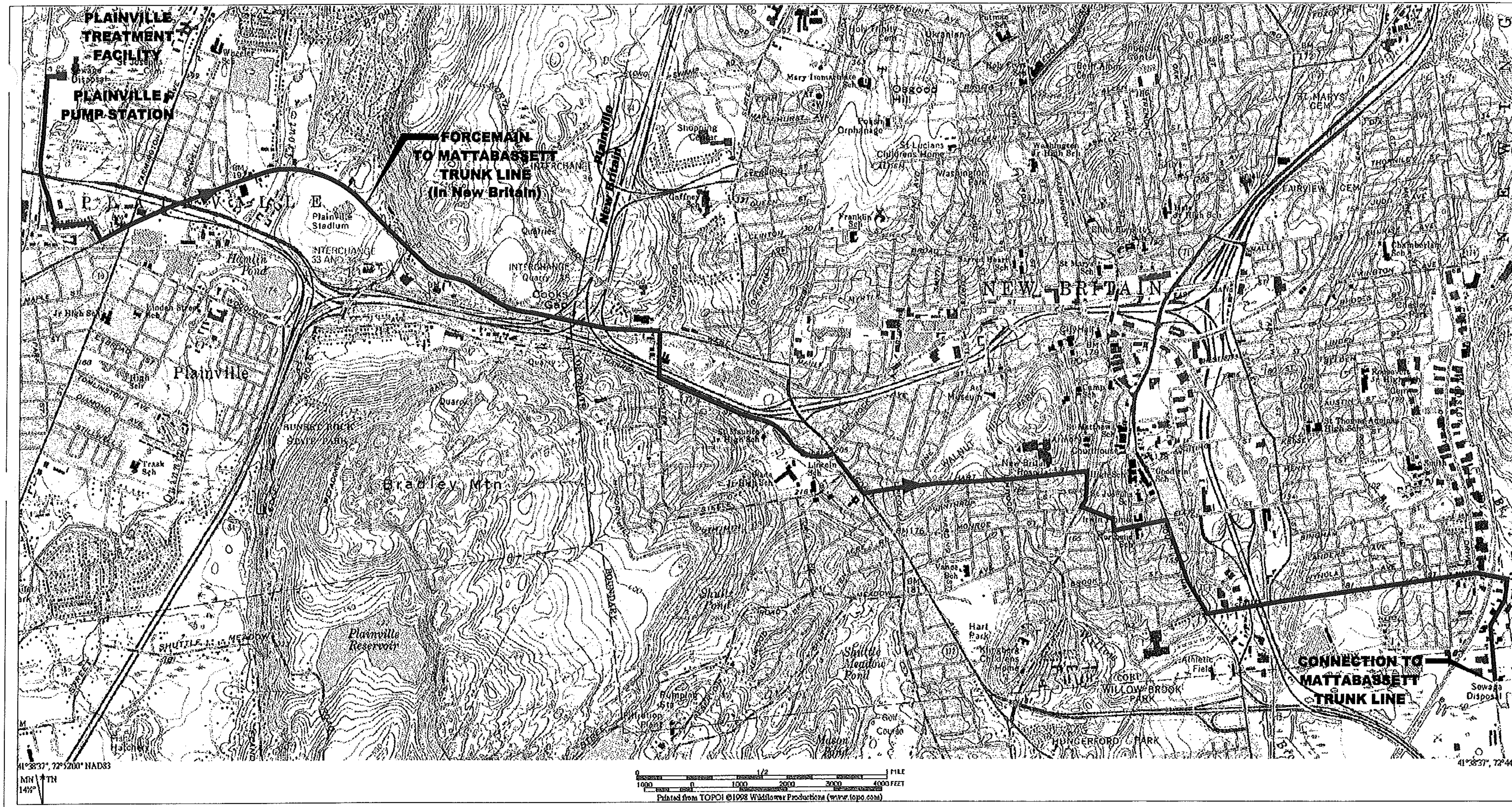
A.	**TOTAL ESTIMATED CONSTRUCTION COST (1999 dollars)**			**$5,934,000**
B.	TECHNICAL SERVICES		20.00%	$1,186,800
C.	LEGAL AND FISCAL	(Town of Plainville Legal & Financial)	0.50%	$29,670
D.	ADMINISTRATION	(Town of Plainville Project Administration)	1.00%	$59,340
E.	CONSTRUCTION CONTINGENCY		15.00%	$890,100
F.	INTEREST	(see note #1)		$0
G.	SITE	(see note #2)		$0

TOTAL ESTIMATED PROJECT COST (1999 dollars) $8,100,000

Notes 1 No Temporary and Permanent Borrowing costs have been included in this Project Cost Estimate.
2. No Property costs included; it is assumed that the work will be on State/City Property or cost will come from Contingency



INTER-MUNICIPAL SEWERAGE STUDY	SCALE: 1" = 20'
TOWN OF PLAINVILLE	DATE: October 8, 1999
SEWERING TO MATTABASSETT TREATMENT PLANT	FIGURE 3-3



LEGEND

FORCEMAIN

P.S.

MATTABASSETT INTER-MUNICIPAL STUDY

PLAINVILLE INTER-MUNICIPAL ALTERNATIVE

SCALE: As Noted
DATE: October 8, 1999

Figure 3-4

Environmental and Permitting Issues

Diversion Permit

Under the proposed regional alternative, approximately 2.2 mgd of treated wastewater (existing conditions) would be transferred from the Pequabuck River and the Farmington River watershed to the Mattabassett Wastewater Treatment Facility and the Connecticut River. The need for a diversion permit for this activity is established by Sections 22a-365 through 22a-380 of the Connecticut General Statutes as follows:

> *"The diversion of the waters of the state shall be permitted only when such diversion is found to be necessary, is compatible with long-range water resource planning, proper management and use of the water resources of Connecticut ...... "*

An analysis of the requirements and issues that must be addressed in the development of a Diversion Permit Application, and the feasibility of obtaining permit from the CTDEP is presented in a technical memorandum included in Appendix A. A summary of this analysis is presented in the following sections.

Background

The Pequabuck River flows east from Plymouth through Bristol and north through Plainville into Farmington, where it joins the Farmington River at Shade Swamp. Plainville currently discharges approximately 2.2 million gallons per day (mgd) of treated sewage through its advanced waste treatment water treatment facility to the Pequabuck River in Plainville. The discharge point is approximately 3 miles south of the confluence of the Pequabuck River with the Farmington River. The river also receives wastewater from advanced wastewater treatment facilities in Plymouth and Bristol upstream of the discharge from Plainville.

The Pequabuck River is classified as a Class B water under the Connecticut Water Quality Standards and supports a variety of recreation and other uses. The Farmington River is a highly valued water resource providing for multiple river uses throughout is length and watershed from water supply reservoirs and well fields to hydropower, anadramous fish spawning, swimming, fishing and recreational boating. A segment of the West Branch of the Farmington River has been recently designated as a Federal Wild and Scenic River. A number of riparian agreements for water use also exist within the river basin. The Metropolitan District Commission (MDC) and the U.S. Army Corps of Engineers regulate flow in the river to maintain minimum flows, prevent flooding and to meet riparian release agreements as well as to provide for recreation and meet fisheries requirements.

As previously described, the regional alternative would require pumping an average of approximately 2.2 mgd Plainville's sewage to the Mattabassett District Commission facility Cromwell. This will reduce the flows in the Pequabuck River at the Plainville discharge point during low flow conditions from approximately 28.4 cubic feet per second (cfs) to 22.5 cfs, a reduction of approximately 20%.

A General Location Plan showing the relative locations of the affected rivers and locations of the wastewater treatment facilities is presented on Figure 3-5.

Key Issues

As part of the Diversion Permit Application process, the wide range of issues resulting from the diversion must be addressed as part detailed hydrologic, engineering and environmental studies. A summary of the key issues affecting the feasibility of obtaining a diversion permit from the CTDEP are as follows:

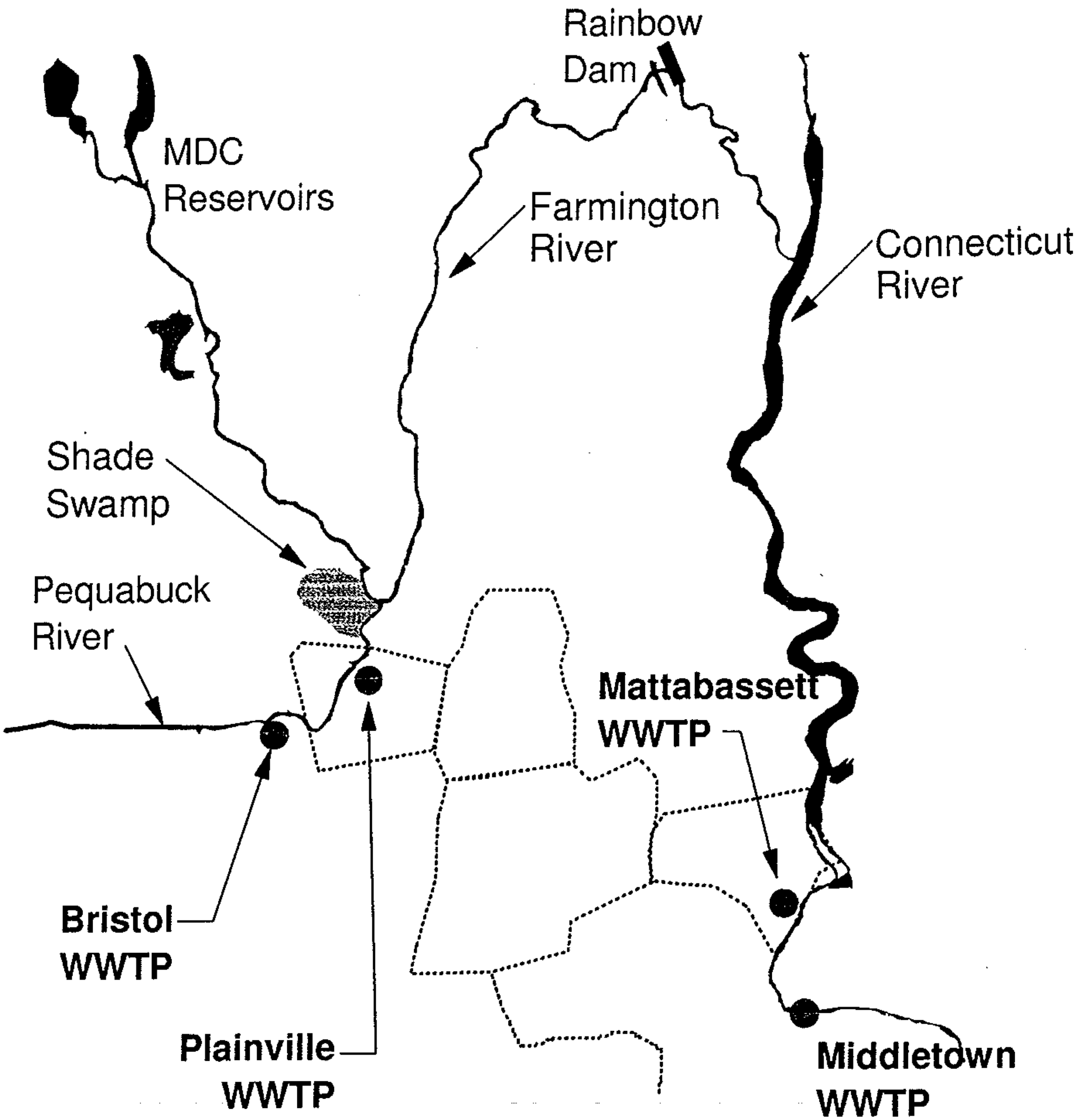
- Water Quality Issues - The removal of the discharge will alter the water quality in the Pequabuck River by lowering the flow and the reducing the total quantity of pollutants being discharged to the river. The CTDEP has recently completed a preliminary water quality model analysis without the Plainville discharge to assess potential impacts on water quality. This model shows that the removal of the Plainville discharge will not have a negative impact on water quality, and will actually result in a slight improvement of river dissolved oxygen concentrations in the Pequabuck River. In addition, the removal of the discharge will also reduce in stream copper and zinc concentrations, which currently are at or exceed water quality standards. The CTDEP has not rerun the Farmington river water quality model without the Plainville discharge, but has indicated that the elimination of the Plainville discharge will not likely have a significant impact.

- River Baseflow Issues - Based on conversations with CTDEP staff, the CTDEP has recently opposed a proposed 1.0 mgd water supply diversion from Scotts Swamp Brook, a tributary to the Pequabuck River, on the grounds that it would reduce the base flows in the Brook to unacceptably low levels. Potential water quality concerns in the lower reach of the Pequabuck in the vicinity of Shade Swamp were also cited. Consequently, the improvements in water quality from the diversion may be offset by CTDEP concerns regarding base flows in the river and other potential environmental impacts.

- Environmental/Fisheries Issues - The reduction in flow in the Pequabuck may alter the fisheries and other habitat by reducing flow rates, river depths and wetted river channel perimeter. The actual impacts would need to be determined through detailed hydrologic and environmental studies. While not expected to be significant, the impact on river flood elevations would also have to be reviewed.

- Hydropower Issues - The Stanley Works operates a hydropower generation station at the Rainbow Dam on the Farmington River, which is downstream of the confluence of its confluence with the Pequabuck. The reduction of flow in the Farmington River may have a slight impact on its generation capacity. Based on discussions with the MDC, it is unlikely that the Plainville diversion will impact the riparian release agreement between the MDC and The Stanley Works. Consequently, it unlikely that the MDC would oppose the diversion based on hydropower issues. It is uncertain if the reduction in flow would be significant enough to be a concern at the Rainbow Dam.

Plainville Diversion



- Farmington River Issues - The Pequabuck River enters the Farmington River below the Wild and Scenic river segment. Unlike the Wild and Scenic river segment, the gradient of the Farmington River downstream of the Pequabuck River is flatter and the pool elevation is regulated. Consequently, the reduction in flow from a diversion will likely only have minimal impact on habitat and fisheries in the Farmington segment. However, the flow reduction may have an impact on high flow release quantities needed to meet fish spawning spring flow requirements. The Farmington River Wild and Scenic Coordinating Committee will need to assess this impact. It is possible that the MDC, which is responsible for releasing water from its dams to meet these spring flow requirements, may also be concerned on this issue.

Diversion Permit Process

The permit process requires preparation of a comprehensive permit application including detailed hydrologic and environmental impact studies. It also requires a study of alternatives and the cost factors, feasibility and environmental effects of each. In addition, since this diversion is an interbasin transfer as define by the statute, it will require an environmental impact report on the impacts of the proposed transfer. A public hearing will likely be required with public notice required to many public officials including the conservation commission and wetlands commission chairs in each town effected. The cost for preparation of the permit application, the required studies and legal/engineering support during the permit application process could range from $100,000 to $250,000, depending on CTDEP requirements and the need to address the concerns of the various interested parties.

Exemptions to the permit process are provided and include an exemption for discharges permitted under the provisions of section 22a-430 and the Federal Clean Water Act. It is possible, although highly unlikely, that the CTDEP would provide an exemption for this diversion without going through the permit application and public hearing process.

Interest Parties

Under the diversion permitting process, the general public and other interested parties will have the opportunity to provide input and indicate concerns relative to the diversion. Other proposals for diversion of waters from the Farmington River basin have drawn significant opposition from a number of groups such as the Farmington River Watershed Association and the Farmington River Wild and Scenic Coordinating Committee. Other potentially interested parties include, but may not be limited to adjacent towns and towns, along the Farmington and Pequabuck Rivers, a variety of environmental, recreational and conservation organizations, and those parties with water supply and hydroelectric power interests on the Farmington River.

Summary of Findings Related to the Diversion Permit

Based on our evaluations, discussions with the CTDEP and the information currently available, there does not appear a major technical issue that would preclude the CTDEP from issuing a diversion permit to the Town of Plainville. The actual feasibility of obtaining the permit would be dependant on the results of the detailed hydrologic and environmental studies needed to support the permit application and the results of the public hearing process. A summary of the issues impacting the feasibility of obtaining a diversion permit for the Plainville discharge are as follows:

- Based on the preliminary CTDEP water quality model runs, diversion of the Plainville discharge will not have a detrimental impact on pollutant concentrations or DO levels in the Pequabuck River. A slight increase in water quality, particularly for copper and zinc concentrations, would probably be realized.

- Reductions in the base river flow of the Pequabuck are a CTDEP concern relative to impacts on fisheries and other habitats in the Scotts Swamp reach of the Pequabuck River.

- With the possible exception of spring spawning water release requirements, impacts on the Farmington River relative to water quality and fisheries/habitat will likely not be significant since Farmington River water elevations downstream of its confluence with the Pequabuck will not be significantly altered by the diversion.

- The riparian rights agreements between the MDC and the Stanley Works for hydropower generation at the Rainbow Dam would not be impacted by the diversion. While the impact would be relatively small, it is uncertain if the reduction in flows from a diversion would be significant enough to be a concern at the Rainbow Dam.

- While an exemption for NPDES permitted discharges is allowed under the regulations, the diversion will most likely be subject to a diversion permit application and public hearing. The application will also require extensive hydrologic and environmental impact studies to address the variety of issues previously outlined. The costs for engineering and legal services to support this process could range from $100,000 to $250,000 depending on the level of documentation required by the CTDEP and the need to address issues raised by interested parties.

- The permitting process will give rise to significant interest, and in all likelihood some opposition, from special interest and citizen groups. These concerns will need to be recognized and addressed as part of the permitting process. If valid technical and environmental concerns can not successfully addressed, the CTDEP may be reluctant to grant a diversion permit.

Other Environmental and Permitting Issues

Section 404 Clean Water Act Permit

Any activity that involves the discharge of dredged or fill materials in waters of the United States requires a permit from the U.S. Army Corps of Engineers (Corps) under Section 04 of the Federal Clean Water Act (33 U.S.C. Sec. 1341). Wetlands, as determined by the 1989 Guidance Manual for Delineating Federal Wetlands, are considered "waters of the U.S."

In Connecticut, the federal and state permitting programs are coordinated in the Connecticut Programmatic General Permit (CT PGP) Program. A permit is submitted to the Corps and they, in turn, coordinate with the Connecticut Department of Environmental Protection (CTDEP) Inland Water Resources Division. One permit letter is issued which covers the federal (Section 404) and state (Section 401) authorizations.

Under the CT PGP, proposed projects are placed into one of three categories. Category I activities are those that generally involve less than 5,000 square feet (sf) of wetland impact. These activities are "non-reporting", i.e. no application is required, although the general conditions of the CT PGP must be adhered to for the authorization to be valid. Category II activities generally involve project that impact between 5,000 sf and one acre of wetland. An application is submitted to the Corps and it is screened by federal and state agencies. The agencies may determine that the activity qualifies under the CT PGP and, therefore, requires no further processing, or that the activity is significant enough to warrant more detailed review as an Individual Permit. Activities involving greater than one acre of impact area automatically are reviewed as Individual Permits.

For construction of the Plainville Interceptor, the alignment of which appears to be in or near wetlands associated with the Pequabuck River, the activity would likely be considered a Category II activity. Upon submission of the permit application, the Corps will notify the applicant of approval, denial, or request of additional information typically within 45 days.

Section 401 Water Quality Certification

As mentioned above, the CTDEP, under the authority of Section 401 of the Federal Clean Water Act, requires applicants to obtain a water quality certificate for activities involving the discharge of dredged or fill material within waters of the U.S. Category I activities are conditionally granted a water quality certificate. Category II activities that exhibit minimal or no impact to water quality are typically granted certification along with the Corps Section 404 permit. A separate application to CT DEP is not required for Category I or II activities.

The timeline for permit approval of Category II activities is concurrent with the Corps Section 404 Permit, which is 45 days.

As part of both the Section 404 and 401 permits, coordination with the State Historic Preservation Officer (SHPO) and the Connecticut Natural Diversity Data Base is required to identify any historic/archaeological resources or rare, threatened or endangered species that may be present in the project area.

Local Inland Wetland Permit

Activities which would occur within, or possibly affect wetlands or watercourses require a permit from the Inland Wetlands and Watercourses Commission. Wetlands under local jurisdiction are based on soil types, which differ slightly from the federal definition, which is based on soils, vegetation and hydrology. Therefore, a delineation of the federal and state wetland limits would be required.

If the Commission determines that the activity is "significant", then a public hearing may be scheduled. A public hearing must commence between 30 and 60 days following the submission of the application. Action is taken on the application within 45 days of the public hearing or, in the absence of a public hearing, within 60 days.

Stream Channel Encroachment

Any person proposing to place an encroachment or obstruction riverward of stream channel encroachment lines must obtain a permit from the CTDEP. Stream channel encroachment lines have been established for about 270 linear miles of riverine floodplain throughout the State. The Pequabuck River from the railroad bridge downstream of North Washington St. (State Route 177) in Plainville to the dam at Middle St. in Bristol is a regulated stretch. The Plainville interceptor, as currently proposed is approximately 500 feet east, and outside of, the regulated area. Therefore, a stream channel encroachment permit **would not be** required.

Other Permits/Approvals

Construction work within the Connecticut Department of Transportation (CTDOT) right-of-way would require permission from CTDOT. The proposed alignment lies within CTDOT right-of-way (State Route 372).

Likewise, any transmission route that conveys the sewage through proposed piping in the City of New Britain would require road-cut type permits from the City. Like any proposed construction within communities, small fees are typically associated with these type permits.

Any newly constructed or modified pump stations, or other ancillary structures, would need approval from the Plainville Planning and Zoning Commission. The timeline for decision from the Commission is similar to that of the Inland Wetlands Commission. However, if the structure is located within or near wetlands, then approval from the Inland Wetlands Commission is typically required before approval from the Planning and Zoning Commission.

Chapter 4

CHAPTER 4 TOWN OF PORTLAND

Introduction

In June 1996, the Town of Portland completed a Feasibility Study of its Wastewater Treatment Plant which contained an evaluation for the expansion and upgrade of the existing facility.

Much of the information contained in the following paragraphs was taken directly from that report.

Subsequent to that Feasibility Study, the Town has moved forward with the development of a "Basis of Design Report" for the local treatment plant which completed in February 1998. In a separate study, they also investigated the cost of conveying their wastewater to the Mattabassett Treatment Plant via directional drilling under the Connecticut River. The option of placing a force main on the Arrigoni Bridge to cross the Connecticut river was also investigated. There were a number of restrictions placed by Connecticut DOT on this alternative. In that prior study, the Town decided only to pursue the option of installing a forcemain under the Connecticut River.

The Basis of Design Report provided the following information and flow projections:

TABLE 4-1

TOWN OF PORTLAND - WASTEWATER FLOW PROJECTIONS

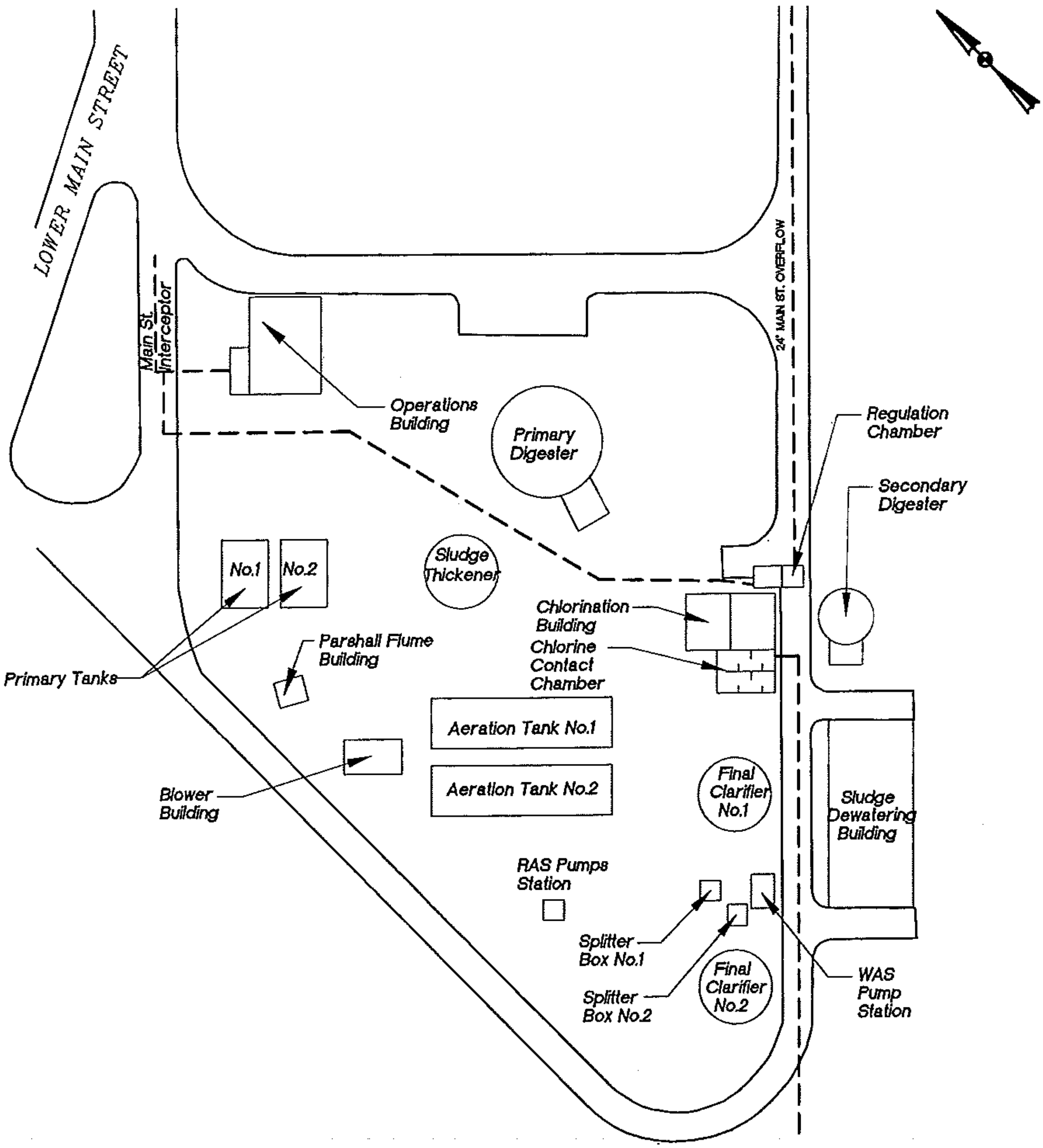
	1994-1997 AVERAGE	Projected Year 2017
Average Daily Flow	0.65	0.85
Maximum Daily Flow	1.82	2.38
Peak Hour Flow	2.53	3.31

These flows will be the basis for establishing flows which would be conveyed to the Mattabassett District WPCF in Cromwell.

Description of Alternatives

Local Alternative

The site plan of the existing treatment facility is shown in Figure 4-1 of this document (Figure 17 in Feasibility Study). To facilitate the evaluation of the treatment plant and cost to upgrade the local treatment plant the narrative on pages 4-3 through 4-6 has been excerpted from the Town of Portland's "Section VII Recommended Renovation Plan" of the Basis of Design Report Volume 1 as prepared by URS Greiner Inc. and Clough, Harbor & Associates LLP.



INTER-MUNICIPAL SEWERAGE STUDY	SCALE: 1"=100'
TOWN OF PORTLAND	DATE: October 8, 1999
EXISTING WASTEWATER TREATMENT FACILITY	FIGURE 4-1

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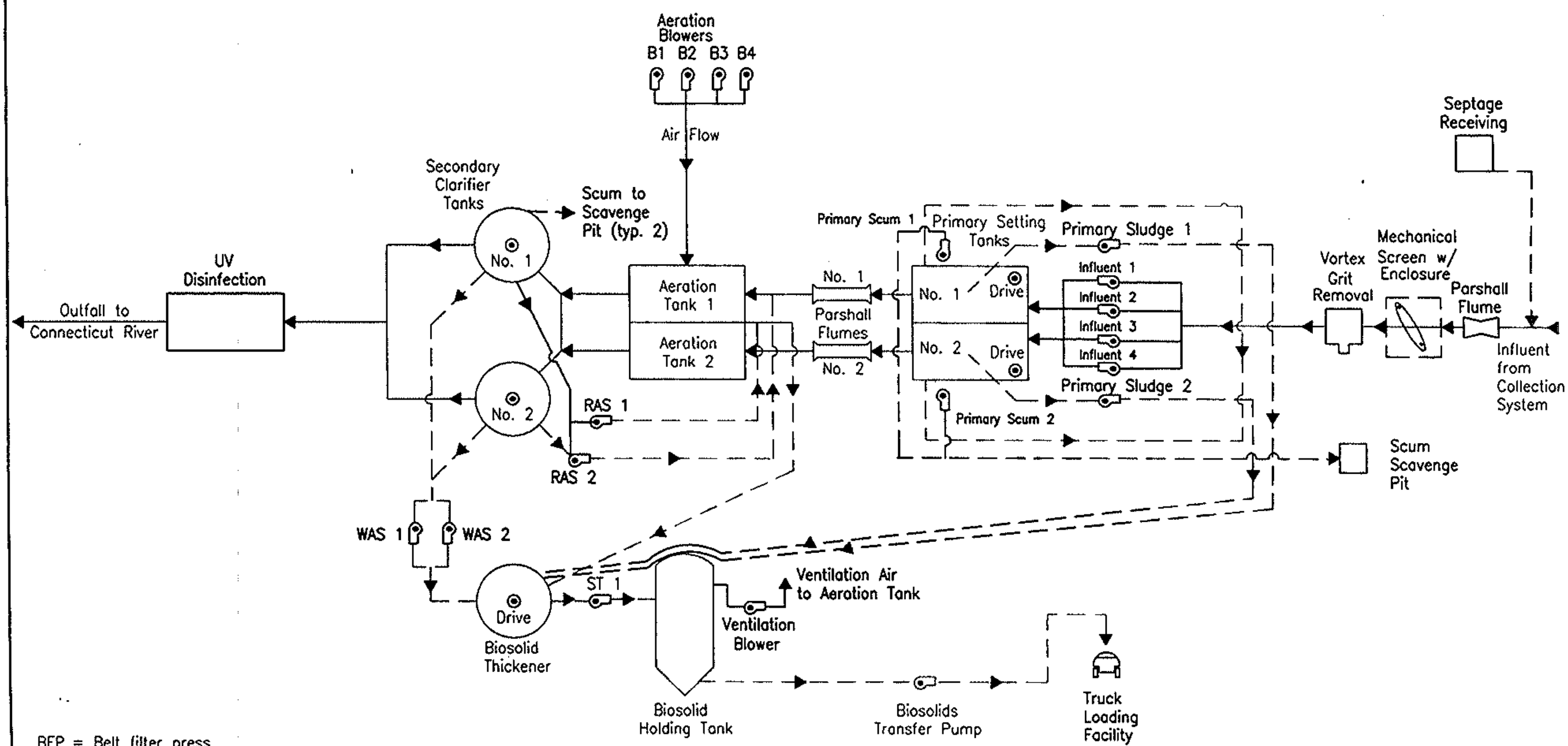


BFP = Belt filter press
PS = Primary sludge
RAS = Return activated sludge
ST = Sludge transfer
WAS = Waste activated sludge

TOWN OF PORTLAND, CONNECTICUT
WPCP RENOVATIONS
BASIS OF DESIGN REPORT

FIGURE NO. 17 | SCALE: NONE

Renovated WPCP
Process Schematic

Sludge Handling

The sludge thickener mechanical equipment will be replaced. By-pass piping will be provided to pump sludge around the sludge thickener, directly to the primary digester such that renovations may be made to the thickener. The primary and secondary digester will be pumped out and cleaned.

In order to facilitate the long-term biosolid disposal option, the primary digester will be converted to a biosolid holding tank and the secondary digester will be decommissioned. Facilities will be provided for pumping biosolids from the holding tank to trucks for hauling and disposal.

Miscellaneous

The effluent service water and foam spray water pumps will be replaced. Flow measuring devices will be provided on the primary tank influent lines, RAS lines, WAS lines, primary sludge flow, primary digester supernatant, sludge thickener overflow, and belt filter press filtrate. Handrails will be provided around tankage to improve site safety.

Building Structures

The following renovations will be provided to the Operations, Parshall Flume, Blower, Chlorination and Primary Digester Buildings.

- *Replace roofing systems and deteriorated roof accessories.*
- *Replace single-glazed painted metal-framed windows with energy efficient operable windows.*
- *Replace remaining precast concrete coping with pre-finished metal coping system compatible with roofing system.*
- *Replace deteriorated flashing and counter flashing systems at parapet/roofs.*
- *Repoint exterior masonry walls and restore weepholes.*
- *Replace joint sealant and backer-rod at doors and windows and between dissimilar materials and expansion joints.*
- *Strip and repaint interior painted masonry surfaces.*
- *Upgrade exterior and interior lighting systems.*

The following renovations will be provided to the Operations Building:

- *Upgrade/replace HVAC systems as required by code or additional construction.*
- *Replace emergency power generator; relocate if required. Generator to be sized to accommodate required loads.*
- *Replace Motor Control Center.*
- *Install security and fire alarm systems, connected to Town systems.*
- *Replace motor control system with state-of-the-art management system.*
- *Provide interior renovations to accommodate expanded laboratory.*

A Hazardous Material Survey of all the WPCP building structures has been completed for the Town. Although the survey report is not yet available at this date, the abatement costs have been included in the overall upgrading cost estimate.

B. CONSTRUCTION COST SUMMARY

A summary of the estimated construction costs is included in Table 4-2.

Renovations to the WPCP will be completed while the existing plant remains on-line. Additional coordination and temporary facilities will be required to incorporate the proposed work into the existing facilities, while maintaining treatment operations.

A 20% contingency factor has been included in the construction cost estimates of unit processes requiring substantial coordination.

(End of Text provided by URS Greiner)

TABLE 4-2
TOWN OF PORTLAND
SUMMARY OF COSTS - LOCAL ALTERNATIVE

(Cost information contained in Table 4-2 provided by URS Greiner Consulting Engineers)

Description of Item of Work		Est. Component Cost	Est. Total Cost
HEADWORKS			
Mechanical Screening w/Enclosure		$150,000	
Grit Removal		$136,000	
Septage Receiving		$27,000	
Parshall Flume		$5,000	
Influent Pumps		$154,000	
Influent Pump Hoist		$6,000	
Regulation Chamber "E" Pumps		$37,000	
Decommission Septage Receiving and Scum Pumps		$4,000	
	SUBTOTAL		$519,000
PRIMARY TREATMENT			
Chain and Flight Mechanical Equipment		$211,000	
Scum Removal		$75,000	
Baffles		$5,000	
Effluent Piping		$22,000	
Primary Sludge Pumps		$69,000	
	SUBTOTAL		$382,000
SECONDARY TREATMENT			
AERATION			
Blowers (Included inNitrogen Removal)		$0	
Diffusers (Included in Nitrogen Removal)		$0	
Tank Steps		$4,000	
Sump Pumps (Included in Nitrogen Removal)		$0	
Foam Pipe System		$1,500	
Structural Repairs		$45,000	
Compressors		$30,000	
SECONDARY CLARIFIERS			
Mechanical Equipment		$221,000	
Level Floors		$7,000	
RAS Pumps and Pump Station		$45,600	
WAS Pumps and Pump Station		$46,900	
Replace Splitter Box Weirs		$3,000	
Convert WAS Station to Wet Well		$17,000	
	SUBTOTAL		$421,000
DISINFECTION *	** Inaccordance with Town's agreement with USEPA*		
UV System	SUBTOTAL		$334,000
SLUDGE TREATMENT			
SLUDGE THICKENER			
By-pass Piping		$20,000	
Mechanical Replacement		$60,000	
Structural Repair Allowance		$10,000	

TABLE 4-2

TOWN OF PORTLAND

SUMMARY OF COSTS - LOCAL ALTERNATIVE

(Cost information contained in Table 4-2 provided by URS Greiner Consulting Engineers)

Description of Item of Work		*Est. Component Cost*	*Est. Total Cost*
SLUDGE TREATMENT (continued)			
PRIMARY DIGESTER (Sludge Holding Tank)			
By-pass Piping		$20,000	
Cleaning and Internal Inspection		$240,000	
Structural Repair Allowance		$10,000	
Gas Seal Replacement		$10,000	
Transfer Pump Replacement		$17,000	
Sludge Level Measurement system Replacement		$15,000	
Odor Control		$60,000	
Biosolids Loading system		$27,000	
SECONDARY DIGESTER			
Cleaning and Internal Inspection		$20,000	
Demolition		$60,000	
	SUBTOTAL		$569,000
MISCELLANEOUS EQUIPMENT			
Effluent Water and Foam Spray Pumps		$14,500	
Flow Metering		$60,000	
Handrails		$33,000	
Outfall Riprap		$4,500	
	SUBTOTAL		$112,000
BUILDING STRUCTURES			
Operations Building		$361,000	
Parshall Flume Building		$11,000	
Blower Building		$10,000	
Chlorination Building		$54,000	
Secondary Digester		$0	
Primary Digester		$21,500	
Laboratory Renovation		$35,000	
Dewatering Building		$20,500	
	SUBTOTAL		$513,000
MISCELLANEOUS SITE WORK			$35,000
OTHER MISCELLANEOUS WORK	(item added by Maguire)		$155,000
HAZARDOUS WASTE REMOVAL			$40,000
	SUBTOTAL		$3,080,000
CONTRACTOR OVERHEAD AND PROFIT		21%	$647,000
SUBTOTAL ESTIMATED CONSTRUCTION COST			$3,727,000
NITROGEN REMOVAL			$738,000
TOTAL ESTIMATED CONSTRUCTION COST			**$4,465,000**
CONTINGENCY ADJUSTMENT 20% to 15% (for consistency)		-5%	($223,250)
TOTAL ESTIMATED CONSTRUCTION COST (Adjusted)			**$4,242,000**
TECHNICAL SERVICES		20%	$848,000
TOTAL ESTIMATED PROJECT COST			**$5,090,000**

It should be noted that the nitrogen removal process proposed herein will meet all of the DEP goals through the year 2014 without phasing.

For the purposes of this Report, the costs outlined in Table 4-2, as provided by URS Greiner/Woodward Clyde, have been adjusted by reducing the 20% contingency to 15% and by adding both a category entitled "Other Miscellaneous Work" and a 20% contingency for technical services (engineering costs).

With those adjustments, the total estimated project cost for the Town of Portland "Local Alternative" is **$5,090,000.**

The total operation and maintenance costs for both the treatment plant and collection system are estimated to be $457,500 annually. Of that total cost, an estimated **$217,500** annually is spent on the operation and maintenance of the wastewater treatment facility.

Inter-Municipal Alternative

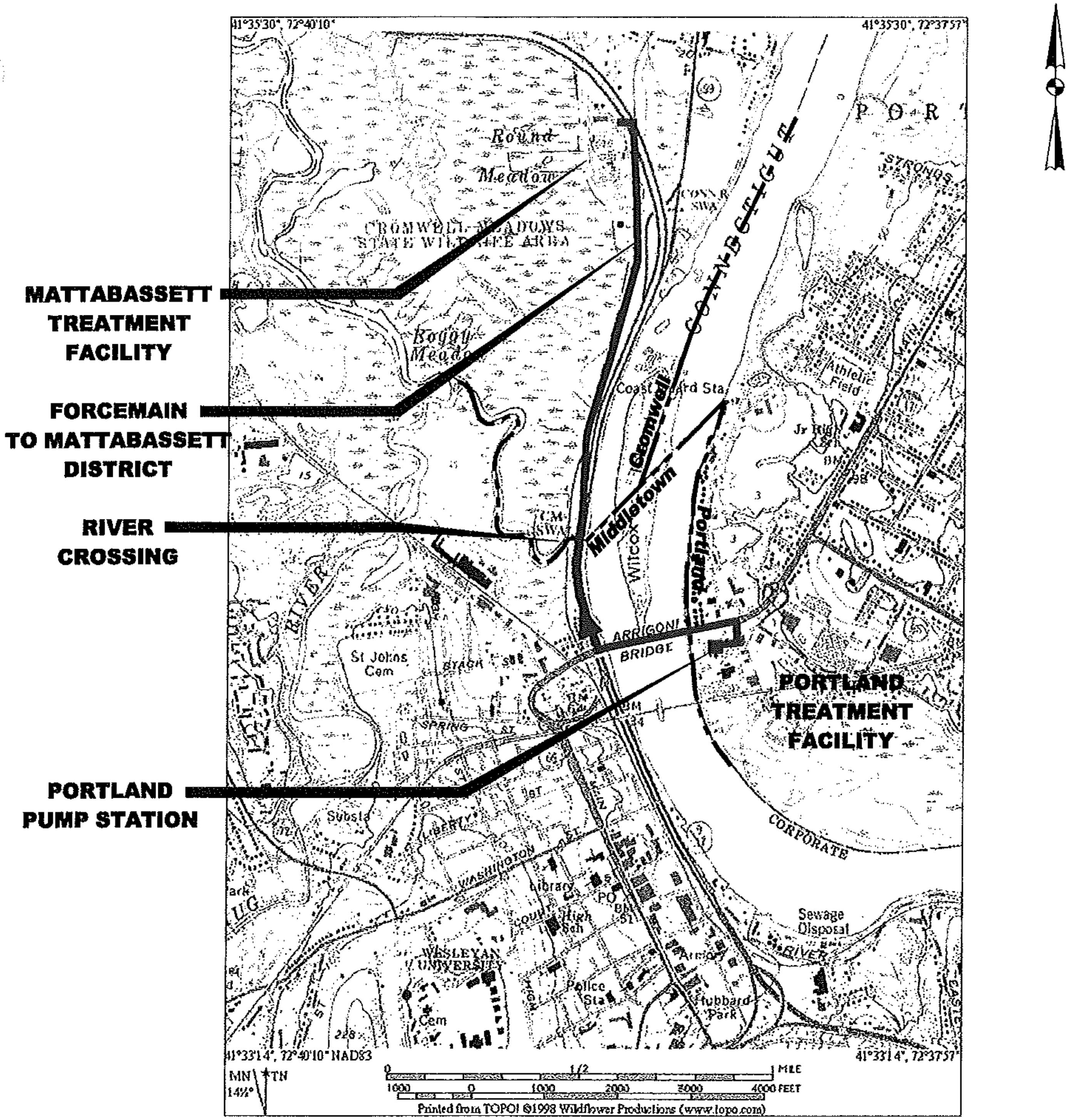
As an alternative to upgrading the existing wastewater treatment plant, the Town could convey its wastewater to the Mattabassett District plant. This option will require that the Town construct a new regional pumping station at the treatment plant site, decommission the existing plant, and construct a force main across the Connecticut River to the Mattabassett plant along a suggested corridor (right-of-way) between the railroad line and the west side of the Route 9 right-of-way.

This Inter-municipal conveyance alternative is portrayed in Figure 4-3.

As mentioned previously, the Town has chosen to cross under the Connecticut river via directional drilling rather than hang the pipe off the Arrigoni Bridge. The pipeline on the Middletown side would be laid in the same trench as the Middletown force main. The force main, estimated to be a 14-inch diameter, is approximately 9,900 feet long from the proposed Portland pumping station to the Mattabassett treatment plant.

The estimated cost for this Inter-municipal Alternative, including a 15% contingency and 20% engineering cost, is approximately **$3,600,000.** The O&M cost associated with the new regional pumping station is estimated to be **$35,000** annually.

In addition to the above costs, the Town of Portland must also pay their fair share of costs associated with the Mattabassett treatment plant. These cost figures have been presented in Chapter 6. Additional discussions on these costs as well as a cost comparison of the local option with the inter-municipal alternative of conveying wastewater to Mattabassett is also included in Chapter 6.



LEGEND

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MATTABASSETT INTER-MUNICIPAL STUDY **PORTLAND** **INTER-MUNICIPAL ALTERNATIVE**	SCALE: As Noted DATE: October 8, 1999 Figure 4-3

Environmental and Permitting Issues

Because the proposed forcemain installation activity would occur in and about the Connecticut River, which is a navigable water of the United States, it would come under the purview of the CT Department of Environmental Protection's Office of Long Island Sound Programs (OLISP). However, certain portions of the project may occur landward of the high tide line and, therefore, would be regulated at the local level.

It is recommended that a pre-application meeting be held with the Army Corps of Engineers (Corps) and CT Department of Environmental Protection's (CTDEP) Inland Water Resources Division and Office of Long Island Sound Programs (OLISP) to discuss permit streamlining strategies. It is possible that, for permitting purposes, the project is divided into two segments based on inland and tidal wetland impact areas.

A key determination will be the delineation of the tidal and inland wetlands. CT DEP has determined that the high tide line in the project area is 5.67 feet (NGVD). Activities at or below this elevation would be considered within the tidal zone. Also, it is possible that an elevation up to 1 foot above the high tide line (5.67 + 1 = 6.67 feet) could be regulated as tidal wetland, if physical evidence so demonstrates. A field delineation of the tidal/inland wetland boundaries would be required to make such a determination.

Inland wetlands activities are regulated by the Corps and the Town of Portland Inland Wetlands Commission while tidal wetlands are regulated by CTDEP OLISP and the Corps.

Section 404 Clean Water Act Permit

Any activity that involves the discharge of dredged or fill materials in waters of the United States requires a permit from the U.S. Army Corps of Engineers (Corps) under Section 404 of the Federal Clean Water Act (33 U.S.C. Sec. 1341). Wetlands, as determined using the 1989 Guidance Manual for Delineating Federal Wetlands, are considered "waters of the U.S."

In Connecticut, the federal and state permitting programs are coordinated in the Connecticut Programmatic General Permit (CT PGP) Program. For **inland wetland** activities, an application is submitted to the Corps which, in turn, coordinates with the Connecticut Department of Environmental Protection (CTDEP) Inland Water Resources Division. However, for the portion of the project occurring within the Connecticut River and associated tidal wetlands, an application is submitted to CTDEP's Office of Long Island Sound Programs (OLISP) which, in turn, coordinates with the Corps. Most of the proposed activity would occur within tidal and navigable waters and, therefore, the Section 404 review would be initiated through OLISP.

Under the CT PGP, this project would likely by a Category II activity. Category II activities within tidal and navigable waters involve less than 1 acre of disturbance. The application is reviewed jointly by the Corps, CTDEP, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and EPA and a permit is issued by CTDEP OLISP which would cover the state Structures and Dredging Permit, state 401 Water Quality Certification, and federal Section 404 permit. If, during the agency screening process, the activity is determined to require an individual permit, then the aforementioned permits may be issued individually.

One permit letter is issued which covers the federal (Section 404), state Section 401 and state Structures and Dredging authorizations. Assuming this activity would fall under Category II of the CT PGP, CTDEP OLISP would notify the applicant within 45 days of the receipt of a application of the status of the permit review or if additional information is needed.

Structures and Dredging Permit

A structures, dredging and fill permit is required for work occurring waterward of the high tide line in tidal, coastal or navigable waters. The placement of the proposed sewer line underneath the Connecticut River bed would be regulated by this permit. The assessment of existing sediment conditions (grain size, chemical content) would likely be required if the sewer line were to be lain in an excavated trench. Less sediment testing would be required if directional drilling is used.

As mentioned above, the application for this permit would be submitted to CT DEP OLISP, which would then distribute it to the other regulatory agencies for screening. Assuming the activity would be classified as Category II under the CT PGP, a permit letter would be issued by CT DEP OLISP which would also cover the federal Section 404 and state Section 401 permits.

The total processing time is 6-9 months which includes a required public notice and comment period.

Section 401 Water Quality Certification

As mentioned above, the CTDEP, under the authority of Section 401 of the Federal Clean Water Act, requires applicants to obtain a water quality certificate for activities involving the discharge of dredged or fill material within waters of the U.S. Category I activities are conditionally granted a water quality certificate. Category II activities that exhibit minimal or no impact to water quality are typically granted certification along with the Corps Section 404 permit. A separate application to CT DEP is not required for Category I or II activities.

The timeline for permit approval of Category II activities is concurrent with the state's Structures and Dredging Permit (see above).

As part of both the Section 404 and 401 permits, coordination with the State Historic Preservation Officer (SHPO) and the Connecticut Natural Diversity Data Base is required to identify any historic/archaeological resources or rare, threatened or endangered species that may be present in the project area.

Inland Wetland Permit

Activities which would occur within, or possibly affect inland wetlands or watercourses require a permit from the Portland Inland Wetlands and Watercourses Commission (tidal wetlands are regulated by CTDEP OLISP) Wetlands under local jurisdiction are based on soil types, which differ slightly from the federal definition, which is based on soils, vegetation and hydrology. Therefore, a delineation of the federal and state wetland limits would be required.

The Commission shall render a final decision within 65 days of the receipt of the complete application. If it determines that the activity is "significant", then a public hearing may be scheduled and a decision on the application shall be made within 65 days of the public hearing.

Stream Channel Encroachment

Any person proposing to place an encroachment or obstruction riverward of stream channel encroachment lines must obtain a permit from the CTDEP. Stream channel encroachment lines have been established for about 270 linear miles of riverine floodplain throughout the State. The Connecticut River in Portland is a regulated area. The proposed local interceptor would likely fall within the stream channel encroachment lines and, therefore, a stream channel encroachment permit would be required.

The average total processing time is 165 days which includes a required public notice and comment period.

Other Permits/Approvals

Construction work within the Connecticut Department of Transportation (CTDOT) right-of-way would require permission from CTDOT.

Any newly constructed or modified pump stations, or other ancillary structures, would need approval from the Portland Planning and Zoning Commission. The timeline for decision from the Commission is similar to that of the Inland Wetlands Commission. However, if the structure is located within or near wetlands, then approval from the Inland Wetlands Commission is typically required before approval from the Planning and Zoning Commission.

Chapter 5

CHAPTER 5 THE MATTABASSETT DISTRICT

Preface

The original intent of this study was to evaluate the feasibility of three new communities (Middletown, Plainville and Portland) joining the existing three member (New Britain, Berlin and Cromwell) Mattabassett District. Decisions made by the Towns of Plainville and Portland during the preparation of this study resulted in the conclusion that only the City of Middletown would pursue the original purpose of this Study.

The Mattabassett District WPCF discussed in this Chapter and the modifications and upgrades to be made to the plant to accommodate flows from Middletown, Plainville and Portland were developed while all three communities were actively considering the option of joining the Mattabassett District. In finalizing this Study, no attempt has been made to revise the contents of this Chapter once it was learned that Plainville and Portland were no longer interested in the Mattabassett option.

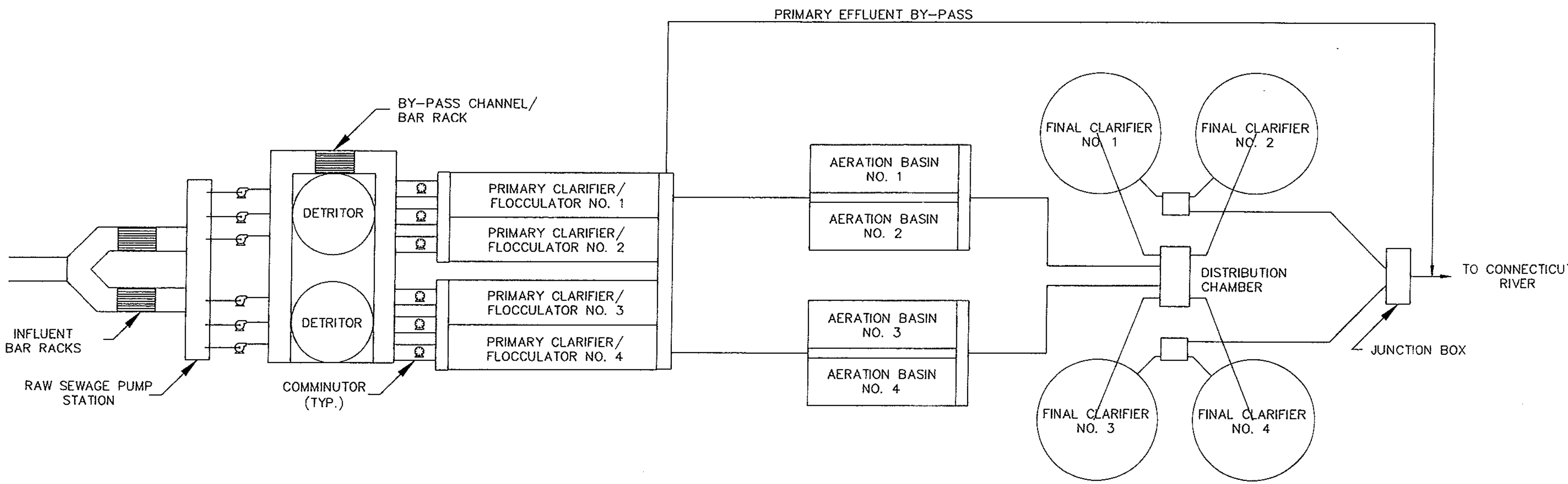
The Executive Summary of this Report contains an updated evaluation of the Mattabassett District WPCF for the one remaining interested community (the City of Middletown).

Introduction

The Mattabassett District Water Pollution Control Facility (WPCF) receives wastewater and septage from its constituent members - New Britain, Berlin, Cromwell, and from a portion of three contractual communities, namely Farmington (through New Britain), the Westfield section of Middletown, and the Hartford Metropolitan District Commission (parts of Newington and Rocky Hill). There are no combined sewers in these areas and the Mattabassett District is not aware of any sanitary sewer overflows. However, there are significant inflow/infiltration issues in the collection system, that the individual communities are addressing.

The WPCF was designed to treat an average flow of 20 million gallons per day (mgd). During wet weather events, all flow receives primary treatment and secondary treatment is provided up for flows up to 40 mgd. During these high flow events, primary effluent and secondary effluent are blended prior to being disinfected and discharged through the plant's submerged outfall pipe in the Connecticut River.

A general description of the wastewater treatment processes at the District WPCF is presented below. A general schematic of the WPCF wet stream treatment processes is presented in Figure 5-1.



MATTABASSETT INTER-MUNICIPAL STUDY

MATTABASSETT DISTRICT

WET-STREAM PROCESS FLOW DIAGRAM

SCALE: NOT TO SCALE

DATE: October 8, 1999

FIGURE 5-1

Existing Treatment Systems

Influent Pump Station

Wastewater enters the WPCF through a 72-inch diameter main trunk sewer. Flow is split to two mechanically cleaned bar screens which remove large objects to protect the downstream equipment. Each bar screen channel can be isolated and the screen taken out of service for maintenance. Screenings are discharged to grinders where they are shredded and discharged back into the waste stream. The bar screens and screens grinders are currently being upgraded as part of a separate project. Flow from each screen channel enters a separate wet well. The wet wells can be isolated or operated as a common wet well. The WPCF has six raw sewage pumps to lift influent wastewater up to the detritor forebay. The suction pipes for three pumps are located in each of the two wet wells. Two pumps are equipped with constant speed motors and are rated at 19 mgd each. Four pumps are equipped with variable speed drives and have a capacity of between 8 and 18 mgd each.

Grit Removal

The discharge from the raw sewage pumps is split between two detritor units that are designed to remove grit and heavy inorganic particles. Material which settles to the bottom of the detritor is removed via a collector mechanism which is designed to wash the grit as it is moved upward. Washing removes some of the organic material removed with the grit and returns it to the waste stream. The washed grit discharged to a pneumatic grit ejector which transports the grit to the grit storage tank in the Sludge Disposal Building for incineration or discharge to a dumpster. Presently, the grit washing system is not effective and the grit contains organic material which makes landfill disposal difficult. Alternative grit washing systems may need to be considered if other means of grit disposal, in addition to incineration, is desired.

Effluent from the detritors passes through four channels equipped with comminutors to grind rags and other large objects which may still be in the waste stream prior to entering the primary clarifiers. A bypass channel equipped with a manual bar rack can be used to bypass either the detritors, the comminutors, or both if necessary.

Septage Receiving Station

The plant currently receives approximately 100,000 to 200,000 gallons of septage per month. All septage is screened and discharged into a septage receiving tank with a volume of 15,640 gallons. Septage is pumped from the receiving tank to the detritor forebay.

Primary Clarification

Flow from the four comminutor channels discharges into an effluent channel where it is split between two channels equipped with Parshall flumes. Each flume has a reported capacity of 40 MGD each.

Downstream of each flume, the wastewater passes through a preaeration channel and enters a distribution channel. There are two preaeration and distribution channels. One feeds Primary Clarifier Nos. 1 and 2 and the second feeds Primary Clarifier Nos. 3 and 4. Waste activated sludge (WAS) is discharged to the head of each preaeration channel (downstream of the Parshall Flumes) and mixed with the primary clarifier influent. Each primary clarifier has an integral flocculation and sedimentation basin. Originally, the primary clarifiers utilized chemically enhanced primary treatment. However, with the construction of the secondary treatment process, the flocculation chemicals and flocculators are no longer used and the plant staff added internal baffles to improve solids removal. Chain and flight sludge collector mechanisms are located in both the "flocculation zone" and sedimentation areas of the primary clarifiers. Therefore, the entire clarifier area is available for settling.

Secondary Treatment

There are two pairs of aeration tanks, with each pair containing two aeration tanks designed for complete mix operation. Each pair is fed by a common influent channel located between the two aeration tanks. Primary effluent, and returned activated sludge (RAS) are combined at the influent end of the influent channel and fed through submerged influent gates along the length of each tank. An effluent channel equipped with an effluent weir runs along the length of the tank opposite of the influent gates. The aeration tanks were designed to operate in a complete mix mode. However, by lowering a portion of the effluent weir at the south end of the tanks and utilizing only the influent gates at the north end of the gates, a plug-flow mode of operation can be approximated.

Aeration Tank Nos. 2 and 3 have been equipped with a fine bubble aeration system consisting of Sanitaire ceramic disc diffusers with a full floor coverage. Aeration Tank Nos. 1 and 4 have coarse bubble Sanitaire units along two headers running the length of the aeration tank, with diffusers on each side of the aeration header. Dissolved oxygen concentration is controlled via dissolved oxygen probes and a controller that changes the blower output.

Typically, the plant operates only Aeration Tank No. 2 and No. 3. Presently, the plant is operating with three aeration tanks. Aeration Tank No. 1 and No. 2 are being operated in a plug flow mode as described above with a mixed liquor suspended solids (MLSS) concentration of approximately 1,000 mg/l. Aeration Tank No. 3 is operating in a complete mix mode with a MLSS concentration of approximately 2,000 mg/l. Initial results indicate a better settling MLSS with the quasi-plug flow system (Aeration Tank Nos. 1 and 2). However, the effluent from the secondary clarifiers associated with Aeration Tank Nos. 1 and 2 is more turbid than the effluent from Aeration Tank No. 3 and some nitrification is occurring. MLSS from the aeration tanks flow to the final clarifier distribution chamber. If desired, MLSS from Aeration Tank Nos. 1 and 2 can be isolated from Aeration Tank Nos. 3 and 4.

Secondary Clarifiers

There are four - 120 ft diameter secondary clarifiers with a side water depth of 12 feet. MLSS is fed through a center well with a single peripheral effluent weir. Sludge is removed through a rapid sludge return system consisting of multiple tube siphons and scraper arms. Underflow is collected in one of two return sludge wells where waste activated sludge (WAS) and returned activated sludge pumps withdraw the sludge. WAS is sent to the primary clarifier influent channel. The WAS also can be sent to the solids handling building where it can either be sent to the sludge holding tanks or directly to the belt filter press. RAS is sent to the aeration tank influent channel. The RAS can be isolated to maintain Aeration Tanks and Secondary Clarifier Nos. 1 and 2 separate from the other two aeration tanks and secondary clarifiers. Secondary clarifier scum is pumped either with the WAS or to the primary clarifier scum well.

Disinfection/Outfall

Secondary Effluent flows to a chlorine mixing chamber. From the mixing chamber, the secondary effluent is mixed with any primary effluent bypass that may be occurring. The plant effluent water system withdraws liquid following chlorination. The outfall line and diffuser provide the detention time to achieve effluent disinfection. A chlorine residual analyzer is used to control the chlorine dosing rate. The outfall structure has an overflow set at elevation 19.0. Normal water surface elevation in the Connecticut River is approximately elevation 4.0. The overflow which occurs in the existing structure at normal water surface elevations reportedly cause foam generation on occasion.

Solids Treatment System

Primary sludge, including WAS, is pumped to one of two 500,000 gallon sludge holding tanks. The sludge holding tanks use recirculation pumps and aeration blowers to mix the tanks' contents. Currently, no sludge decanting is performed. Foreign sludges (those not produced in the WPCF) are also pumped into the sludge holding tanks. The stored sludge is sent through sludge grinders and pumped to the belt filter presses for dewatering. Presently, there are four - 1.2 meter Andritz belt filter presses and rotary screen thickeners. Each press is rated for 90 gpm. Dewatered sludge is sent via a sludge conveyor to the single fluidized bed incinerator.

Existing Odor Control

Existing odor control facilities at the Mattabassett WPCF include six separate soil bed biofiltration units, and one packed bed wet chemical scrubber. Figure 1 integrates the facility wet stream process flow diagram with the six respective biofilter units. The following summarizes the design air flow rates and the unit processes that are treated by each biofilter unit.

- <u>Biofilter Number 1</u> - Biofilter No. 1 is designed to treat 3,000 cubic feet per minute (cfm) of air from the Influent Pump Station, a building which houses two mechanically cleaned bar screens, grinders for shredding debris removed by the bar screens, and two raw sewage pump wetwells.

- Biofilter Number 2 - Biofilter No. 2 is designed to treat 5,600 cfm of odorous air from the forebays, two grit detritor units, the septage receiving wetwell and the preaeration channel.

- Biofilter Number 3 - Biofilter No. 3 is the largest biofilter and is designed to treat 10,000 cfm of odorous air. This biofilter treats air from the Primary Clarifiers, Primary Gallery, and an access tunnel located between the east and west primary clarifier units.

- Biofilter Number 4 - Biofilter No. 4 is designed to treat 2,450 cfm of odorous air from the primary effluent channel, scum wetwell, and the effluent collection trough.

- Biofilter Number 5 - Biofilter No. 5 treats a design air flow rate of 1,700 cfm from the east aeration tank mixed liquor channel.

- Biofilter Number 6 - Biofilter No.6 is designed to treat 1,700 cfm of odorous air from the west aeration tank mixed liquor channel.

The plant has recently replaced the media composition in each of the six biofilter units. The new composition mix included more wood chips and less soil. This helps to maintain the media bed integrity and lessen the effects of bed compacting.

The single stage, wet chemical, packed bed scrubber treats approximately 4,000 cfm of odorous air that is vented from the sludge storage tanks. The scrubber employs a dual chemical scrubbing solution consisting of sodium hydroxide and sodium hypochlorite. The scrubber is followed by a retrofitted activated carbon adsorption vessel that acts as a spray chamber to remove residual chlorine from the scrubber discharge. The retrofitted vessel does not consist of carbon, but rather, contains a water spray in the void vessel chamber. It is important to note that this odor control system is currently under redesign and is in the process of being replaced by a bioscrubber in series with a biofilter.

In addition to the odor control devices listed above, the plant vents the odorous air from the belt filter press hooded enclosures to the incinerator for use as make-up air and adds sodium chlorite to the sludge prior to dewatering.

Effluent Quality Requirements and Goals

The Mattabassett WPCF is designed and permitted for an average/peak flow of 20/45 mgd. The permit does not have a maximum permitted flow rate, but the average flow value is used to establish loading limits. The WPCF's effluent quality requirements are shown in Table 5-1.

Table 5-1
THE MATTABASSETT DISTRICT
NPDES Permit Effluent Limitations

Parameter	Minimum Value	Maximum Daily Value	Average Monthly Value	Minimum Percent Removal
BOD_5, mg/L	N.A.	50	30	85%
TSS, mg/L	N.A.	50	30	85%
pH, s.u.	6.0	9.0	N.A.	N.A.
Settleable Solids, mL/L	N.A.	N.A.	0.1	0.1
Total Residual Chlorine, mg/L (5/1 through 9/31)	0.2	1.5	N.A.	N.A.
Fecal Coliform 30-day geometric mean 7 day geometric mean	N.A.	200 400	N.A. N.A.	N.A. N.A.

Flow Projections

The Mattabassett District Wastewater Treatment Facility has a current average daily flow of approximately 20 mgd and sees peak hour flows as high as 40 mgd.

A major component of this report entails developing future flows, through the planning year 2020, for the constituent and contractual members of The Mattabassett District.

In addition, these same future flows have been developed for the study municipalities: the Town of Plainville, the City of Middletown, and the Town of Portland.

The average daily, sustained wet weather, and peak hour flows have been calculated and are summarized in the following tables. Table 5-2 first summarizes the flows assuming that no Inflow/Infiltration reduction will occur, then summarizes the flows with the assumption that Inflow/Infiltration reduction measures will be taken by each component member.

Appendix E includes a narrative on how the flows were calculated for each contributor to the overall future flow of the Mattabassett District.

Table 5-2

THE MATTABASSETT DISTRICT

Summary of Design Year Flows

without Inflow/Infiltration Rehabilitation

MUNICIPALITY	Initial Year 2000			Design Year 2020		
	ADF	SWWF	PEAK	ADF	SWWF	PEAK
Berlin	3.11	3.74	10.90	4.30	5.46	12.90
Cromwell	3.32	3.76	15.20	4.43	5.33	17.00
Middletown (POTW+)	4.97	5.71	22.30	6.67	8.01	24.8
Middletown (Westfield)	2.36	2.70	9.70	3.42	4.19	11.50
New Britain	14.02	16.80	54.2	21.47	28.69	66.40
Plainville	2.21	2.34	7.00	2.50	2.76	7.50
Portland	0.80	0.98	2.70	1.14	1.46	3.30
MDC (Newington/Rocky Hill)	2.11	2.65	5.70	3.17	4.13	7.80
TOTAL SUMMARY	**33.00**	**38.70**	**120.70**	**47.10**	**60.00**	**143.80**

Summary of Design Year Flows

with Inflow/Infiltration Rehabilitation

MUNICIPALITY	ADF	SWWF	PEAK	ADF	SWWF	PEAK
Berlin	2.44	2.80	8.10	3.29	3.96	9.50
Cromwell	2.68	2.93	11.10	3.50	4.02	12.40
Middletown (POTW+)	4.26	4.78	18.50	5.89	6.77	21.20
Middletown (Westfield)	2.08	2.39	7.50	3.00	3.64	9.10
New Britain	10.73	11.94	37.80	13.50	15.95	42.10
Plainville	1.89	1.95	4.70	2.10	2.24	5.00
Portland	0.61	0.72	2.90	0.85	1.04	3.30
MDC (Newington/Rocky Hill)	2.11	2.65	5.70	3.17	4.13	7.80
TOTAL SUMMARY	**26.90**	**30.20**	**90.80**	**35.20**	**41.70**	**104.00**

ADF=Average Daily Flow (MGD), SWWF = Sustaind Wet Weather Flow (MGD), PEAK = Peak Hour Flow (MGD)

Based on the flows presented above, and the plans of individual towns to implement infiltration/inflow (I/I) peak flow reduction programs, the design flows selected for the evaluation of WPCF upgrade alternatives are presented in Table 5-3. These design flows will provide for management of the current individual flows without I/I improvements, including peak hour flows, and year 2020 flows with implementation of I/I improvements.

Table 5-3
THE MATTABASSETT DISTRICT
Design Flow Rates

Parameter	Local Alternative	Inter-municipal Alternative
Average Day, mgd	25	35
Sustained Wet Weather, mgd	29	40
Peak Hour, mgd	90	120

Regulatory Issues

Three specific regulatory issues need to be addressed by the Mattabassett District WPCF as part of their upcoming NPDES permit renewal, which will influence WPCF upgrade needs in association with any inter-municipal sewage treatment.

These issues include:

- Nitrogen Reduction
- Peak Flow Management
- Chlorine Contact Time/Dechlorination

Each of these issues will need to be addressed whether or not additional municipalities are connected to the Mattabassett District. A discussion of each of these issues is presented below.

Nitrogen Reduction

The Comprehensive Conservation and Management Plan (CCMP) for the Long Island Sound Study (LISS) calls for the overall reduction in total nitrogen (TN) discharges to Long Island Sound by 58.5 percent from both point and non-point sources from 1990 base load levels by 2014. While the contribution of non-point sources is quantifiable based on empirical data, accurate and enforceable control strategies are not currently available. Therefore the watershed reduction will be primarily met by actual reductions in point sources to achieve the overall 58.5 percent target.

The CT DEP has projected that a reduction in all point sources of approximately 70 percent TN will achieve this goal without any significant reduction in non-point sources. The policy committee of the LISS has set targets of 40 percent of the 58.5 percent goal by 2004, 75 percent of the goal by 2009, and the full 58.5 percent by 2014.

To meet these interim targets by reducing TN discharges from point sources only, would require a state-wide reduction in TN of 27.5 percent (40 percent of the 70 percent TN reduction goal) by 2004, a reduction in TN of 51.5 percent (75 percent of the approximately 70 percent reduction goal) by 2009, and a reduction of 68.5 percent (100 percent of the goal) by 2014. The current 1990 baseload for the Mattabassett District WPCF is 2,350 pounds nitrogen/day. To validate this baseload value, the nitrogen data from 1989 through 1997 was reviewed. In 1990, the effluent nitrogen data does not include organic nitrogen. This was the only year when TKN data was not reported. Instead, only effluent ammonia was reported in 1990.

To develop an estimate of the likely 1990 organic nitrogen loading in the plant effluent, the difference between TKN and ammonia in 1989 and in the time period of 1991 through 1997 was compared as shown in Table 5-4.

Table 5-4
THE MATTABASSETT DISTRICT
Effluent Total Nitrogen

YEAR	TN with org-n lbs/d	TN without org-n lbs/d	org-n lbs/d
1989	3,010	2,479	541
1990	**3,356***	2,814	**543***
1991-1997	2,731	2,189	543

* Estimated based on 1989 and 1991 through 1997 average organic nitrogen in plant effluent since TKN was not measured in 1990.

Organic nitrogen in the plant discharge is approximately 3.5 mg/l, this based on 18.5 MGD (1991 through 1997 average flow). Typical organic nitrogen concentrations range from 1.0 to 3.0 mg/l in most WPCF's discharges. Based on this information, the original 1990 baseload established by DEP appears to be significantly lower than the plant's reported total nitrogen for 1989 and 1990 (even when organic nitrogen was not included). A modification in the Mattabassett District 1990 baseload total nitrogen value from 2,350 lb/day to 3,000 lb/day has been requested is presently under evaluation by DEP.

Effluent Nitrogen Goals

Effluent total nitrogen (TN) target concentrations for both the local alternative and the inter-municipal alternative are presented in Table 5-5 to achieve both the 2009 and 2014 target values. The local alternative concentrations were calculated based on the requested baseload value of 3,000 lb nitrogen/day and an average WPCF flow rate of 25 mgd. The inter-municipal alternative concentrations were calculated based on the combined based load value of 3,765 lb nitrogen/day (the sum of the requested 3,000 lb/day nitrogen baseload for the Mattabassett WPCF plus the current 1990 baseloads from the Middletown, Plainville, and Portland plants) and an average WPCF flow rate of 35 mgd.

The effluent TN target concentrations are very low for both the local and inter-municipal alternatives and likely would not be achieved by a conventional biological nitrogen removal system. A typical anoxic/oxic BNR system can reliably produce an effluent TN concentration of 8 mg/l but under optimum conditions could produce an effluent TN concentration as low as 6 mg/L. Accordingly, the need for additional denitrification facilities downstream of the activated sludge system would be required to achieve the ultimate total nitrogen removal goal. At best, single stage nitrification with denitrification filters could reliably produce an effluent TN of 4 mg/L, but under optimum conditions could produce an effluent TN concentration as low as 3 mg/L.

Table 5-5
THE MATTABASSETT DISTRICT
Nitrogen Baseload Values and Required Effluent Total Nitrogen (TN) Concentrations

Plant	1990 DEP TN Baseload, lb/day	Local Alternative TN at 25 mgd, mg/L		Inter-municipal Alternative TN at 35 mgd, mg/L	
		2009 Target	2014 Target	2009 Target	2014 Target
Mattabassett District	3,000	7.0	4.5		
- Middletown - Plainville - Portland	334 305 126				
Total	3765			6.3	4.1

Peak Flow Management

As described above, the Mattabassett WPCF is currently designed to provide secondary treatment for flows up to 40 mgd. Flows in excess of 40 mgd overflow a weir in the primary effluent channel and are blended with chlorinated secondary effluent prior to discharge. Based on discussions with the Connecticut Department of Environmental Protection (CTDEP), because the Mattabassett District is not a CSO community, bypassing can not be incorporated into the WPCF's discharge permit.

Therefore, as part of both the local and inter-municipal alternatives, the WPCF will have to be upgraded to provide secondary treatment for the peak hour flow rate. While the required aeration tank volume to provide BOD_5 removal and nitrogen reduction is based on average flow rates, the number of clarifiers, the chlorine contact tank volume, and the size of piping in the upgraded secondary facilities will be dependent on the peak hour flow rate.

Chlorine Contact Time/Dechlorination

The Mattabassett District NPDES permit requires and effluent chlorine residual of between 0.2 and 1.5 mg/L between May 1 and September 31. Based on discussions with the DEP, the Mattabassett District WPCF's permit will likely include a maximum total residual chlorine concentration of 0.2 to 0.5 mg/L when it is renewed. In addition, a chlorine contact time of 15 minutes must be provided at the peak hour flow rate. These requirements will require the addition of a chlorine contact tank as well as dechlorination facilities to the WPCF. As an alternative, the use of UV disinfection could also be considered.

Description of Alternatives

Introduction

Two alternatives were evaluated at the Mattabassett District WPCF. The first, the Local Alternative, considers future flows from current member communities only. The second, the Inter-municipal Alternative, considers additional flows from Middletown, Plainville, and Portland. The design flows used to evaluate each alternative are presented in Table 5-3 above. For each alternative, the required unit processes to achieve an effluent total nitrogen (TN) of 6 to 8 mg/L (the 2009 DEP target) was evaluated as well as the required unit process to achieve an effluent TN of 3 to 4 mg/L (the 2014 DEP target). In addition, a fifth evaluate was performed to determine what unit processes would be required to provide the same level of treatment the WPCF currently provides at the future inter-municipal design flows. This alternative was evaluated for only the purpose of apportioning capital costs among the potential new members and would not be considered for construction. To evaluate each alternative, a hydraulic analysis, process analysis, and odor management analysis was conducted on the Mattabassett WPCF. A general discussion of each of these analyses is presented below followed be a description of the WPCF modifications necessary to achieve the goals for each alternative.

Hydraulic Analysis

A hydraulic analysis was performed on the WPCF for both the local and inter-municipal alternatives to determine what improvements, if any, would be required to pass the peak hour flows through the plant. The results of the hydraulic analyses are presented in the technical memorandum included as Appendix B. A summary of the general improvements required based on the hydraulic analysis are presented below.

Primary Facilities

The existing primary treatment facilities have the capacity to pass the design peak-hour flow rate for the local alternative (90 mgd). For the inter-municipal alternative, although the Middletown and Portland flows would be discharged to the detritor forebay, the existing raw sewage pump station does not have sufficient capacity to handle the peak hour flows from the remaining communities with one pump out of service. Therefore, modifications or replacement of two to three of the existing pumps would be required to provide for peak hour flows with one pump out or service. In addition, at the inter-municipal peak hour flow rate, two additional comminutors installed in the channels indicated as "future" would be required.

Secondary Facilities

All alternatives evaluated require the installation of additional aeration tanks and secondary clarifiers. The current secondary facilities split flow between each of the four aeration tanks based on the symmetry of the piping system. This symmetry could potentially be used for the addition of one additional aeration tank. However, to install more than one additional aeration tank (as is required for all biological nutrient removal alternatives) it would be necessary to install a primary effluent distribution chamber utilizing overflow weirs to split the flow proportionally between the aeration tanks and allow tanks to be removed from service and still split the flow. In addition, to split the flow between all secondary clarifiers will require an aeration tank effluent distribution chamber.

To provide sufficient head to operate the aeration tank effluent distribution chamber would require raising the effluent weirs in the aeration tanks by approximately one foot. A similar increase in water surface in the primary effluent channel would be necessary to operate the primary effluent distribution chamber. Because the preliminary hydraulic analysis indicated that there is not sufficient head to install both a primary effluent distribution channel and an aeration tank effluent distribution channel in the current hydraulic profile, all alternatives requiring more than one additional aeration tank included a primary effluent pumping station.

The installation of a primary effluent pumping station would provide sufficient head to properly split flows between the aeration tanks and the secondary clarifiers while allowing units to be taken out of service and maintaining a proportional flow split. Because it would be necessary to pump primary effluent, it was decided to increase the water depth in the aeration tanks by a total of five feet to maximize tank volume and minimize the required foot print for new aeration tanks when more than one additional aeration tank is required. The need for the primary effluent pump station is based on a preliminary hydraulic analysis and should be reviewed during detailed design to verify that gravity flow would not be possible.

Disinfection/Outfall

The existing outfall chamber has a standpipe with an overflow elevation of approximately 19.0. To discharge the peak hour flows for both the local and inter-municipal alternatives, it would be proposed to modify this chamber and eliminate the standpipe. Based on the preliminary hydraulic analysis, the existing outfall diffuser configuration would likely result in flooding of the final clarifier weirs at the local peak hour flow rate of 90 mgd (with a river elevation of 20.0) even with the outfall chamber modifications to eliminate the standpipe. The existing diffuser has a capacity of approximately 82 mgd. However, based on the flow projections included above, the projected peak-hour flow rate in the year 2020 with sewer rehabilitation work is below design capacity of the facility. Therefore, it was assumed that the outfall diffuser would not have to be replaced under the local alternative. For the inter-municipal alternative, the existing 60-inch diameter diffuser would have to be replaced with an 84-inch diameter diffuser. Should the denitrification filters be constructed, the additional head provided by the pump station could potentially provide the additional head needed to pass peak hour flows through the existing diffuser. This would need to be verified during detailed design.

The plant currently utilizes detention time in its outfall pipe to provide chlorine contact. This is effective because the current outfall chamber/standpipe ensure that the 84-inch outfall pipe flows full. The proposed modifications to the outfall pipe would result in the pipe flowing partially full under normal river elevations (Elev. 4.0). Therefore, to provide the necessary chlorine contact time, a contact tank providing 15 minutes detention time at peak hour flow would be installed.

Process Analysis

A process analysis was performed for each of the five alternatives described above. The process analysis to meet both the 2009 and 2014 nitrogen reduction goals for both the local and inter-municipal alternatives included addressing both the peak flow management and chlorination/dechlorination issues presented in the Regulatory Issues section. The process analysis to provide BOD_5 removal only for the inter-municipal design flows only included those processes necessary to maintain the current level of treatment. The results of these process analyses is presented in a technical memorandum included as Appendix C and are summarized below for each alternative.

Biological Nutrient Removal Alternatives

Nitrogen Reduction

In general, for both the local and inter-municipal alternatives, to meet the 2009 nitrogen reduction targets would require the conversion of the WPCF's existing complete mix aeration system to a four-pass, plug flow, contact stabilization, step-feed configuration which would utilize the anoxic/oxic (A/O) process.
Additional aeration volume would also be installed to provide the required solids retention time (SRT) of approximately 18 days necessary to achieve full, year-round nitrification. The contact stabilization process is provided for peak flow management to prevent solids washout from the secondary clarifiers during peak flow periods while carrying an average MLSS concentration of 4,000 mg/L through the aeration basin. To provide the necessary aeration volume for the local alternative, four additional aeration tanks would be required. Six additional aeration tanks would be required for the inter-municipal alternative. The number of tanks is based on the assumption that the water depth in both the new and existing tanks would be approximately 25 feet.

To meet the 2014 nitrogen reduction goals, the A/O process described above would be followed by packed-bed denitrification filters. The filters would have to be followed by a post-aeration system to replace oxygen utilized in the denitrification filters.

Secondary Clarifiers/Peak Flow Management

As described in the process memorandum, additional secondary clarifiers would be required for both the local and inter-municipal alternative. Based on the information presented in the Regulatory Issues section, the DEP has indicated that the by-pass of primary effluent would not be allowed and that the study should include secondary clarifier capacity for peak hour flows. For the local alternative, a total of two additional secondary clarifiers would be required. Four additional final clarifiers would be required for the inter-municipal alternative.

Chlorine Contact Time/Dechlorination

As discussed in the hydraulic analysis, modifications to the existing outfall chamber would result in the need for a chlorine contact tank. Each alternative would include a chlorine contact tank which provides for 15 minutes detention time at the peak hour design flow rates. In addition, the DEP has indicated that the WPCF's permit will likely include a maximum total residual chlorine concentration of 0.2 to 0.5 mg/L. For the purposes of these evaluations, the addition of a sodium bisulfite dechlorination system was included. A detention time of 45 seconds at peak flow was utilized for bisulfite addition.

Waste Activated Sludge Thickening

As described above, the existing WPCF pumps waste activated sludge (WAS) to the primary clarifier influent channels for co-thickening with primary sludge. Because this can contribute to the growth of filamentous organisms in the primary clarifiers and to increase the capacity of the primary clarifiers to eliminate the need to add a fifth primary clarifier, it is proposed to separate the WAS from the primary clarifiers and thicken it separately in gravity thickeners. Four new gravity thickeners would be installed near the ash lagoons at the north end of the site.

Inter-municipal BOD_5 Removal Only

The BOD_5 removal only alternative was evaluated to apportion capital costs among potential new members and existing constituents or contract members that require additional capacity beyond their current allocation. Therefore, these modifications include only those necessary to provide the same level of treatment as the existing facility at the inter-municipal alternative average daily flow rate of 35 mgd. Modifications required to address the regulatory issues of nitrogen removal, peak flow management, and dechlorination were not included in this alternative. However, as discussed in the hydraulic analysis, modifications to the existing outfall chamber would require the addition of a chlorine contact tank.

The existing WPCF reportedly provides secondary treatment for flows up to 40 mgd and by-pass primary effluent flow in excess of 40 mgd. Based on a design average flow rate of 20 mgd, the existing secondary treatment facilities provide for a peaking factor of 2.0. Therefore, for this alternative, it was assumed that the expanded secondary facilities would also provide for a peaking factor of 2.0 or a peak hour flow rate of 70 mgd. To provide secondary treatment to 70 mgd would require the addition of one additional aeration tank. It was also assumed that all five aeration tanks would be provided with fine bubble diffused aeration. To provide secondary clarifier capacity equivalent to the existing WPCF would require the addition of three secondary clarifiers.

Odor Management

As part of the Mattabassett Inter-Municipal Study, an assessment of the odor management systems currently in use at the Mattabassett WPCF was performed. The purpose of this assessment was to identify enhancements to the current odor control strategies that can be incorporated into the facility expansion, and to identify additional odor control measures to be incorporated into the Mattabassett WPCF expansion and upgrade. These additional measure would consist of odor controls for existing process operations currently without control measures, as well as controls for new unit processes. The objective for design of the odor controls for the upgraded Mattabassett Facility would be to provide no net increase in odors with an increase in plant flows. These results of this odor assessment are presented in a technical memorandum included in Appendix D and is summarized below.

Two site visits were performed during the odor management assessment. The first was to investigate unit processes and current odor management systems in-place at the Mattabassett WPCF. The second was to conduct smoke tests is specific areas to determine the proper operation of existing systems. Based on the analyses of the information and data obtained during these two site visits to the Mattabassett District WPCF, a number of findings with relation to odors associated with the plant operations and/or processes were developed and presented in the technical memorandum.

The main conclusions in relation to existing odor control system included:

- Inadequate ventilation in specific enclosed areas to provide negative pressure for odor control.
- Short-circuiting air flow and bed compacting of the biofilter units.
- The identification of a number of additional potential odor sources for which controls should be considered.

The WPCF is assessing the odor control systems to ensure that they are operating properly. For instance, the biofilter media has recently been replaced with a different type of media. As modifications to the existing systems are incorporated, their effectiveness would be evaluated through a monitoring project. Any further improvements to existing systems should be incorporated into the upgrade/expansion of the WPCF.

In addition to the above conclusions and recommendations for modifications to the existing odor management systems, odor control must be provided for the process alternatives for each of the two study options, local alternative or inter-municipal. Both options require a decrease in odors coinciding with an increase in plant flow. In addition, both options will require waste activated sludge thickening unit processes. At this time, gravity sludge thickening is being proposed and will require odor control.

New aeration tanks will be added for any of the process alternatives. The aeration tanks, at this time, based on the results of our limited sampling analyses, do not appear to be a significant odor source. However, based on conversations with plant operations staff, aeration tank odors have been detected off-site. Furthermore, by increasing the number of aeration tanks the overall surface area, and therefore, the flux of potential odorous releases will increase. As a result, we believe, that to comply with a decrease in odor due to the plant expansion, the aeration tanks will require covers and treatment.

Biofiltration would be an appropriate treatment technology for the aeration basin emissions, and is the recommended odor control technology for this facility plan. If it is determined that the space for the required aeration tank odor control is limited, then concrete covers for the aeration tanks should be considered. The biofilter units can then be placed atop of the concrete covers. The need for, and final selection of, the odor treatment technology should be verified in subsequent design phases.

Several new final clarifier tanks will be added along with the new aeration tanks. The effluent weirs and the launders are the odorous source locations associated with these tanks. To provide for a no net increase in odors, the effluent weir and launder should be covered and exhausted to an odor control system. Biofiltration is an appropriate technology for this odor source.

Again, the final selection of the odor treatment technology should be verified in subsequent design phases.

The future for gravity sludge thickening processes will include 50 foot diameter gravity thickener tanks. These tanks will require dedicated covers, containment, and treatment in a biofilter system. As with the two odor control applications discussed above, the selection of the final odor control treatment technology should be verified in a subsequent design phase.

Necessary Unit Process Modifications

The specific unit process modifications/expansion necessary to treatment goals of each alternative are presented below. Unit process sizing is presented in Appendix C.

Local Alternative - A/O Process (DEP 2009 total nitrogen reduction target)

To convert the existing Mattabassett WPCF to an A/O process with the capacity to treat 25 mgd would require the following modifications:

- Provide a total aeration system volume of 7.9 million gallons:
  - Existing aeration tanks have a water depth of approximately 20 feet. The walls on the existing aeration tanks would be raised to provide a total water depth of 25 feet. The existing tanks would be converted to four-pass, plug-flow aeration tanks which could be operated in the contact stabilization, step feed mode. This would be accomplished by installing baffles to create an anoxic zone in each pass and installing submersible mixers in each pass. The existing diffused aeration equipment would be modified to provide fine bubble diffused aeration in each of the passes of each tank.
  - In addition, four new four-pass, plug-flow aeration tanks of approximately the same dimensions as the existing tanks would be installed with a water depth of 25 feet. The tanks would be designed to operate in the contact stabilization, step feed mode.
- As discussed in the hydraulic analysis, a primary effluent pumping station/flow distribution chamber would be installed to split the flow proportionately between all in-service aeration tanks.
- Because of the increased discharge pressures associated with increasing the water depth in the aeration tanks to 25 feet, it would be necessary to replace (or upgrade, if possible), the existing blowers with new blowers than can operate at the higher discharge pressures.

- Two new secondary clarifiers with the same dimensions as the existing final clarifiers would have to be installed.

- A chlorine contact tank which provides 15 minutes detention time at 90 mgd would be required.

- A dechlorination system, such as a sodium bisulfite system would be required.

- The outfall chamber would be modified to eliminate the standpipe.

- Four gravity thickeners would be installed for WAS thickening.

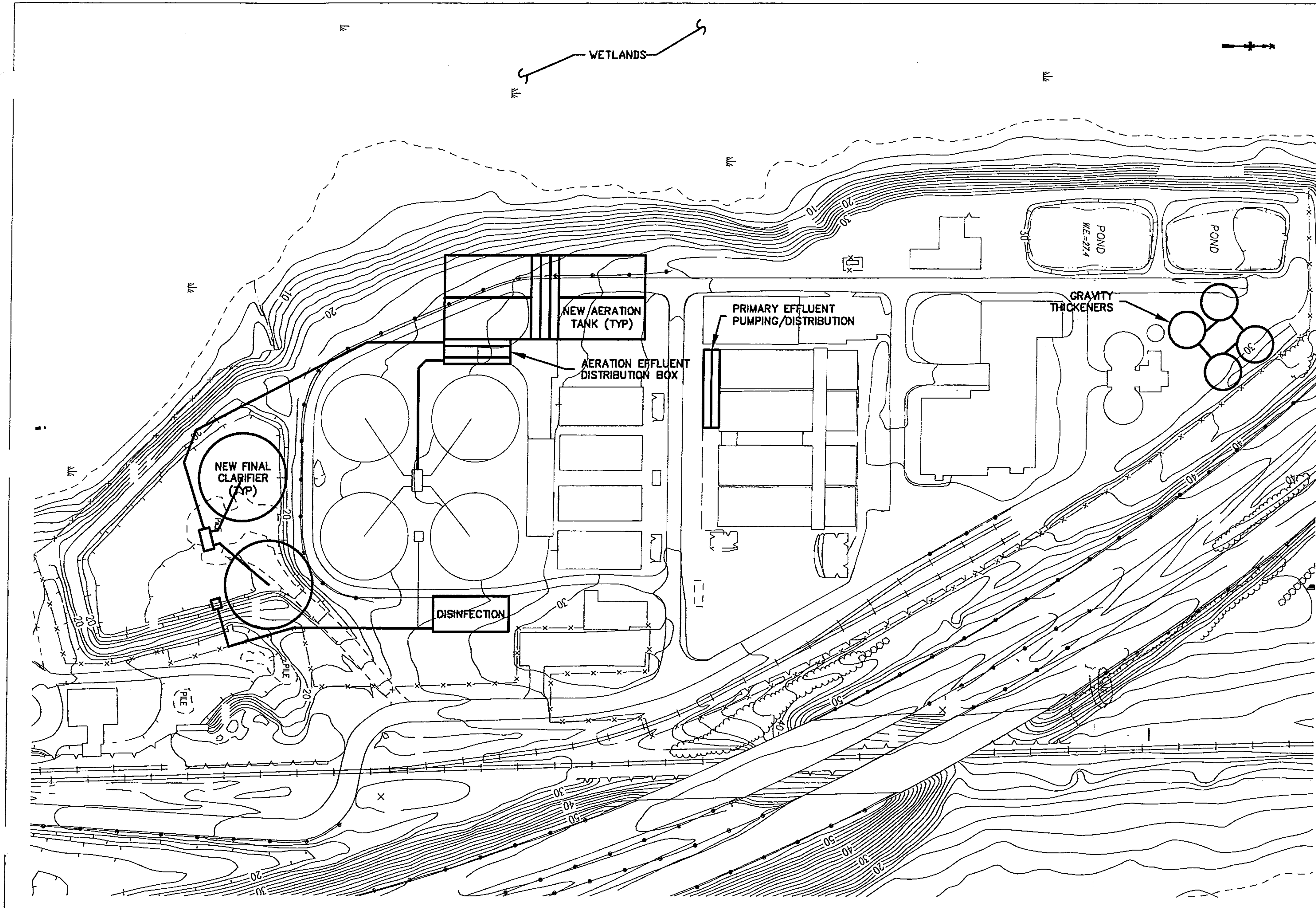
- Odor control improvements would be provided including:

  - Covering the existing and new aeration tanks and venting the space beneath the covers through a biofilter odor control system.

  - Covering the existing and new secondary clarifier effluent launders and venting the space beneath the covers through a biofilter odor control system.

  - Covering the new WAS gravity thickener tanks and venting the space beneath the covers through a biofilter odor control system.

A preliminary site plan which illustrates the proposed modifications is presented in Figure 5-2.



MATTABASSETT INTER-MUNICIPAL STUDY

MATTABASSETT DISTRICT WPCP SITE PLAN

LOCAL ALTERNATIVE – A/O PROCESS UPGRADES

SCALE: NOT TO SCALE

DATE: October 8, 1999

FIGURE 5-2

Local Alternative - A/O Process Followed by Denitrification Filters (DEP 2014 total nitrogen reduction target)

The modifications required for this alternative would include all those listed above for the local alternative A/O Process. In addition, the following modifications would also be necessary:

- Install a secondary effluent pump station with a peak capacity of 62.5 mgd to lift secondary effluent up to new denitrification filters. Flows in excess of 62.5 mgd would bypass the denitrification system.
- Install four new packed bed denitrification filters (approximately 53 feet in diameter).
- Install a post aeration system designed to re-aerate only flows which pass through the denitrification filters.

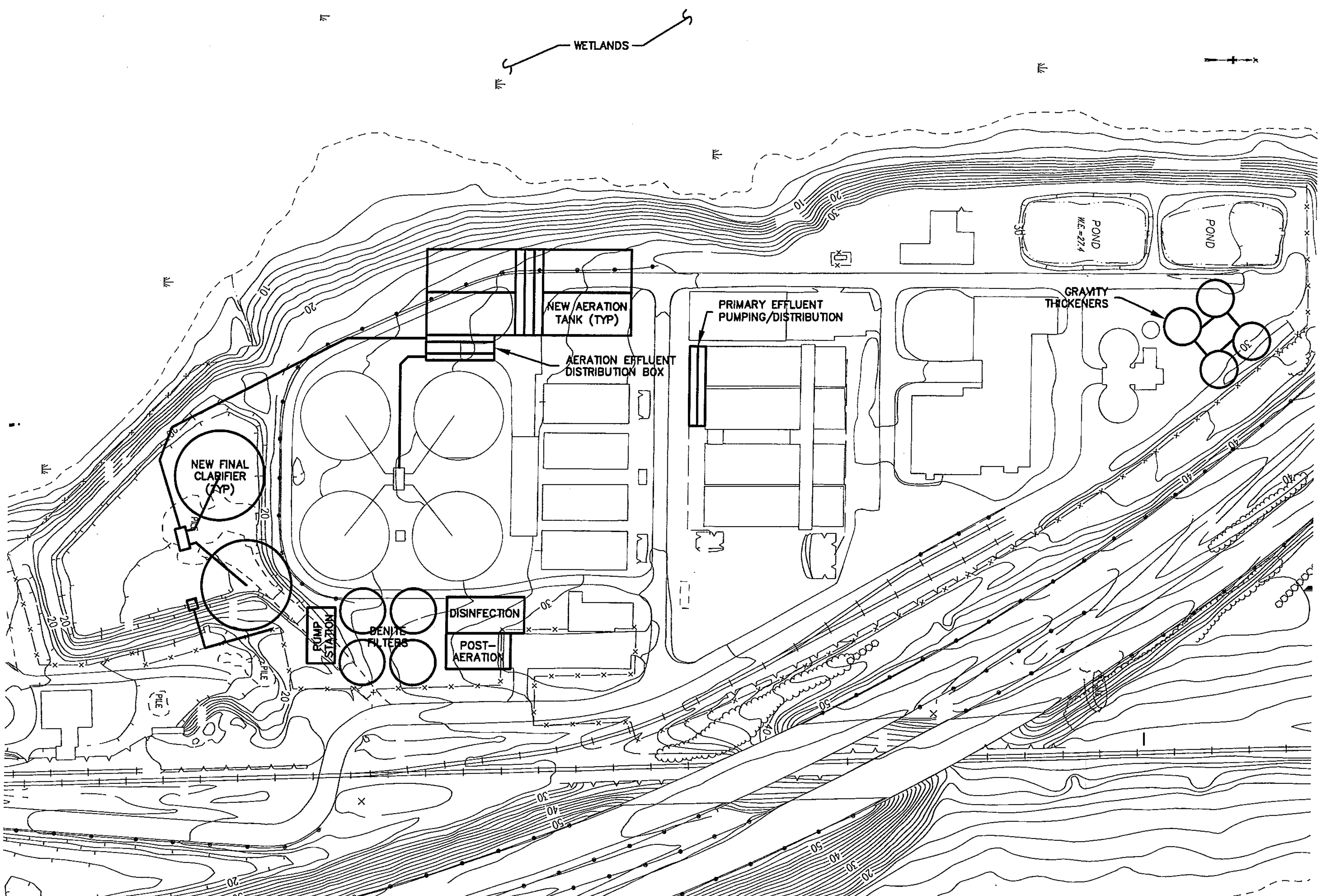
A preliminary site plan which illustrates the proposed modifications is presented in Figure 5-3.

Inter-municipal Alternative -A/O Process (DEP 2009 total nitrogen reduction target)

To convert the existing Mattabassett WPCF to an A/O process with the capacity to treat 35 mgd would require the following modifications:

- Modify the raw sewage pumps to provide peak flow capacity with one pump out of service.
- Install two new comminutors in the channels provided for "future" comminutors.
- Provide a total aeration system volume of 11 million gallons:
    - The existing aeration tanks have a water depth of approximately 20 feet. The walls on the existing aeration tanks would be raised to provide a total water depth of 25 feet. The existing tanks would be converted to four-pass, plug-flow aeration tanks which could be operated in the contact stabilization, step feed mode. This would be accomplished by installing baffles to create an anoxic zone in each pass and installing submersible mixers in each pass. The existing diffused aeration equipment would be modified to provide fine bubble diffused aeration in each of the passes of each tank.
    - In addition, six new four-pass, plug-flow aeration tanks of slightly larger dimensions than the existing tanks would be installed with a water depth of 25 feet. The tanks would be designed to operate in the contact stabilization, step feed mode.
- As discussed in the hydraulic analysis, a primary effluent pumping station/flow distribution chamber would be installed to split the flow proportionately between all in-service aeration tanks.
- Because of the increased discharge pressures associated with increasing the water depth in the aeration tanks to 25 feet, it would be necessary to replace (or upgrade, if possible), the existing blowers with new blowers than can operate at the higher discharge pressures.

- Four new secondary clarifiers with the same dimensions as the existing final clarifiers would have to be installed.



MATTABASSETT INTER-MUNICIPAL STUDY

MATTABASSETT DISTRICT WPCP SITE PLAN

LOCAL ALTERNATIVE – A/O, DENITE FILTER PROCESS UPGRADES

SCALE: NOT TO SCALE

DATE: October 8, 1999

FIGURE 5–3

- A chlorine contact tank which provides 15 minutes detention time at 120 mgd would be required.
- A dechlorination system, such as a sodium bisulfite system would be required.
- The outfall chamber would be modified to eliminate the standpipe.
- Install a new 84-inch diameter outfall diffuser or a parallel 60-inch diffuser to discharge the peak hour flow rate of 120 mgd.
- Four gravity thickeners would be installed for WAS thickening.
- Odor control improvements would be provided including:
    - Covering the existing and new aeration tanks and venting the space beneath the covers through a biofilter odor control system.
    - Covering the existing and new secondary clarifier effluent launders and venting the space beneath the covers through a biofilter odor control system.
    - Covering the new WAS gravity thickener tanks and venting the space beneath the covers through a biofilter odor control system.

A preliminary site plan which illustrates the proposed modifications is presented in Figure 5-4.

Inter-municipal Alternative - A/O Process Followed by Denitrification Filters (DEP 2014 total nitrogen reduction target)

The modifications required for this alternative would include all those listed above for the local alternative A/O Process. In addition, the following modifications would also be necessary:

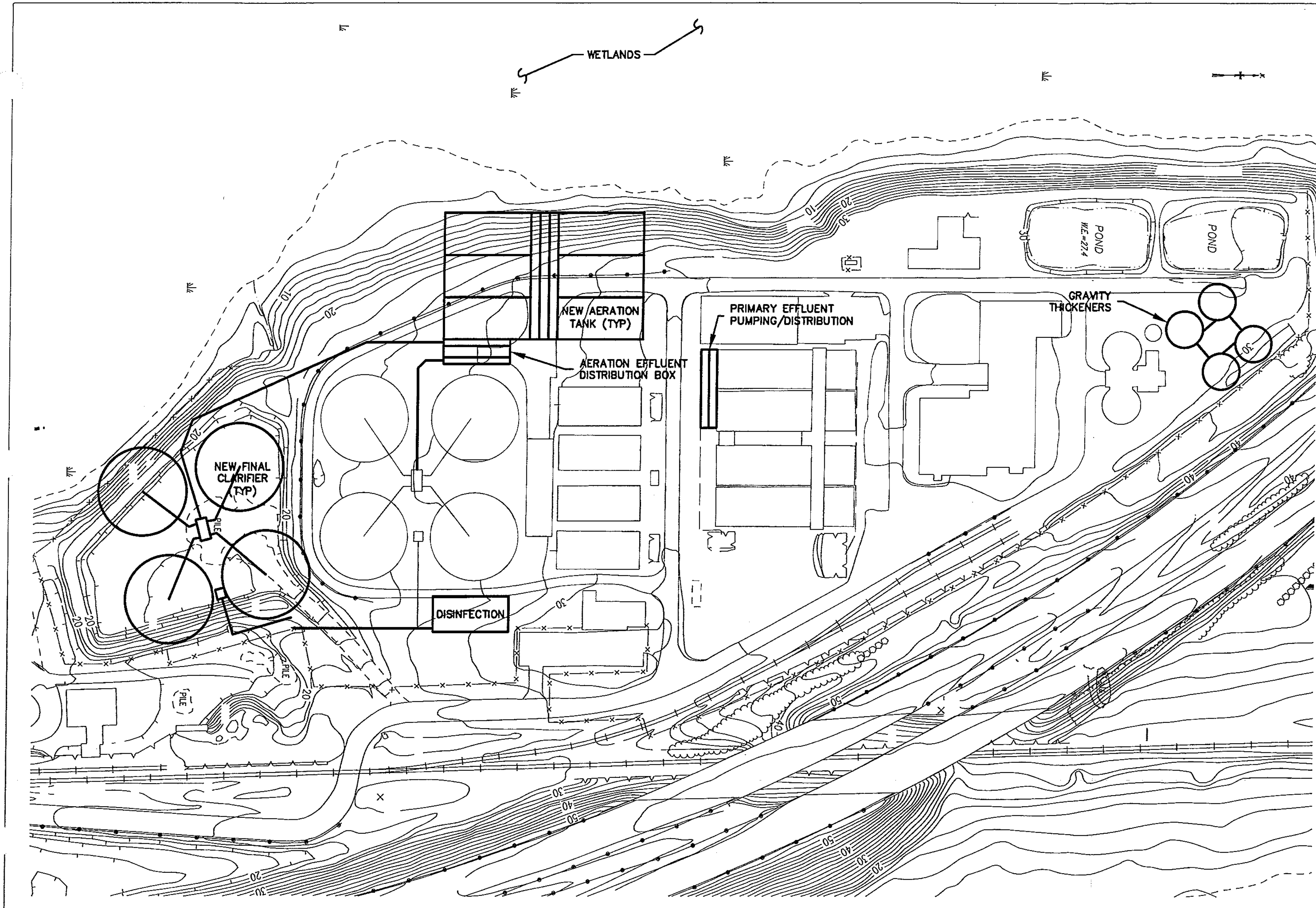
- Install a secondary effluent pump station with a peak capacity of 87.5 mgd to lift secondary effluent up to new denitrification filters. Flows in excess of 87.5 mgd would bypass the denitrification system.
- Install four new packed bed denitrification filters (approximately 60 feet in diameter).
- Install a post aeration system designed to re-aerate only flows which pass through the denitrification filters.

A preliminary site plan which illustrates the proposed modifications is presented in Figure 5-5.

Inter-municipal Alternative - BOD_5 Removal Only

The modifications required to provide the same level of treatment as the existing WPCF at the inter-municipal design average flow rate of 35 mgd include:

- Modify the raw sewage pumps to provide peak flow capacity with one pump out of service.
- Install two new comminutors in the channels provided for "future" comminutors.
- Modify the piping between the primary clarifiers and aeration tanks and eliminate the ventures.
- Raise the effluent weirs in the aeration tanks be approximately one foot.



SCALE: NOT TO SCALE

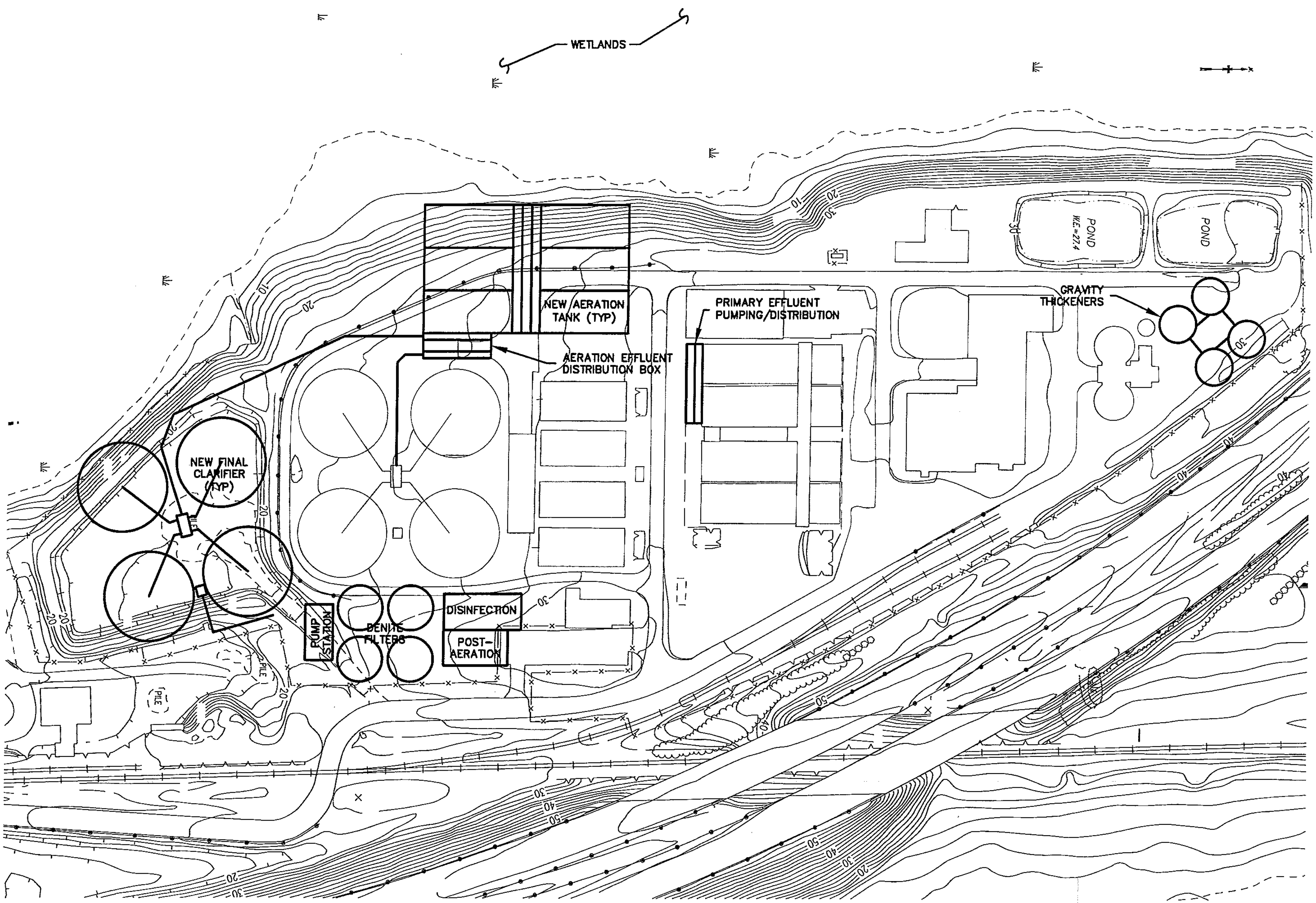
DATE: October 8, 1999

FIGURE 5-4

MATTABASSETT INTER MUNICIPAL STUDY

MATTABASSETT DISTRICT WPCP SITE PLAN

REGIONAL ALTERNATIVE – A/O PROCESS UPGRADES



SCALE: NOT TO SCALE

DATE: October 8, 1999

FIGURE 5-5

MATTABASSETT INTER MUNICIPAL STUDY

MATTABASSETT DISTRICT WPCP SITE PLAN

REGIONAL ALTERNATIVE – A/O, DENITE FILTER UPGRADES

- Install one new aeration tank to provide a total aeration volume of 4.4 million gallons.
- Install an aeration tank effluent distribution chamber and new piping to the final clarifier distribution chambers.
- Install three additional final clarifiers.
- Install a chlorine contact tank to provide 15 minutes detention time at 70 mgd.
- Modify the outfall structure to eliminate the "overflow"/vertical piping section.
- Install a new 84-inch diameter outfall diffuser or a parallel 60-inch diffuser to discharge the peak hour flow rate of 120 mgd.

A preliminary site plan which illustrates the proposed modifications is presented inFigure 5-6.

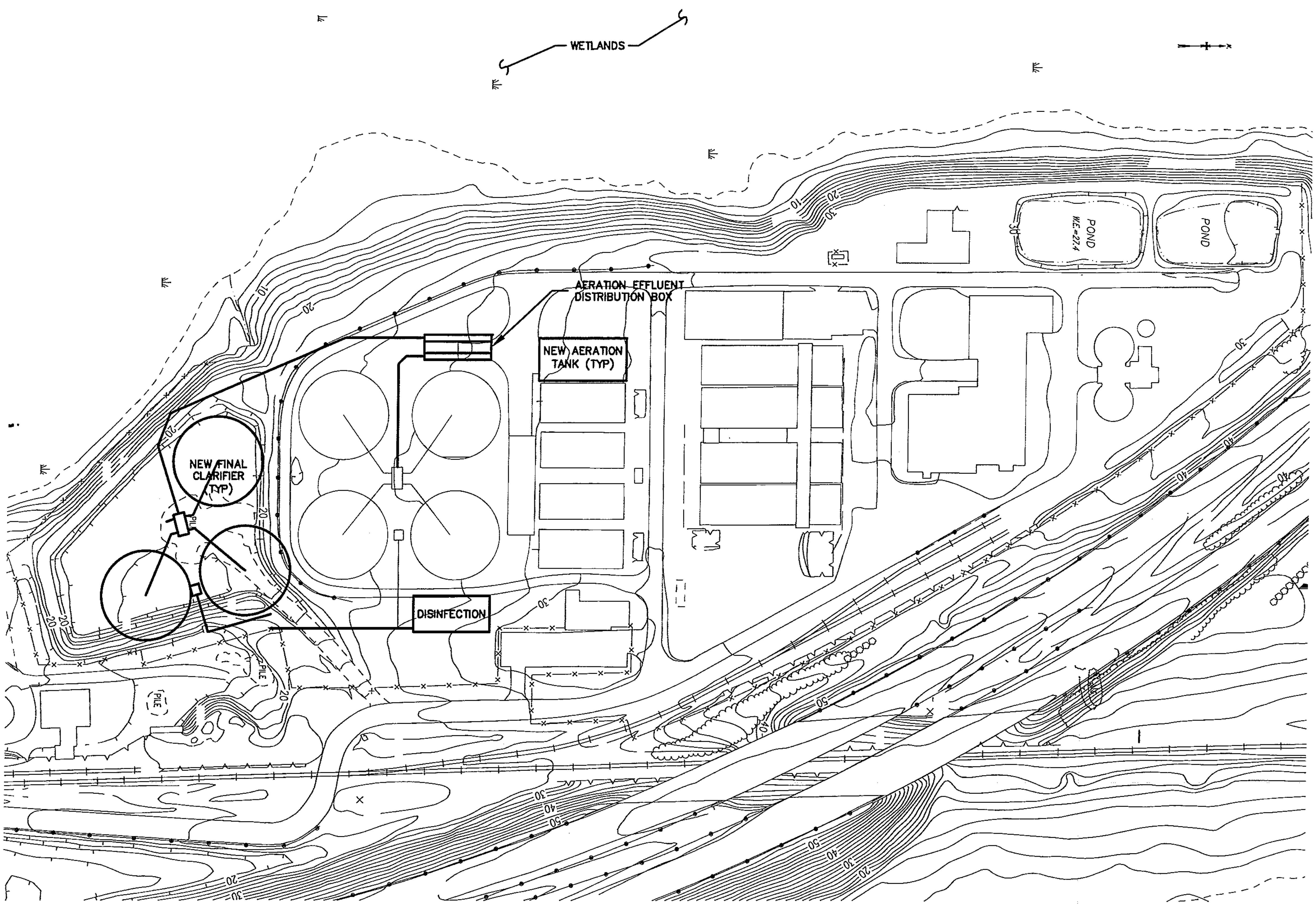
Capital Costs

Based on the process and hydraulic analyses presented in Section 5.4, preliminary, "order-of-magnitude" capital costs for each of the five alternatives were developed. In addition, preliminary annual operating costs were developed. The annual operating costs were developed by determining order-of-magnitude costs for the additional unit processes for each alternative and are based on additional power costs and chemical costs for sodium hypochlorite, sodium bisulfite, and methanol when appropriate. In addition, annual labor costs were included for alternatives which include denitrification filters. These additional annual costs were then added to the actual fiscal year 1997 costs at the Mattabassett District WPCF. The capital costs include a 15 percent contingency and 20 percent for engineering, construction administration, resident engineering, and start-up services and are presented in 1998 dollars. The costs do not include any administrative, legal, or other fiscal costs incurred by the Mattabassett District associated with the design or construction of these modifications.

The specific modifications required for each of the five alternatives were presented in Section 5.4. A summary of the preliminary, order-of-magnitude capital and annual operation and maintenance (O&M) costs for each of the five alternatives are presented in Table 5-6. More detailed costs are presented in Tables 5-7 through 5-11.

Table 5-6
THE MATTABASSETT DISTRICT
Summary of Preliminary, Order-of-Magnitude Costs

Alternative	Target Year	Capital Cost	O&M Cost
Local - A/O Process	2009	$43,200,000	$4,830,000
Local - A/O-Denite Filter Process	2014	$73,900,000	$5,230,000
Inter-municipal - A/O Process	2009	$60,500,000	$5,170,000
Inter-municipal - A/O - Denite Filter Process	2014	$102,400,000	$5,870,000
Inter-municipal - BOD_5 Removal Only	N/A	$27,400,000	$4,650,000



MATTABASSETT INTER-MUNICIPAL STUDY

MATTABASSETT DISTRICT WPCP SITE PLAN

REGIONAL ALTERNATIVE – BOD REMOVAL ONLY UPGRADES

SCALE: NOT TO SCALE

DATE: October 8, 1999

FIGURE 5–6

Table 5-7
THE MATTABASSETT DISTRICT WATER POLLUTION CONTROL PLANT
Local Alternative - A/O Process - Denitrification Filters

		Est. Component Cost	Est. Total Cost
Primary Effluent Pumping/Distribution			
Pumps		$330,000	
Distribution Box		$644,000	
Piping		$123,000	
			$1,097,000
Aeration Tank Modifications			
Raise walls, create four-pass configuration		$2,196,000	
Aeration modifications		$180,000	
Baffles and mixers for A/O		$960,000	
			$3,336,000
New Aeration Tanks			
Four new aeration tanks		$6,087,000	
Aeration equipment		$480,000	
Replace existing blowers		$720,000	
Baffles and mixers for A/O		$960,000	
Aeration tank effluent distribution/piping		$1,138,000	
			$9,385,000
Final Clarifiers			
Clarifiers (2)		$3,686,000	
Distribution Box/Piping		$300,000	
Density Current Baffles		$309,000	
			$4,295,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,345,000	
Dechlorination		$263,000	
			$1,608,000
Denitrification			
Denitrificaiton filter pump station		$1,950,000	
Denitrificaiton filters		$15,684,000	
Post Aeration		$964,000	
			$18,598,000
Outfall Structure Modifications			$280,000
Odor Control			
Aeration Tanks		$2,992,000	
Final Clarifiers		$557,000	
Gravity Thickeners		$518,000	
			$4,067,000
WAS Thickening			
Gravity thickeners		$1,490,000	
Pump building/pumps		$400,000	
WAS pumping/piping modifications		$100,000	
			$1,990,000
	SUBTOTAL		$44,700,000
INSTRUMENTATION	10%		$4,470,000
ELECTRICAL	10%		$4,470,000
	SUBTOTAL		$53,600,000
CONTINGENCY	15%		$8,000,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$61,600,000
ENGINEERING, CONSTRUCTION ADMINISTRATION AND OBSERVATION	20%		$12,300,000
TOTAL PROJECT COST			***$73,900,000***
Annual O&M Costs			
FY 97 Actual Expenditures		$4,019,222	
Additional Electrical Costs		$875,000	
Additional Chemical Costs		$183,000	
Additional Labor Costs		$150,000	
	TOTAL ANNUAL O&M COSTS		$5,227,222

THIS CHAPTER CONTAINS SUPERSEDED INFORMATION - REFER TO EXECUTIVE SUMMARY

Table 5-6
THE MATTABASSETT DISTRICT WATER POLLUTION CONTROL PLANT
Local Alternative - A/O Process

		Est. Component Cost	Est. Total Cost
Primary Effluent Pumping/Distribution			
Pumps		$330,000	
Distribution Box		$644,000	
Piping		$123,000	
			$1,097,000
Aeration Tank Modifications			
Raise walls, create four-pass configuration		$2,196,000	
Aeration modifications		$180,000	
Baffles and mixers for A/O		$960,000	
			$3,336,000
New Aeration Tanks			
Four new aeration tanks		$6,087,000	
Aeration equipment		$480,000	
Replace existing blowers		$720,000	
Baffles and mixers for A/O		$960,000	
Aeration tank effluent distribution/piping		$1,138,000	
			$9,385,000
Final Clarifiers			
Clarifiers (2)		$3,686,000	
Distribution Box/Piping		$300,000	
Density Current Baffles		$309,000	
			$4,295,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,345,000	
Dechlorination		$263,000	
			$1,608,000
Outfall Structure Modifications			$280,000
Odor Control			
Aeration Tanks		$2,992,000	
Final Clarifiers		$557,000	
Gravity Thickeners		$518,000	
			$4,067,000
WAS Thickening			
Gravity thickeners		$1,490,000	
Pump building/pumps		$400,000	
WAS pumping/piping modifications		$100,000	
			$1,990,000
	SUBTOTAL		$26,100,000
INSTRUMENTATION	10%		$2,610,000
ELECTRICAL	10%		$2,610,000
	SUBTOTAL		$31,300,000
CONTINGENCY	15%		$4,700,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$36,000,000
ENGINEERING, CONSTRUCTION ADMINISTRATION AND OBSERVATION	20%		$7,200,000
TOTAL PROJECT COST			***$43,200,000***
Annual O&M Costs			
FY 97 Actual Expenditures		$4,019,222	
Additional Electrical Costs		$665,000	
Additional Chemical Costs		$144,000	
Additional Labor Costs		$0	
	TOTAL ANNUAL O&M COSTS		$4,828,222

Table 5-8
THE MATTABASSETT DISTRICT WATER POLLUTION CONTROL PLANT
Regional Alternative - A/O Process

		Est. Component Cost	Est. Total Cost
Headworks			
Modify raw sewage pumps		$660,000	
New comminutors (2)		$360,000	
			$1,020,000
Primary Effluent Pumping/Distribution			
Pumps		$400,000	
Distribution Box		$644,000	
Piping		$124,000	
			$1,168,000
Aeration Tank Modifications			
Raise walls, create four-pass configuration		$2,196,000	
Aeration modifications		$180,000	
Baffles and mixers for A/O		$960,000	
			$3,336,000
New Aeration Tanks			
Six new aeration tanks		$7,957,000	
Aeration equipment		$738,000	
Replace existing blowers		$1,080,000	
Baffles and mixers for A/O		$1,440,000	
Aeration tank effluent distribution/piping		$1,152,000	
			$12,367,000
Final Clarifiers			
Clarifiers		$7,372,000	
Distribution Box/Piping		$300,000	
Density Current Baffles		$412,000	
			$8,084,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,793,000	
Dechlorination		$351,000	
Tank effluent piping		$180,000	
			$2,324,000
Outfall Modifications			
Outfall structure modificaitons		$280,000	
Outfall diffuser piping modifications		$546,000	
			$826,000
Odor Control			
Aeration Tanks		$3,740,000	
Final Clarifiers		$743,000	
Gravity Thickeners		$518,000	
			$5,001,000
WAS Thickening			
Gravity thickeners		$1,800,000	
Pump building/pumps		$440,000	
WAS pumping/piping modifications		$100,000	
			$2,340,000
	SUBTOTAL		$36,500,000
INSTRUMENTATION	10%		$3,650,000
ELECTRICAL	10%		$3,650,000
	SUBTOTAL		$43,800,000
CONTINGENCY	15%		$6,600,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$50,400,000
ENGINEERING, CONSTRUCTION ADMINISTRATION AND OBSERVATION	20%		$10,100,000
TOTAL PROJECT COST			***$60,500,000***
Annual O&M Costs			
FY 97 Actual Expenditures		$4,019,222	
Additional Electrical Costs		$936,000	
Additional Chemical Costs		$215,000	
Additional Labor Costs		$0	
	TOTAL ANNUAL O&M COSTS		$5,170,222

Table 5-9
THE MATTABASSETT DISTRICT WATER POLLUTION CONTROL PLANT
Regional Alternative - A/O Process - Denitrification Filters

		Est. Component Cost	Est. Total Cost
Headworks			
Modify raw sewage pumps		$660,000	
New comminutors (2)		$360,000	
			$1,020,000
Primary Effluent Pumping/Distribution			
Pumps		$400,000	
Distribution Box		$644,000	
Piping		$124,000	
			$1,168,000
Aeration Tank Modifications			
Raise walls, create four-pass configuration		$2,196,000	
Aeration modifications		$180,000	
Baffles and mixers for A/O		$960,000	
			$3,336,000
New Aeration Tanks			
Six new aeration tanks		$7,957,000	
Aeration equipment		$738,000	
Replace existing blowers		$1,080,000	
Baffles and mixers for A/O		$1,440,000	
Aeration tank effluent distribution/piping		$1,152,000	
			$12,367,000
Final Clarifiers			
Clarifiers		$7,372,000	
Distribution Box/Piping		$300,000	
Density Current Baffles		$412,000	
			$8,084,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,793,000	
Dechlorination		$351,000	
Tank effluent piping		$180,000	
			$2,324,000
Denitrification			
Denitrificaiton filter pump station		$2,070,000	
Denitrificaiton filters		$21,960,000	
Post Aeration		$1,338,000	
			$25,368,000
Outfall Modifications			
Outfall structure modificaitons		$280,000	
Outfall diffuser piping modifications		$546,000	
			$826,000
Odor Control			
Aeration Tanks		$3,740,000	
Final Clarifiers		$743,000	
Gravity Thickeners		$518,000	
			$5,001,000
WAS Thickening			
Gravity thickeners		$1,800,000	
Pump building/pumps		$440,000	
WAS pumping/piping modifications		$100,000	
			$2,340,000
	SUBTOTAL		$61,800,000
INSTRUMENTATION	10%		$6,180,000
ELECTRICAL	10%		$6,180,000
	SUBTOTAL		$74,200,000
CONTINGENCY	15%		$11,100,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$85,300,000
ENGINEERING, CONSTRUCTION ADMINISTRATION AND OBSERVATION	20%		$17,100,000
TOTAL PROJECT COST			***$102,400,000***
Annual O&M Costs			
FY 97 Actual Expenditures		$4,019,222	
Additional Electrical Costs		$1,230,000	
Additional Chemical Costs		$471,000	
Additional Labor Costs		$150,000	
	TOTAL ANNUAL O&M COSTS		$5,870,222

Table 5-10
THE MATTABASSETT DISTRICT WATER POLLUTION CONTROL PLANT
Regional Alternative - BOD_5 Removal Only

		Est. Component Cost	Est. Total Cost
Headworks			
Modify raw sewage pumps		$660,000	
New comminutors (2)		$360,000	
			$1,020,000
Aeration Tank Modifications			
Raise walls 2 feet		$244,000	
Modify diffusers in two tanks		$60,000	
Install fine bubble diffusers in two tanks		$180,000	
			$484,000
New Aeration Tank			
Aeration tank		$1,287,000	
Aeration equipment		$90,000	
Effluent distribution/piping		$1,215,000	
			$2,592,000
Final Clarifiers			
Clarifiers		$5,529,000	
Distribution box/piping		$300,000	
			$5,829,000
Chlorine Contact Tank			
Chlorine Contact Tank		$1,177,000	
Tank effluent piping		$180,000	
			$1,357,000
Outfall Modifications			
Outfall structure modificaitons		$280,000	
Outfall diffuser piping modifications		$546,000	
			$826,000
Odor Control			
Aeration Tanks		$3,740,000	
Final Clarifiers		$650,000	
			$4,390,000
	SUBTOTAL		$16,500,000
INSTRUMENTATION	10%		$1,650,000
ELECTRICAL	10%		$1,650,000
	SUBTOTAL		$19,800,000
CONTINGENCY	15%		$3,000,000
PRELIMINARY OPINION OF CONSTRUCTION COST			$22,800,000
ENGINEERING, CONSTRUCTION ADMINISTRATION AND OBSERVATION	20%		$4,600,000
TOTAL PROJECT COST			***$27,400,000***
Annual O&M Costs			
FY 97 Actual Expenditures		$4,019,222	
Additional Electrical Costs		$411,000	
Additional Chemical Costs		$215,000	
Additional Labor Costs		$0	
	TOTAL ANNUAL O&M COSTS		$4,645,222

Environmental and Permitting Issues

Several environmental and permitting issues would be involved in an upgrade/expansion to the Mattabassett WPCF.

Among these are:

- Local wetlands permits.
- Planning & Zoning/Flood Plain permits.
- Permits associated with any outfall modifications including:
  - Army Corp of Engineers
  - DEP Stream Encroachment
  - Coast Guard

Each of these issues is discussed below.

Local Wetlands

The proposed modifications do not include placing structures within the wetlands to the west side of the Mattabassett WPCF site. However, structures would be located within the wetlands buffer zone. In addition, some areas within the existing WPCF site are mapped as wetlands by the Town of Cromwell. These areas include both ash lagoons and the propose site of any additional secondary clarifiers. A wetlands survey would need to be performed to confirm boundaries and exact local wetland permitting requirements. If the area of wetland disturbance exceeded federal requirements, a Corps of Engineers wetland permit may also be required.

As part of the modifications, it may be possible that some wetland mitigation would be required. This mitigation could include creation of new wetlands on either Mattabassett District owned property or on adjacent property. In addition, the design would have to include strict controls to prevent any impacts to existing wetlands during construction.

Planning & Zoning/Flood Plain

Any new construction would be subject to requirements for protection from flood. This should not be an issue due to the proposed tank elevations. However, construction along the west side of the site may result in filling a portion of the side slope which would reduce existing flood storage. Therefore, providing compensatory flood storage capacity may be required as part of the expansion/upgrade design.

Outfall Modifications

As discussed under the hydraulic analysis, modifications to the both the outfall chamber and the diffuser may be required. These modifications would require construction within the Connecticut River and would require obtaining permits from the Army Corps of Engineers, from the Connecticut DEP for stream channel encroachment, and from the Coast Guard for modifications to the diffuser requiring work within the river.

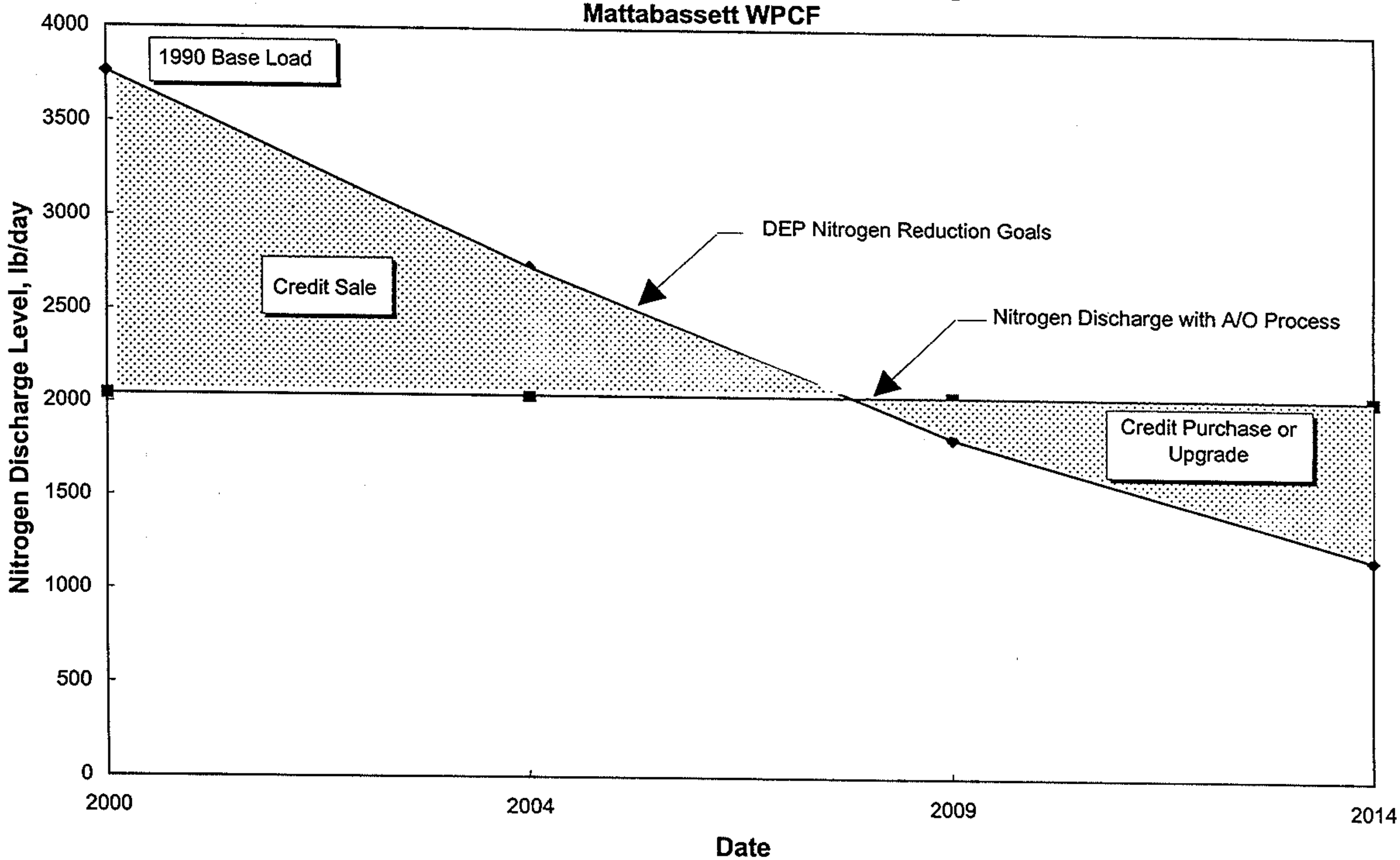
Nitrogen Credit Trading

Another regulatory issue which needs to be considered as part of the inter-municipal study is the nitrogen credit trading program currently under development. The DEP is developing a nitrogen credit trading program as an alternative management program. Emission credit trading is a system designed to meet pollution reduction limits through the selling and buying of credits created by the voluntary over control of the pollutant (in this case TN) by a potential seller to a buyer who cannot achieve the reduction limits more economically through construction or in a timely fashion. The excess reduction over the limit is the "credit". The value of the credit depends in part on the cost of treatment or reduction of the pollutant.

Achieving the final nitrogen reduction requirement at the Mattabassett District WPCF would require significant capital improvements. As an alternative, the nitrogen credit trading program could potentially allow facilities which are removing additional nitrogen beyond their goals to sell credits to other facilities and would potentially allow the purchasing facility to meet its goals without the need for extensive capital improvements. Therefore, as part of any evaluation for nitrogen reduction, one of the alternatives to be considered would be making capital improvements to meet interim nitrogen reduction targets and purchasing credits to meet final nitrogen reduction requirements.

This concept is illustrated for the Mattabassett WPCF in Figure 5-7. As shown, the Mattabassett WPCF's TN discharge goals for the inter-municipal alternative would be reduced from the expected base load of 3,765 lb/day to 1,186 lb/day by 2014. Assuming an average TN concentration of 7 mg/L from the A/O process upgrade, the resultant TN discharge from the WPCF would be 2,043 lb/day. Following completion of the A/O process upgrade until approximately 2008, the District would be removing more TN than the DEP goals and have credits available for sale to other communities. Subsequently, the CTDEP goals would be lower than the District's discharge. At that time, the District would need to determine if it was more cost effective to purchase credits or implement additional TN removal to meet the DEP goals.

Figure 5-7
Annual Reduction Limits Under Proposed Trading Model
Mattabassett WPCF



Chapter 6

CHAPTER 6 COST ANALYSIS

Preface

The original intent of this study was to evaluate the feasibility of three new communities (Middletown, Plainville and Portland) joining the existing three member (New Britain, Berlin and Cromwell) Mattabassett District. Decisions made by the Towns of Plainville and Portland during the preparation of this study resulted in the conclusion that only the City of Middletown would pursue the original purpose of this Study.

The Cost Analysis presented below in this Chapter was prepared while all three communities were actively considering the option of joining the Mattabassett District. In finalizing this Study, no attempt has been made to revise the contents of this Chapter once it was learned that Plainville and Portland were no longer interested in the Mattabassett option.

The Executive Summary of this Report contains an updated Cost Analysis for the one remaining interested community (the City of Middletown).

Introduction

A financial analysis was performed to assess the economic feasibility of connecting Middletown, Plainville and Portland (the "Inter-municipal Alternative") to the Mattabassett District Water Pollution Control Facility (WPCF) as compared to the estimated wastewater treatment costs if each community were to continue with their current system (the "Local Alternative").

Specifically, the goals of the cost analysis were to:

- develop user costs that are sufficient to cover capital and operation and maintenance (O&M) costs associated with the expansion/upgrade of the Mattabassett facilities for a 20 year planning period,
- develop a pricing strategy/surcharge system to recover costs associated with handling peak flows,
- minimize inequities through the use of properly defined cost-causative factors,
- meet requirements, charters, ordinances and applicable environmental regulations, and
- compare the estimated inter-municipal alternative user cost to those if the communities were to continue locally, so that each community and the Mattabassett District can make a decision as to the economic feasibility of the inter-municipal alternative.

The financial analysis is presented in detail in Appendix F. A summary of the methodology, assumptions, and results of this analysis are presented in this Chapter.

Methodology and Assumptions

The methodology used for the evaluation of the Inter-municipal Alternative is based on the current system used by the Mattabassett District for assessing costs to its existing Contractual Members. Specifically, capital costs for the District are prorated among the members based on their reserve capacity allocation and operating costs are prorated based on member's share of treated average daily flow.

The methodology used as part of this financial analysis, however, was adjusted to account for peak flows. Specifically, those capital costs that are associated with handling peak flows (flows in excess of 2.5 times the community's reserved capacity allocation) were prorated based on a member's contribution to peak flows and not average daily flow. This peak flow allocation was used for evaluating the Mattabassett District rates under both the Inter-municipal and Local Alternatives.

It should be noted that capacity and capital cost analyses for the WPCF are based on the assumption that each of the communities will rehabilitate their sewers to minimize extraneous flow to the WPCF over the 20 year planning period. The year 2020 average daily flow allocations presented in this Chapter are based on each community's individual rehabilitation of their sewers. The costs associated with rehabilitation of the sewers, however, has not been included this analysis.

Additional assumptions used to develop the cost analysis are included in Appendix F of this report.

Flow Contribution/Allocations

Flow Allocations

Estimates of each participant's average daily flow contributions and peak hourly flow contributions were developed for the 20 year planning period (i.e. fiscal year (FY) 2000 to fiscal year 2020). Table 6-1 presents these flow contributions for both FY 2000 and FY 2020. The FY 2020 flows are based on the rehabilitation of the sewer system to remove excessive infiltration and inflow. The FY 2000 flows do not include sewer system rehabilitation. The FY 2020 flow contributions were used to allocate the estimated O&M costs associated with the Inter-municipal Alternative to each of the communities over the 20 year planning period.

Capacity Allocations

Table 6-2 presents the allocations used to prorate the capital costs associated with the expansion/upgrade of the Mattabassett WPCF under the Inter-municipal Alternative. Specifically, it identifies the current allocation (in mgd) for each of the communities based on a total allocation of 22 mgd and calculates the additional allocation needed for each of the communities (in mgd) based on the projected fiscal year 2020 average daily flows with rehabilitation (35 mgd).

Table 6-1

Mattabassett Regionalization Project - Participant Flow Allocation

INTER-MUNICIPAL ALTERNATIVE

IF REHABILITATE :

	FY 2000						FY 2020					
Participant	Average Daily Flow (mgd)	% of Subtotal	% of Total	Peak Hour Flow (mgd)	% of Subtotal	% of Total	Average Daily Flow (mgd)	% of Subtotal	% of Total	Peak Hour Flow (mgd)	% of Subtotal	% of Total
Constituent Municipalities:												
New Britain	10.73	68%	40%	37.80	66%	40%	13.5	67%	39%	42.10	66%	39%
Berlin	2.44	15%	9%	8.10	14%	8%	3.29	16%	9%	9.50	15%	9%
Cromwell	2.68	17%	10%	11.10	19%	12%	3.5	17%	10%	12.40	19%	11%
Subtotal	15.85	100%	59%	57.00	100%	60%	20.29	100%	58%	64.00	100%	59%
Existing Contractual Municipalities:												
Middletown (Westfield)	2.08	13%	8%	7.50	13%	8%	3	15%	9%	9.10	14%	8%
Hartford MDC	2.11	13%	8%	5.70	10%	6%	3.17	16%	9%	7.80	12%	7%
Subtotal	4.19	26%	16%	13.20	23%	14%	6.17	30%	18%	16.90	26%	16%
New Contractual Municipalities:												
Middletown (POTW-4)	4.26	27%	16%	18.50	32%	19%	5.51	27%	16%	20.30	32%	19%
Plainville	1.89	12%	7%	4.70	8%	5%	2.1	10%	6%	5.00	8%	5%
Portland	0.61	4%	2%	2.00	4%	2%	0.66	3%	2%	2.10	3%	2%
Subtotal	6.76	43%	25%	25.20	44%	26%	8.27	41%	24%	27.40	43%	25%
TOTAL	26.8		100%	95.40		100%	34.73		100%	108.30		100%

Table 6-2

Mattabassett Regionalization Project - Participant Capacity Allocations

INTER-MUNICIPAL ALTERNATIVE

IF REHABILITATE :

		FY 2020 (1)				FY 2010 (2)		
Participant	Current Allocation (mgd)	Average Daily Flow (mgd)	Additional Allocation Needed	% of Total	Allowable Peak Flow (2.5x) (3)	Estimated Peak Flow (mgd)	Additional Peak Flow Needs (mgd)	% of Total
Constituent Municipalities:								
Farmington								
New Britain	12.60	13.50	0.90	7%	33.75	39.89	6.14	37%
Berlin	3.30	3.29	0.00	0%	8.23	8.77	0.55	3%
Cromwell	2.00	3.50	1.50	12%	8.75	11.73	2.98	18%
Subtotal	17.90	20.29	2.40	19%	50.73	60.40	9.67	59%
Existing Contractual Municipalities:								
Middletown (Westfield)	2.50	3.00	0.50	4%	7.50	8.26	0.76	5%
Hartford MDC	1.60	3.17	1.57	12%	7.93	6.67	0.00	0%
Subtotal	4.10	6.17	2.07	16%	15.43	14.93	0.76	5%
New Contractual Municipalities:								
Middletown (POTW 4)	0.00	5.51	5.51	43%	13.78	19.38	5.60	34%
Plainville	0.00	2.10	2.10	16%	5.25	4.85	0.00	0%
Portland	0.00	0.66	0.66	5%	1.65	2.05	0.40	2%
Subtotal	0.00	8.27	8.27	65%	20.675	26.28	6.00	37%
TOTAL	22.00	34.73	12.74	100%	86.825	101.60	16.44	100%

Table 6-2 also calculates the estimated peak flow allocations used to prorate the capital costs associated with handling peak flows. The peak flow allocations are based on a typical target peak flow of 2.5 times the capacity allocation identified above. The additional costs associated with handling peak flows are then proportionally allocated based on a community's exceedance of these target peak flows. Because peak flows will be reduced gradually over the 20-year planning period, and because the WPCF will need to manage current peak flows, a mid-point FY 2010 projected peak flow was used to calculate each community's additional peak flow handling needs.

User Charge Analysis

A series of spreadsheets were developed to evaluate each community's annual cost share under the Inter-municipal Alternative for each year of the 20 year planning period. The net present value (NPV) of these costs over the 20 year planning period was also evaluated. These spreadsheets are presented in Appendix F to this report. The following summarizes the basis for development of these spreadsheets and each community's cost share.

For the purposes of this analysis, annual debt service numbers are based on an interest rate of 6% per year and the Net Present Value (NPV) calculations are based on a discount factor of 6% per year. The actual annual debt service will be dependent on the availability of Connecticut Clean Water Fund grants and loans. Typically, a 20 percent grant and 80 percent loan (at 2 percent interest) is provided to grant-eligible portions of projects. Consequently, the annual debt service costs are a conservative estimate of potential future costs.

Capital Cost Estimates

Chapter 5 of this report presents the capital costs associated with the expansion/upgrade of the Mattabassett District Facilities under the Inter-municipal Alternative based on:

- expansion of the WPCF to 35 mgd at the current level of treatment (BOD_5 Removal Requirements);
- upgrading the WPCF to meet the State's 2009 goal for total nitrogen removal (A/O Process); and
- upgrading the WWTP to meet the State's 2014 goal for total nitrogen removal (Level III TN Removal).

Those capital costs associated with the expansion of the WPCF to provide the current level of treatment (BOD_5 removal) for an average daily flow rate of 35 mgd were allocated based on a community's additional capacity allocation needs as illustrated in Table 6-2. The majority of these costs are allocated to the new contractual members, however, some costs are allocated to current members based on flows in excess of their current flow allocation. Those costs associated with upgrading the facilities to meet the State's 2009 and 2014 goals were allocated based on a community's FY 2020 capacity allocation.

The capital costs associated with handling peak flows, such as an additional final clarifier or larger chlorine contact tank, were allocated based on a community's FY 2010 peak hour capacity needs (i.e., these costs are allocated to all members which exceed their allowable peak flow of 2.5 times the capacity allocation).

Furthermore, the capital costs associated with expansion to provide the current level of treatment for an average daily flow of 35 mgd and to meet 2009 total nitrogen reduction goals were assumed to be implemented in FY 2000, whereas, the capital improvements and costs associated with meeting the 2014 total nitrogen reduction goals were assumed to be implemented in FY 2014. As a result, only a portion of the capital cost associated with Level III Total Nitrogen Removal improvements is realized in the NPV calculation for the 20 year planning period.

O&M Cost Estimates

Chapter 5 of this report also presents the O&M costs associated with the expansion/upgrade of the Mattabassett District Facilities under the Inter-municipal Alternative.

These O&M costs are proportionally allocated to all members based on their annual average daily flow allocations for each year of the 20 year planning period. As with the capital costs, it was assumed that the O&M costs associated with expansion to provide the current level of treatment for an average daily flow of 35 mgd and to meet 2009 total nitrogen reduction goals are to be implemented in FY 2000, whereas, the O&M costs associated with meeting the 2014 total nitrogen reduction goals were assumed to be implemented in FY 2014.

In addition, for the purposes of this analysis, annual O&M costs are assumed to escalate at a rate of 4% per year for each year of the 20 year planning period.

Conveyance Cost Estimates

In addition to the capital and O&M assessments for treatment at the Mattabassett WPCF, each participant is also to be responsible for their individual collection system costs, including any potential additional capital and O&M costs associated with the construction and operation of transmission facilities to convey their wastewater to the regional WPCF and/or decommission existing facilities. A summary of these costs is presented in each community's individual section of the report.

Summary

Appendix F presents a summary of the total estimated annual costs, including WPCF capital and O&M assessments and conveyance system capital and O&M costs, for each participant under the Inter-municipal Alternative for each year of the 20 year planning period. It also presents the total NPV of these capital and O&M costs for the 20 year planning period. The following section compares these Inter-municipal Alternative estimated costs to each community's estimated Local Alternative costs.

Inter-municipal vs. Local Alternative Cost Comparison

Annual Costs

Capital and O&M costs associated with the continued operation of the Middletown, Plainville, and Portland wastewater treatment facilities are presented in Chapters 2, 3, and 4, respectively. These costs included capital improvement costs necessary at each facility under the Local Alternative. Also presented in Chapters 2, 3, and 4 are the capital and O&M costs associated with conveying the Middletown, Plainville, and Portland flows to the Mattabassett District WPCF under the Inter-municipal Alternative. The Inter-municipal Alternative costs also included costs associated with decommissioning of the existing wastewater treatment facilities. Local Alternative cost information for each community is summarized in the individual tables at the end of this chapter. The Inter-municipal Alternative cost information discussed above and presented in Appendix F is also summarized in the individual community tables at the end of this chapter. These tables present the estimated first year total O&M costs and capital costs for each community.

A summary comparison of the first year annual O&M costs and capital costs for each community is also presented in Tables 6-3 and 6-4. Specifically, Table 6-3 summarizes the annual O&M and capital costs, in 1998 dollars, associated with meeting the 2009 total nitrogen reduction goals and Table 6-4 summarizes the annual O&M and capital costs, in 1998 dollars, associated with meeting the 2014 total nitrogen reduction goals. This comparison is also illustrated in Figures 6-1 and 6-2.

Based on the information presented in Tables 6-3 and 6-4, most communities will realize an annual savings under the Inter-municipal Alternative beginning with the first year. It is estimated that the total Inter-municipal Alternative savings realized in the first year would be on the order of $2.78 million to meet the 2009 total nitrogen reduction goals and $2.97 million to meet the 2014 total nitrogen reduction goals in 1998 dollars. The exceptions are the Hartford MDC and the Town of Portland. Hartford MDC costs were identified to increase under the Inter-municipal Alternative due to the costs associated with increasing their current allocation from 1.6 mgd to 3.17 mgd (almost a 100% increase in allocation). It should be noted, however, that these initial costs are later offset by the O&M savings realized over the 20 year planning period (see discussion below).

The Town of Portland would pay less under the Inter-municipal Alternative to meet 2009 total nitrogen reduction goals, but would pay more under the Inter-municipal Alternative to meet the 2014 total nitrogen reduction goals. An incremental cost to meet the 2014 goal under the Local Alternative for Portland is not necessary because the planned WWTP improvements are anticipated to achieve the 2014 goals. Consequently, an additional increase in costs in 2014 would not be necessary for the Local Alternative. However, the O&M savings realized over the 20 year planning period (see discussion below) still results in the Inter-municipal Alternative being more cost effective on a NPV basis. It should also be noted that the future CTDEP treatment goals are uncertain and that new technologies for removal of nitrogen may also be available to lower the cost of additional nitrogen removal at the Mattabassett WPCF. This could potentially result in lower costs to meet the 2014 goals than included in this analysis.

Table 6-3

COMPARISON SUMMARY OF COST ESTIMATES ANNUAL COST IN 1998 DOLLARS TO MEET 2009 GOALS ASSUMES REHABILITATION

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated Savings
	O&M (000s)	Capital (1) (000s)	Total (000s)	O&M (000s)	Capital (1) (000s)	Total (000s)	
1. New Britian	$895	$1,634	$2,529	$1,312	$2,139	$3,451	$922
2. Berlin	$204	$341	$544	$298	$490	$788	$244
3. Cromwell	$224	$633	$857	$328	$586	$914	$57
4. Middletown (Westfield)	$345	$385	$730	$426	$448	$874	$144
5. Hartford MDC	$350	$521	$871	$432	$428	$860	-$11
6. Middletown (POTW+)	$826	$1,933	$2,760	$2,900	$535	$3,435	$675
7. Plainville	$553	$1,193	$1,746	$1,870	$558	$2,428	$682
8. Portland	$121	$479	$600	$218	$444	$662	$62
	$3,518	$7,119	$10,637	$7,783	$5,628	$13,411	$2,775

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Table 6-4

COMPARISON SUMMARY OF COST ESTIMATES
ANNUAL COST IN 1998 DOLLARS TO MEET 2014 GOALS
ASSUMES REHABILITATION

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated Percent Savings
	O&M (000s)	Capital (1) (000s)	Total (000s)	O&M (000s)	Capital (1) (000s)	Total (000s)	
1. New Britian	$1,175	$3,060	$4,236	$1,526	$3,504	$5,030	$794
2. Berlin	$267	$689	$956	$347	$823	$1,170	$214
3. Cromwell	$294	$1,003	$1,297	$381	$940	$1,321	$24
4. Middletown (Westfield)	$399	$702	$1,101	$467	$752	$1,219	$118
5. Hartford MDC	$405	$856	$1,261	$474	$749	$1,223	-$39
6. Middletown (POTW+)	$938	$2,516	$3,453	$3,050	$1,220	$4,270	$817
7. Plainville	$603	$1,414	$2,017	$1,960	$1,123	$3,083	$1,066
8. Portland	$137	$548	$685	$218	$444	$662	-$24
	$4,218	$10,789	$15,007	$8,422	$9,555	$17,977	$2,970

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Figure 6-1
ANNUAL COST COST COMPARISON (1998 DOLLARS)
MEETS 2009 GOALS

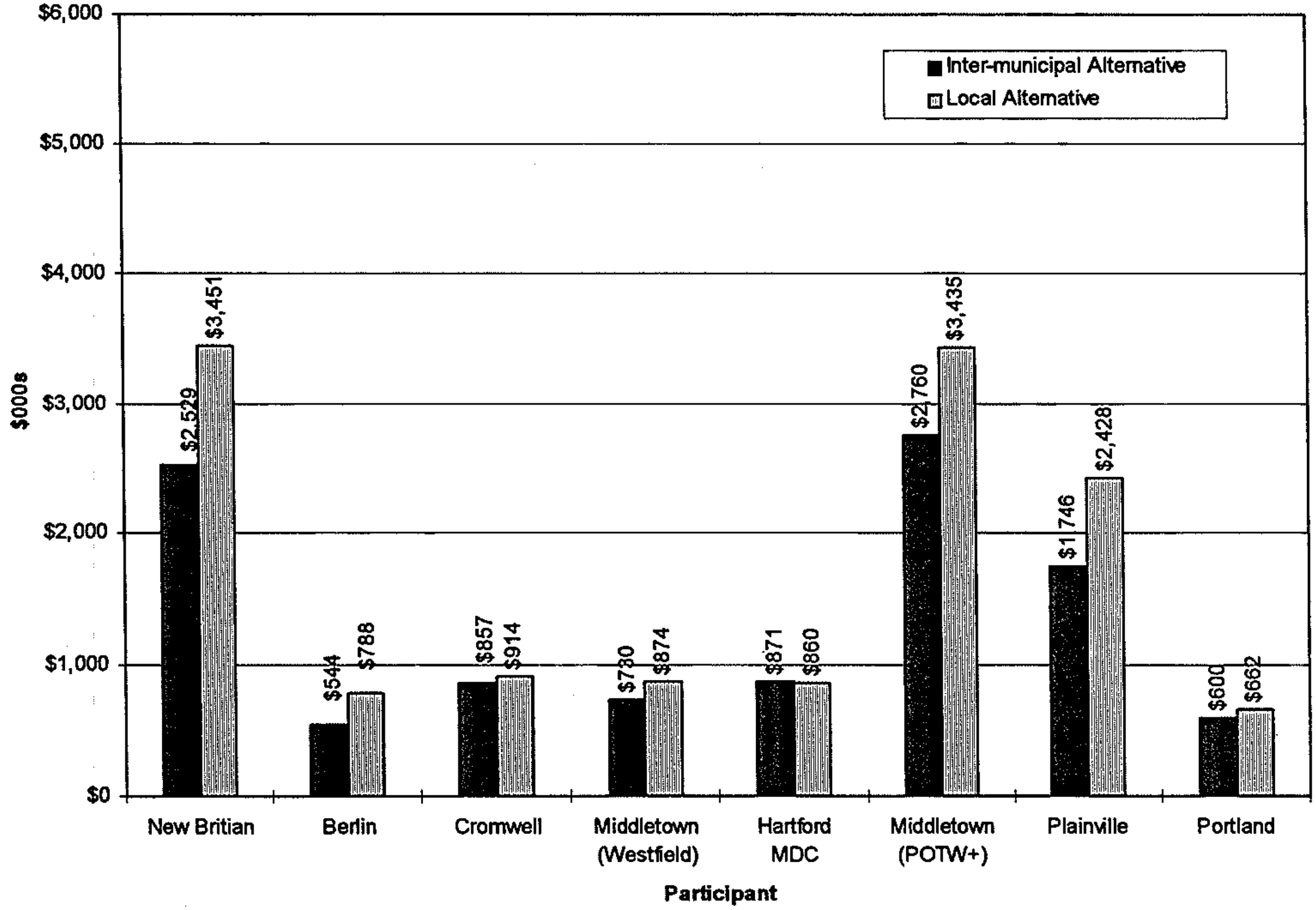
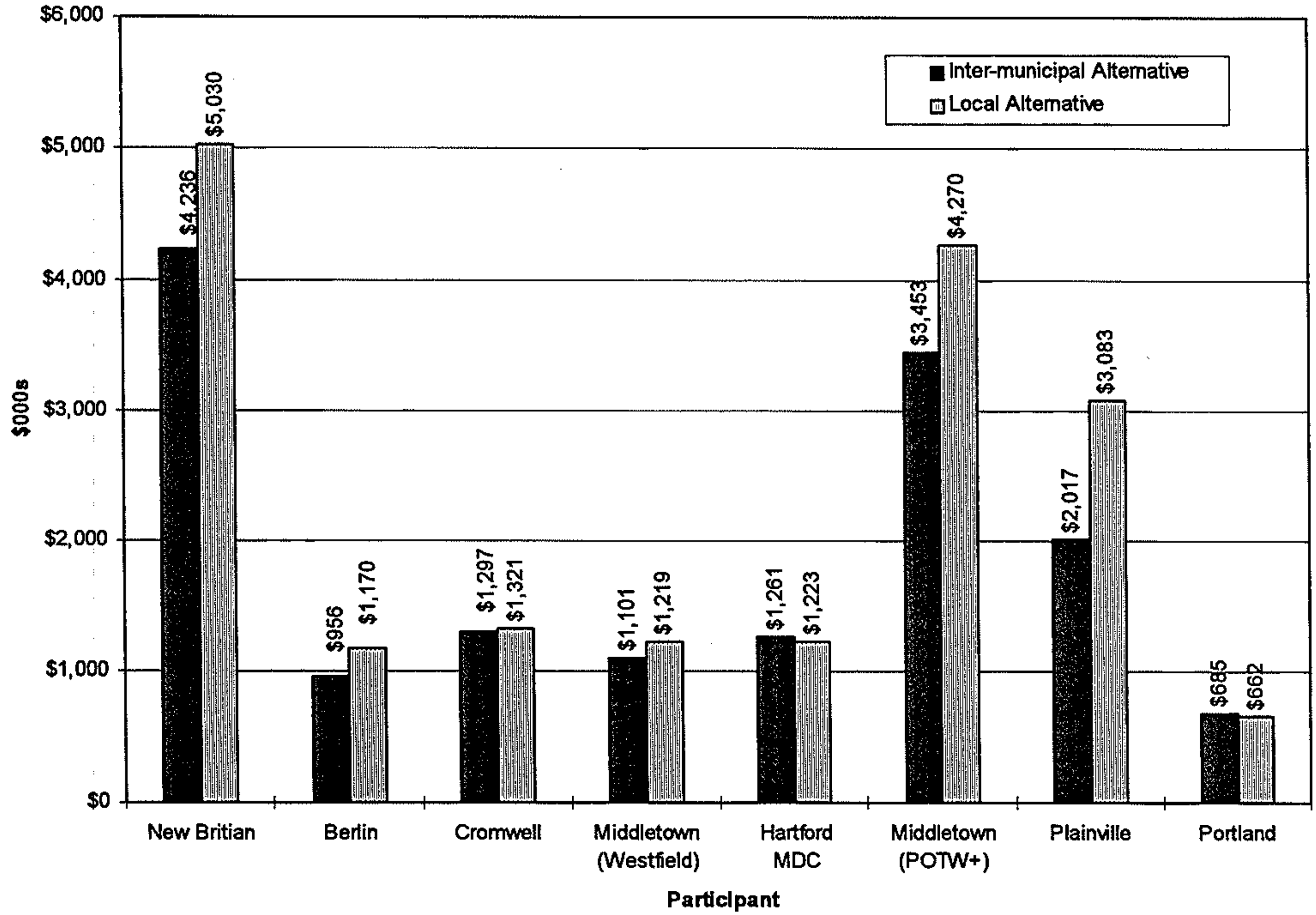


Figure 6-2
ANNUAL COST COST COMPARISON (1998 DOLLARS)
MEETS 2014 GOALS



NPV Analysis

A net present value (NPV) analysis was performed to assess the economics over the 20 year planning period. The NPV analysis is based on the following assumptions:

- annual debt service for the capital improvements are based on an interest rate of 6%,
- O&M costs escalate at a rate of 4% per year, and
- the NPV discount factor (value of money) is 6%.

A NPV comparison of operation and maintenance costs and capital costs is presented in Tables 6-5 and 6-6. Specifically, Table 6-5 summarizes the NPV costs, in 1998 dollars, associated with meeting the 2009 goals and Table 6-6 summarizes the NPV costs, in 1998 dollars, associated with meeting 2014 goals. As identified in Tables 6-5 and 6-6, it appears that all communities would realize an economic benefit under the Inter-municipal Alternative over the 20 year planning period. These savings are also illustrated in Figures 6-3 and 6-4.

Summary

The results indicate that for all communities the economics are more favorable under the Inter-municipal Alternative than under the Local Alternative. Although the capital costs associated with the Inter-municipal Alternative are generally higher than that under the Local Alternative (primarily due to the additional capital costs associated with the construction of conveyance systems) the O&M costs are significantly lower and more than offset these capital costs. These O&M savings are primarily due to the economies of scale associated with the Inter-municipal treatment at a single facility, rather than at individual local facilities. The overall savings associated with the Inter-municipal Alternative over the 20-year planning period is projected to be on the order of $56 million in 1998 dollars based on the NPV analysis.

Table 6-5

COMPARISON SUMMARY OF COST ESTIMATES
NET PRESENT VALUE OVER THE 20 YEAR PLANNING PERIOD
TO MEET 2009 GOALS
ASSUMES REHABILITATION

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated Percent Savings
	O&M NPV (000s)	Capital NPV (000s)	Total NPV (000s)	O&M NPV (000s)	Capital NPV (000s)	Total NPV (000s)	
1. New Britian	$15,467	$16,665	$32,132	$22,254	$24,530	$46,784	$14,652
2. Berlin	$3,635	$3,367	$7,003	$5,229	$5,620	$10,849	$3,847
3. Cromwell	$3,932	$6,934	$10,866	$5,657	$6,720	$12,377	$1,511
4. Middletown (Westfield)	$6,190	$4,005	$10,194	$7,592	$5,140	$12,732	$2,538
5. Hartford MDC	$6,404	$5,717	$12,121	$7,855	$4,910	$12,765	$643
6. Middletown (POTW+)	$14,013	$22,176	$36,189	$47,805	$6,140	$53,945	$17,755
7. Plainville	$8,932	$13,678	$22,610	$30,826	$6,400	$37,226	$14,616
8. Portland	$1,916	$5,489	$7,405	$3,585	$5,090	$8,675	$1,270
	$60,489	$78,033	$138,522	$130,804	$64,550	$195,353	$56,831

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Table 6-6

COMPARISON SUMMARY OF COST ESTIMATES NET PRESENT VALUE OVER THE 20 YEAR PLANNING PERIOD TO MEET 2014 GOALS ASSUMES REHABILITATION

PARTICIPANT	INTER-MUNICIPAL ALTERNATIVE			LOCAL ALTERNATIVE			Estimated Percent Savings
	O&M NPV (000s)	Capital NPV (000s)	Total NPV (000s)	O&M NPV (000s)	Capital NPV (000s)	Total NPV (000s)	
1. New Britian	$18,422	$24,630	$43,052	$24,471	$32,150	$56,621	$13,569
2. Berlin	$4,348	$5,308	$9,656	$5,764	$7,480	$13,244	$3,588
3. Cromwell	$4,694	$8,999	$13,693	$6,229	$8,700	$14,929	$1,235
4. Middletown (Westfield)	$6,833	$5,775	$12,607	$8,075	$6,830	$14,905	$2,297
5. Hartford MDC	$7,079	$7,588	$14,667	$8,362	$6,700	$15,061	$394
6. Middletown (POTW+)	$15,215	$25,427	$40,641	$48,663	$9,970	$58,633	$17,992
7. Plainville	$9,400	$14,917	$24,318	$31,341	$9,550	$40,891	$16,573
8. Portland	$2,064	$5,879	$7,943	$3,585	$5,090	$8,675	$733
	$68,055	$98,523	$166,578	$136,490	$86,470	$222,960	$56,382

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Figure 6-3
NPV COST COMPARISON - REHABILITATION MEETS 2009 GOALS

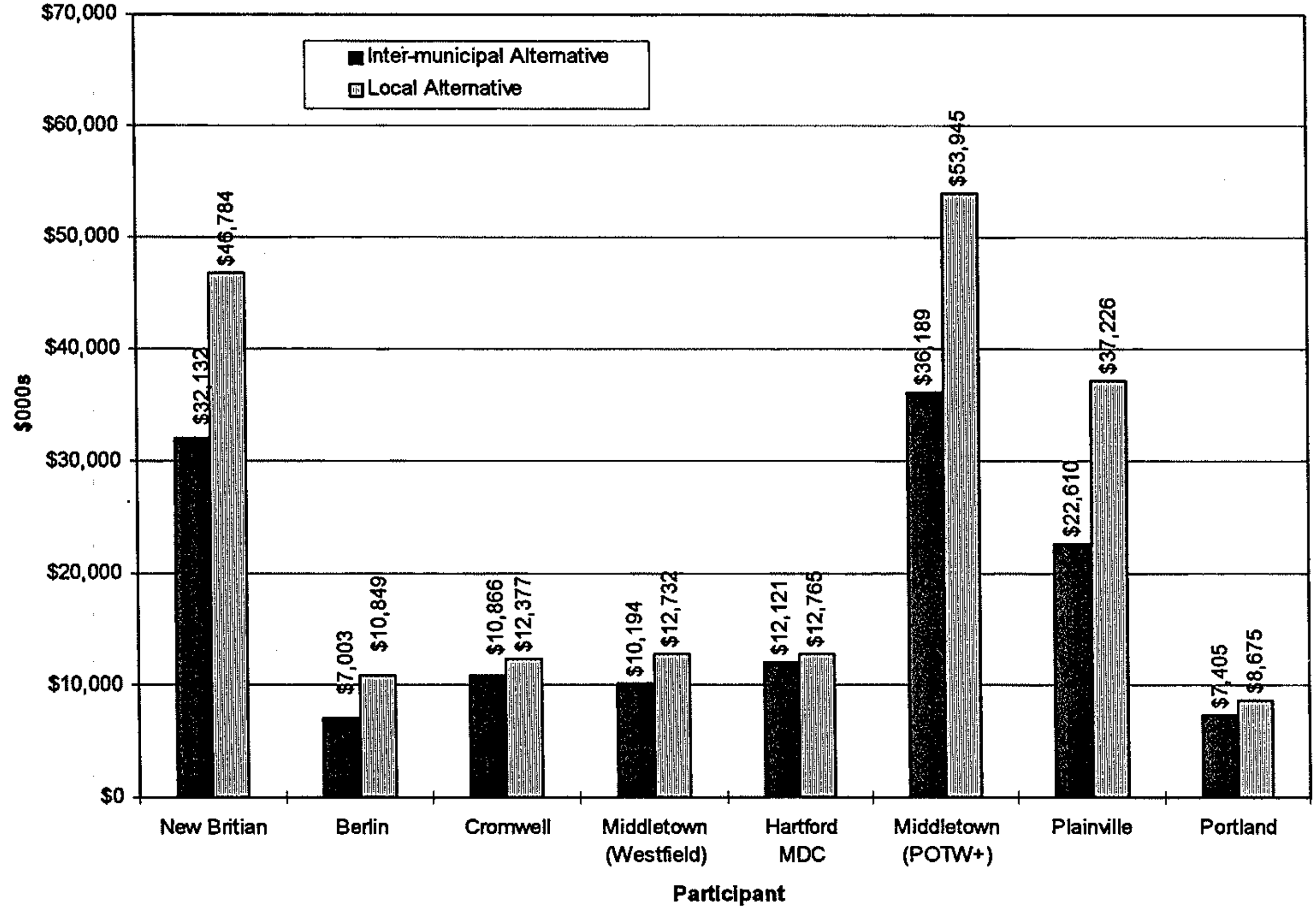
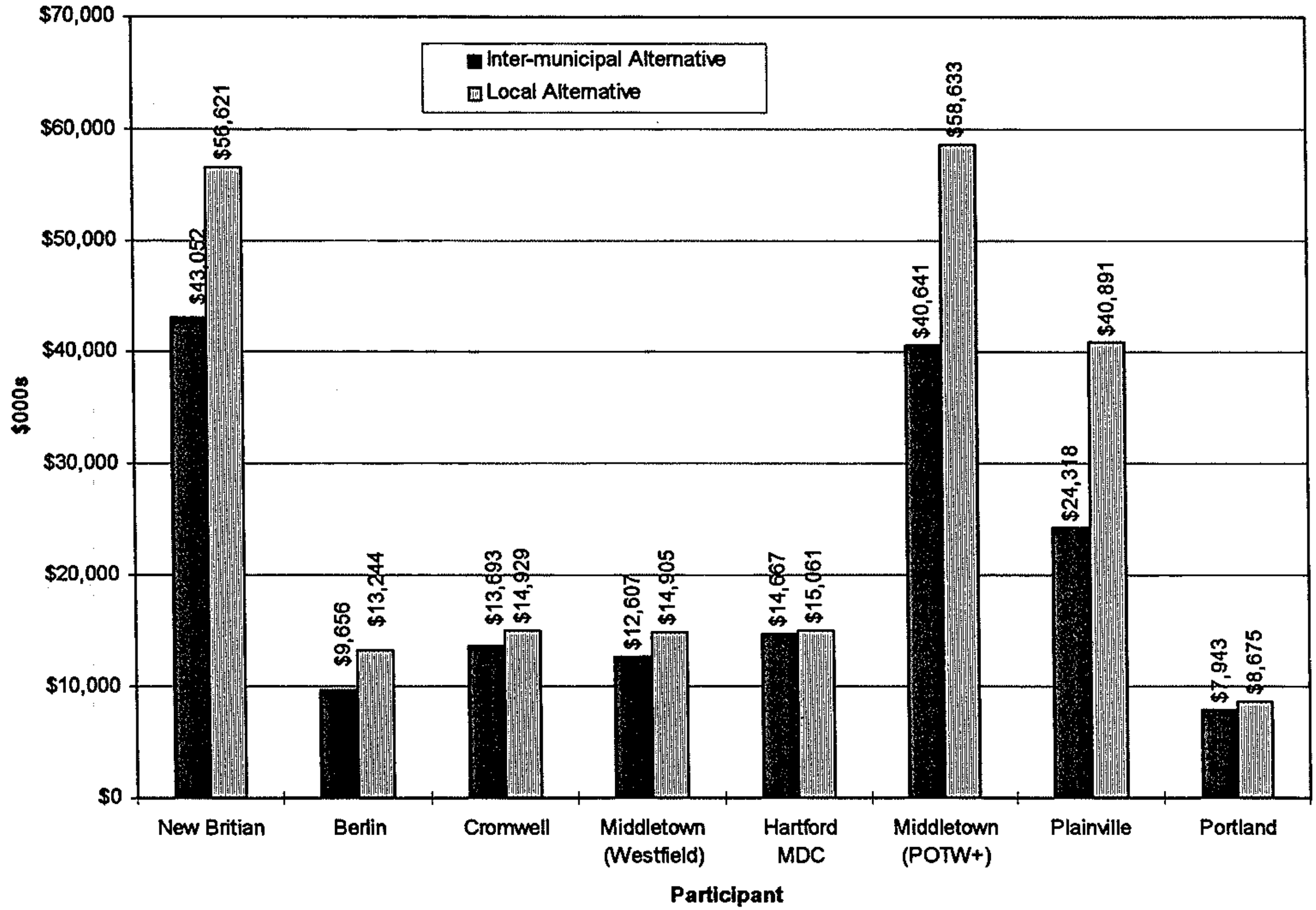


Figure 6-4
NPV COST COMPARISON - REHABILITATION MEETS 2014 GOALS



New Britain
PRELIMINARY COSTS
for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSET (meeting 2009 goals)			
		O&M	CAPITAL
1.	Share of Capital and O&M Costs to meet 2009 goals at the Mattabasset District	$895,000	$18,742,000
	ANNUAL SUBTOTAL	$895,000	$1,634,000
	ANNUAL COST (includes meeting 2009 goals at Mattabassett)	$2,529,000	

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Share of Capital and O&M Costs to Meet 2014 goals at the Mattabasset District	$280,000	$16,368,000
	ANNUAL SUBTOTAL	$280,000	$1,427,000
	ANNUAL COST (includes meeting 2014 goals at Mattabassett)	$1,707,000	

TOTAL ANNUAL COST	$4,236,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

New Britain

PRELIMINARY COSTS

for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (meeting 2009 goals)			
		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$1,312,000	$24,534,000
	ANNUAL SUBTOTAL	$1,312,000	$2,139,000
	ANNUAL COST (to meet 2009 goals)	$3,451,000	

ADDITIONAL COSTS (to upgrade Facility to meet 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$214,000	$15,668,000
	ANNUAL SUBTOTAL	$214,000	$1,366,000
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$1,580,000	

TOTAL ANNUAL COST	$5,031,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Berlin
PRELIMINARY COSTS
for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSET (meeting 2009 goals)			
		O&M	CAPITAL
1.	Share of Capital and O&M Costs to meet 2009 goals at the Mattabasset District	$204,000	$3,911,000
	ANNUAL SUBTOTAL	$204,000	$341,000
	ANNUAL COST (includes meeting 2009 goals at Mattabassett)	$545,000	

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Share of Capital and O&M Costs to Meet 2014 goals at the Mattabasset District	$64,000	$3,992,000
	ANNUAL SUBTOTAL	$64,000	$348,000
	ANNUAL COST (includes meeting 2014 goals at Mattabassett)	$412,000	

TOTAL ANNUAL COST	$957,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Berlin
PRELIMINARY COSTS
for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (meeting 2009 goals)			
		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$298,000	$5,620,000
	ANNUAL SUBTOTAL	$298,000	$490,000
	ANNUAL COST (to meet 2009 goals)	$788,000	

ADDITIONAL COSTS (to upgrade Facility to meet 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$49,000	$3,819,000
	ANNUAL SUBTOTAL	$49,000	$333,000
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$382,000	

TOTAL ANNUAL COST	$1,170,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Cromwell

PRELIMINARY COSTS

for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSET (meeting 2009 goals)			
		O&M	CAPITAL
1.	Share of Capital and O&M Costs to meet 2009 goals at the Mattabasset District	$224,000	$7,260,000
	ANNUAL SUBTOTAL	$224,000	$633,000
	ANNUAL COST (includes meeting 2009 goals at Mattabassett)	$857,000	

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Share of Capital and O&M Costs to Meet 2014 goals at the Mattabasset District	$70,000	$4,244,000
	ANNUAL SUBTOTAL	$70,000	$370,000
	ANNUAL COST (includes meeting 2014 goals at Mattabassett)	$440,000	

TOTAL ANNUAL COST	$1,297,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Cromwell
PRELIMINARY COSTS
for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (meeting 2009 goals)			
		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$328,000	$6,721,000
	ANNUAL SUBTOTAL	$328,000	$586,000
	ANNUAL COST (to meet 2009 goals)	$914,000	

ADDITIONAL COSTS (to upgrade Facility to meet 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$53,000	$4,060,000
	ANNUAL SUBTOTAL	$53,000	$354,000
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$407,000	

TOTAL ANNUAL COST	$1,321,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Middletown (Westfield)
PRELIMINARY COSTS
for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSET (meeting 2009 goals)			
		O&M	CAPITAL
1.	Share of Capital and O&M Costs to meet 2009 goals at the Mattabasset District	$345,000	$4,416,000
	ANNUAL SUBTOTAL	$345,000	$385,000
	ANNUAL COST (includes meeting 2009 goals at Mattabassett)	$730,000	

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Share of Capital and O&M Costs to Meet 2014 goals at the Mattabasset District	$54,000	$3,636,000
	ANNUAL SUBTOTAL	$54,000	$317,000
	ANNUAL COST (includes meeting 2014 goals at Mattabassett)	$371,000	

TOTAL ANNUAL COST	$1,101,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Middletown (Westfield)

PRELIMINARY COSTS

for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (meeting 2009 goals)			
		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$426,000	$5,139,000
	ANNUAL SUBTOTAL	$426,000	$448,000
	ANNUAL COST (to meet 2009 goals)	$874,000	

ADDITIONAL COSTS (to upgrade Facility to meet 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$41,000	$3,475,000
	ANNUAL SUBTOTAL	$41,000	$303,000
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$344,000	

TOTAL ANNUAL COST	$1,218,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Hartford MDC/(Newington-Rowley St.)
PRELIMINARY COSTS
for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSET (meeting 2009 goals)			
		O&M	CAPITAL
1.	Share of Capital and O&M Costs to meet 2009 goals at the Mattabasset District	$350,000	$5,976,000
	ANNUAL SUBTOTAL	$350,000	$521,000
	ANNUAL COST (includes meeting 2009 goals at Mattabassett)	$871,000	

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Share of Capital and O&M Costs to Meet 2014 goals at the Mattabasset District	$55,000	$3,842,000
	ANNUAL SUBTOTAL	$55,000	$335,000
	ANNUAL COST (includes meeting 2014 goals at Mattabassett)	$390,000	

TOTAL ANNUAL COST	$1,261,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Hartford MDC/(Newington-Rowley St.)
PRELIMINARY COSTS
for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (meeting 2009 goals)			
		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$432,000	$4,909,000
	ANNUAL SUBTOTAL	$432,000	$428,000
	ANNUAL COST (to meet 2009 goals)	$860,000	

ADDITIONAL COSTS (to upgrade Facility to meet 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$42,000	$3,682,000
	ANNUAL SUBTOTAL	$42,000	$321,000
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$363,000	

TOTAL ANNUAL COST	$1,223,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Middletown (POTW)

PRELIMINARY COSTS

for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSET (meeting 2009 goals)			
		O&M	CAPITAL
1.	Regional Pump Station Capital and O&M and STP demolition/site restoration	$120,000	$2,580,000
2.	Force Main Capital Costs	-	$3,050,000
3.	Share of Capital and O&M Costs to meet 2009 goals at the Mattabasset District	$706,000	$16,550,000
	ANNUAL SUBTOTAL	$826,000	$1,934,000
	ANNUAL COST (includes meeting 2009 goals at Mattabassett)	$2,760,000	

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)			
		O&M	CAPITAL
4.	ADDITIONAL Share of Capital and O&M Costs to Meet 2014 goals at the Mattabasset District	$111,000	$6,675,000
	ANNUAL SUBTOTAL	$111,000	$582,000
	ANNUAL COST (includes meeting 2014 goals at Mattabassett)	$693,000	

TOTAL ANNUAL COST	$3,453,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Middletown (POTW)

PRELIMINARY COSTS

for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (meeting 2009 goals)			
		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$2,900,000	$6,140,000
	ANNUAL SUBTOTAL	$2,900,000	$535,000
	ANNUAL COST (to meet 2009 goals)	$3,435,000	

ADDITIONAL COSTS (to upgrade Facility to meet 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$150,000	$7,870,000
	ANNUAL SUBTOTAL	$150,000	$686,000
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$836,000	

TOTAL ANNUAL COST	$4,271,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Plainville

PRELIMINARY COSTS

for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSET (meeting 2009 goals)			
		O&M	CAPITAL
1.	Regional Pump Station Capital and O&M and STP demolition/site restoration	$240,000	$1,875,000
2.	Force Main Capital Costs	-	$6,225,000
3.	Share of Capital and O&M Costs to meet 2009 goals at the Mattabasset District	$313,000	$5,580,000
	ANNUAL SUBTOTAL	$553,000	$1,193,000
	ANNUAL COST (includes meeting 2009 goals at Mattabassett)	$1,746,000	

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)			
		O&M	CAPITAL
4.	ADDITIONAL Share of Capital and O&M Costs to Meet 2014 goals at the Mattabasset District	$49,000	$2,546,000
	ANNUAL SUBTOTAL	$49,000	$222,000
	ANNUAL COST (includes meeting 2014 goals at Mattabassett)	$271,000	

TOTAL ANNUAL COST	$2,017,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Plainville
PRELIMINARY COSTS
for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (meeting 2009 goals)			
		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$1,870,000	$6,400,000
	ANNUAL SUBTOTAL	$1,870,000	$558,000
	ANNUAL COST (to meet 2009 goals)	$2,428,000	

ADDITIONAL COSTS (to upgrade Facility to meet 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$90,000	$6,480,000
	ANNUAL SUBTOTAL	$90,000	$565,000
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$655,000	

TOTAL ANNUAL COST	$3,083,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Portland
PRELIMINARY COSTS
for INTER-MUNICIPAL ALTERNATIVE

COSTS TO SEWER AT MATTABASSET (meeting 2009 goals)			
		O&M	CAPITAL
1.	Regional Pump Station Capital and O&M and STP demolition/site restoration	$20,000	$3,600,000
2.	Force Main Capital Costs	-	$0
3.	Share of Capital and O&M Costs to meet 2009 goals at the Mattabasset District	$101,000	$1,890,000
	ANNUAL SUBTOTAL	$121,000	$479,000
	ANNUAL COST (includes meeting 2009 goals at Mattabassett)	$600,000	

ADDITIONAL COSTS (associated with Mattabassett meeting 2014 goals)			
		O&M	CAPITAL
4.	ADDITIONAL Share of Capital and O&M Costs to Meet 2014 goals at the Mattabasset District	$16,000	$803,000
	ANNUAL SUBTOTAL	$16,000	$70,000
	ANNUAL COST (includes meeting 2014 goals at Mattabassett)	$86,000	

TOTAL ANNUAL COST	$686,000

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Portland
PRELIMINARY COSTS
for LOCAL ALTERNATIVE

COSTS TO UPGRADE LOCAL FACILITY (meeting 2009 goals)			
		O&M	CAPITAL
1.	Local Treatment Plant Capital and O&M Costs to Meet 2009 Goals	$217,500	$5,090,000
	ANNUAL SUBTOTAL	$217,500	$444,000
	ANNUAL COST (to meet 2009 goals)	$661,500	

ADDITIONAL COSTS (to upgrade Facility to meet 2014 goals)			
		O&M	CAPITAL
2.	ADDITIONAL Local Treatment Plant Capital and O&M Costs to Meet 2014 goals	$0	$0
	ANNUAL SUBTOTAL	$0	$0
	ADDITIONAL ANNUAL COST (to meet 2014 goals)	$0	

TOTAL ANNUAL COST	$661,500

(1) Capital Recovery Factor (CRF) =.087 at 6% interest for 20 years

Appendices

Appendix A

MALCOLM PIRNIE

TECHNICAL MEMORANDUM

To: File 3395001 **Date:** 5/4/98

Copy: J. Lauria, WHI

From: Mark Barmasse, Robert Moore - HAR

Re: Plainville Diversion - Preliminary Assessment

An assessment of issues associated with the potential diversion of the Plainville WWTP effluent from the Pequabuck River to the Mattabassett District has been completed. This assessment is based on a review of the applicable regulatory requirements, conversations with several of the parties potentially impacted by a diversion, discussions with CTDEP staff from the various units involved in diversion permit reviews and a review of the CTDEP Pequabuck River Water Quality Analysis Report (6/83) and water quality model results (6/83 report and recent rerun without Plainville). A summary of the findings of this assessment follows.

<u>Background</u>

Plainville currently discharges approximately 1.8 million gallons per day (mgd) of treated sewage through its advanced waste treatment water pollution control facility to the Pequabuck River in Plainville. (see attached location map) The town discharges this sewage in accordance with its waste load allocation, issued 6/83 and incorporated into its NPDES effluent limits. The discharge point is approximately 3 miles south of the confluence of the Pequabuck River with the Farmington River.

The Pequabuck River flows east from Plymouth through Bristol and North through Plainville into Farmington where it joins the Farmington River at Shade Swamp. The river receives wastewater from advanced treatment facilities in Plymouth and Bristol, upstream of the discharge from Plainville. The 7Q10 low flow in the river without wastewater treatment discharges is 13.6 cubic feet per second (cfs) or 8.8 mgd. At the point of the Plainville discharge, the total flow used in the CTDEP water quality model is approximately 28.4 cfs (18.4 mgd) including the Plainville design flow of 5.9 cfs (3.8 mgd). The River is Classified as Class B under the CT Water Quality Standards and a water quality model of the river has been developed to adopt waste load allocations for the three municipal sewage discharges. This report, dated June 1983, dictated the level of treatment required to achieve water quality standards and maintain a minimum dissolved oxygen (DO) level in the river of 5.0 mg/l. The critical reach of the river relative to DO is at Shade Swamp near the confluence with the Farmington River, which is downstream of the Plainville discharge. This modeling was based on Plainville permitted discharge capacity of 4.0 mgd at the 7Q10 flow.

The Farmington River is a highly valued water resource providing for multiple river uses throughout is length and watershed from water supply reservoirs and well fields to hydropower, anadramous fish spawning, swimming, fishing and recreational boating, to waste water assimilation. A segment of the West Branch of the Farmington River has been the improvements in water quality from the diversion may be offset by CTDEP concerns regarding baseflows in the river and other potential environmental impacts.

- Environmental/Fisheries Issues - The reduction in flow in the Pequabuck may alter the fisheries and other habitat by reducing flow rates, river depths and wetted river channel perimeter. River bank and river cover may be altered during low flow periods. Anadramous fish spawning may be impacted. While not expected to be significant, the impact on river flood elevations would also have to be reviewed. All of these issues must be evaluated in detail as part of detailed hydrologic and environmental studies that must be submitted with a diversion permit application.

- Hydropower Issues - The Stanley Works operates a hydropower generation station at the Rainbow Dam on the Farmington River, which is downstream of the confluence of its confluence with the Pequabuck. The reduction of flow in the Farmington River may have a slight impact on its generation capacity. Based on discussions with the MDC, it is unlikely that the Plainville diversion will impact the riparian release agreement between the MDC and The Stanley Works. This agreement calls for the MDC to release specified quantities of water from its upstream dams during certain periods of the year, not to maintain specified minimum flows in the river. Consequently, it unlikely that the MDC would oppose the diversion based on hydropower issues. It is uncertain if the reduction in flow would be significant enough to be a concern at the Rainbow Dam.

- Farmington River Issues - The Pequabuck River enters the Farmington River below the Wild and Scenic river segment. The gradient of the Farmington down stream of the Pequabuck is flatter and the pool elevation is regulated. Consequently, the reduction in flow from a diversion will likely only have minimal impact on habitat and fisheries in the Farmington segment. However, the flow reduction may have an impact on high flow release quantities to meet fish spawning spring flow requirements. The Farmington River Wild and Scenic (FRWS) Coordinating Committee will need to assess this impact. It is possible that the MDC, which is responsible for releasing water from its dams to meet these spring flow requirements, may also be concerned on this issue.

The Diversion Permit

The need for a diversion permit as established by Sections 22a-365 through 22a-380 of the CT General Statutes, is as follows :

- Pequabuck River Watershed Association
- The CTDEP.
- Middletown and the Mattabassett District Commission.
- A variety of recreational boaters associations.
- A variety of Anglers associations.
- Other Environmental and Conservation organizations
- The Corps of Engineers
- The Department of Public Health and Addiction Service
- The Stanley Works.

Summary of Findings

Based on our evaluations, discussions with the CTDEP and the information currently available, there does not appear a major technical issue that would preclude the CTDEP from issuing a diversion permit to the Town of Plainville. The actual feasibility of obtaining the permit would be dependant on the results of the detailed hydrologic and environmental studies needed to support the permit application and the results of the public hearing process. A summary of the issues impacting the feasibility of obtaining a diversion permit for the Plainville discharge are as follows:

- Based on the preliminary CTDEP water quality model runs, diversion of the Plainville discharge will not have a detrimental impact on pollutant concentrations or DO levels in the Pequabuck River. A slight increase in water quality, particularly for copper and zinc concentrations, would probably be realized.

- Reductions in the base river flow of the Pequabuck are a CTDEP concern relative to impacts on fisheries and other habitats in the Scotts Swamp reach of the Pequabuck River.

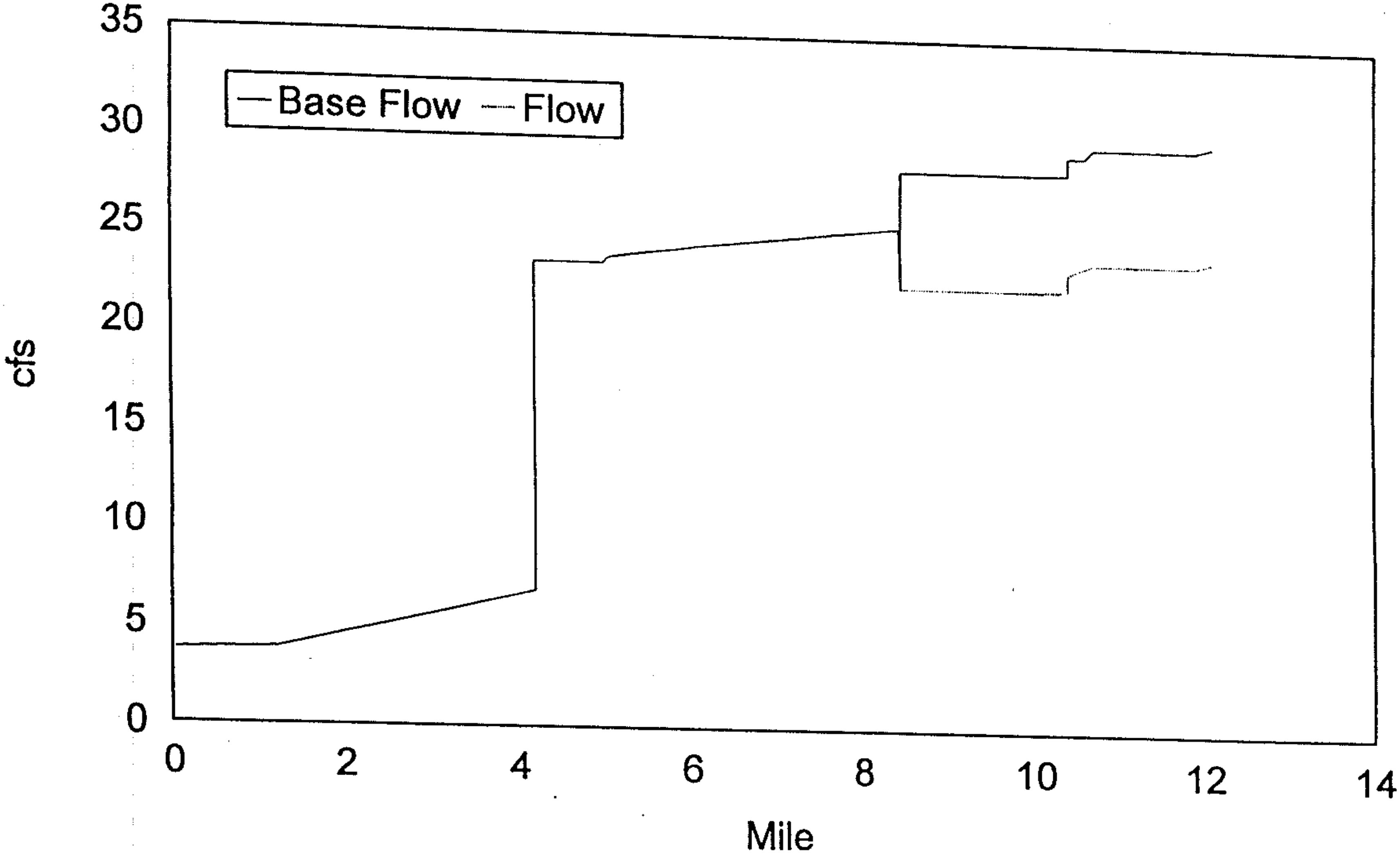
- With the possible exception of spring spawning water release requirements, impacts on the Farmington River relative to water quality and fisheries/habitat will likely not be significant since Farmington River water elevations downstream of its confluence with the Pequabuck will not be significantly altered by the diversion.

- The riparian rights agreements between the MDC and the Stanley Works for hydropower generation at the Rainbow Dam would not be impacted by the diversion. While the impact would be relatively small, it is uncertain if the reduction in flows from a diversion would be significant enough to be a concern at the Rainbow Dam.

- While an exemption for NPDES permitted discharges is allowed under the regulations, the diversion will most likely be subject to a diversion permit application

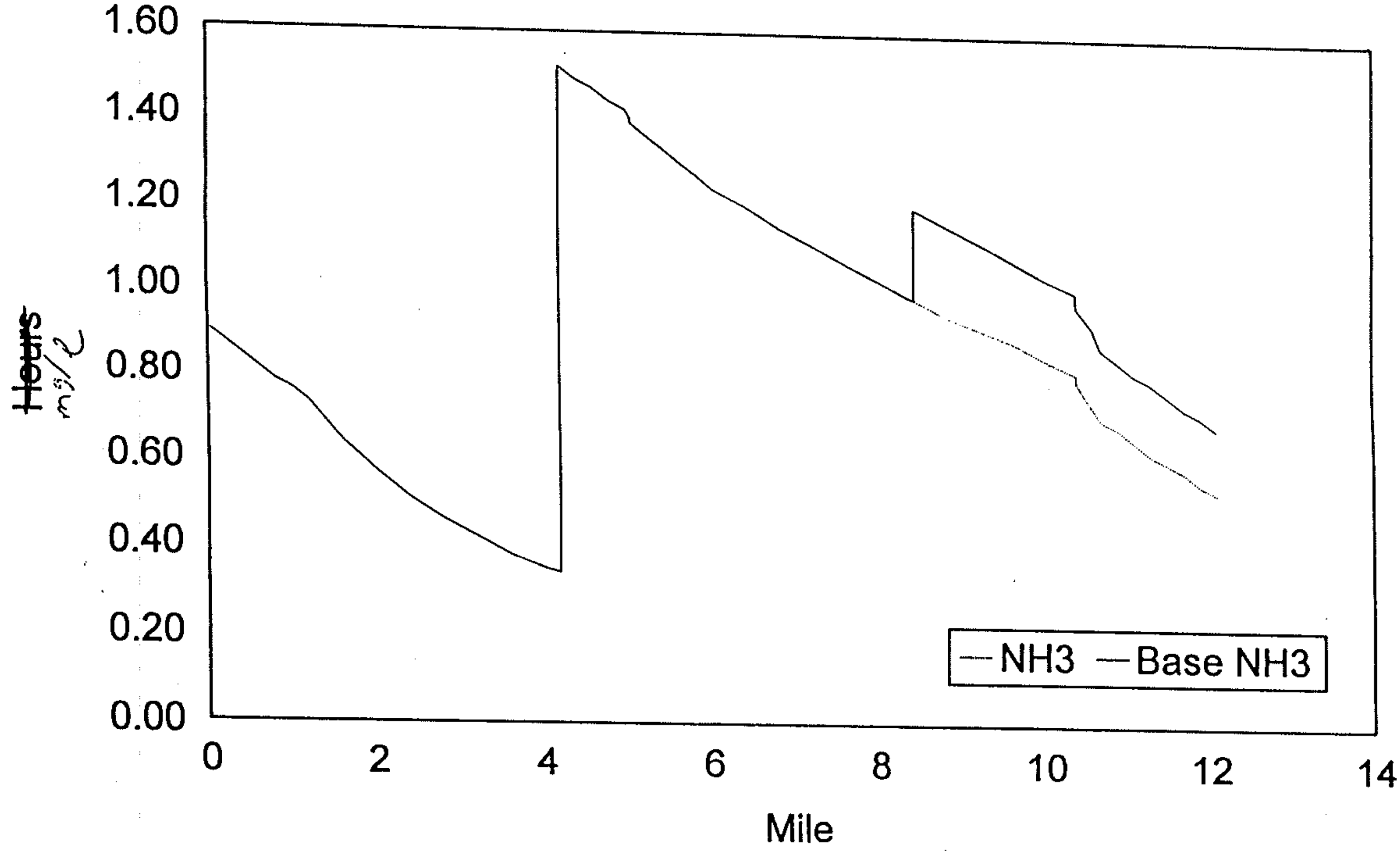
Pequabuck River

Effect of Plainville Removal



Pequabuck River

Effect of Plainville Removal



Appendix B

MALCOLM PIRNIE

INTEROFFICE CORRESPONDENCE

To: Chris Pierce, HAR **Date:** May 19, 1998

Copy: Mark Barmasse, HAR; Hagop Shahabian, WHI

From: Gregory J. Daviero, WHI

Re: Mattabassett Conceptual Hydraulic Profile

We have conducted a preliminary analysis of the hydraulics for the Mattabassett District Water Pollution Control Plant. Using MPI's in-house PROFILE computer model we have developed a conceptual hydraulic profile illustrating the proposed Regional Alternative peak and average flow conditions. These two profiles were developed to determine the possible range of conditions based on a series of conceptual plant modifications along with the best available information for the existing structures. The peak flow profile was developed to present the worst-case conditions with one aeration basin and one secondary clarifier out of service and uses peak hour flows and a river elevation of 20.0 feet (5-yr. storm event). The average scenario represents the best-case hydraulic profile with average flow, a river elevation of 4.0 feet, and all treatment units in service. The hydraulic profile showing both peak hour and average flow conditions is presented in Figures 1 and 2. A site plan which illustrates the conceptual modifications to the plant used in developing the hydraulic profile is presented in Figure 3. Table 1 summarizes the flows and operating units for each profile.

Table 1
Basis for Hydraulic Profile
Based on Regional Alternative Flow Projections

Flow Description	Plant Flow (mgd)	RAS Flow (mgd)	Process Units (Number of Units Operating/Total Number Available)						CT River El. (ft)
			Detritor	Comminutors	Primary Clarifiers	Aeration Tanks	Secondary Clarifiers	Chlorine Contact Tanks	
Peak Hour	120	60	2/2	6/6	4/4	9/10	7/8	1/1	20.00
Average	35	21	2/2	6/6	4/4	10/10	8/8	1/1	4.00

More detailed analysis of the plant hydraulics will be required as part of the preliminary and detailed design process.

It is estimated that the Regional Alternative peak hour flow is the maximum flow that can be hydraulically passed through the existing primary clarifiers. The hydraulic capacity of the existing secondary facilities (aeration tanks, secondary clarifiers, and the associated piping) is considerably less, estimated at only 65 mgd assuming a return sludge flow of 30 mgd. In order to provide secondary treatment at the regional peak hour flowrate of 120 mgd, process modulating chambers with a new CCT, and installing a new secondary effluent junction box. Significant pipe friction and minor losses result from discharging the peak hour flow through the piping connecting these structures. Three alternatives were considered.

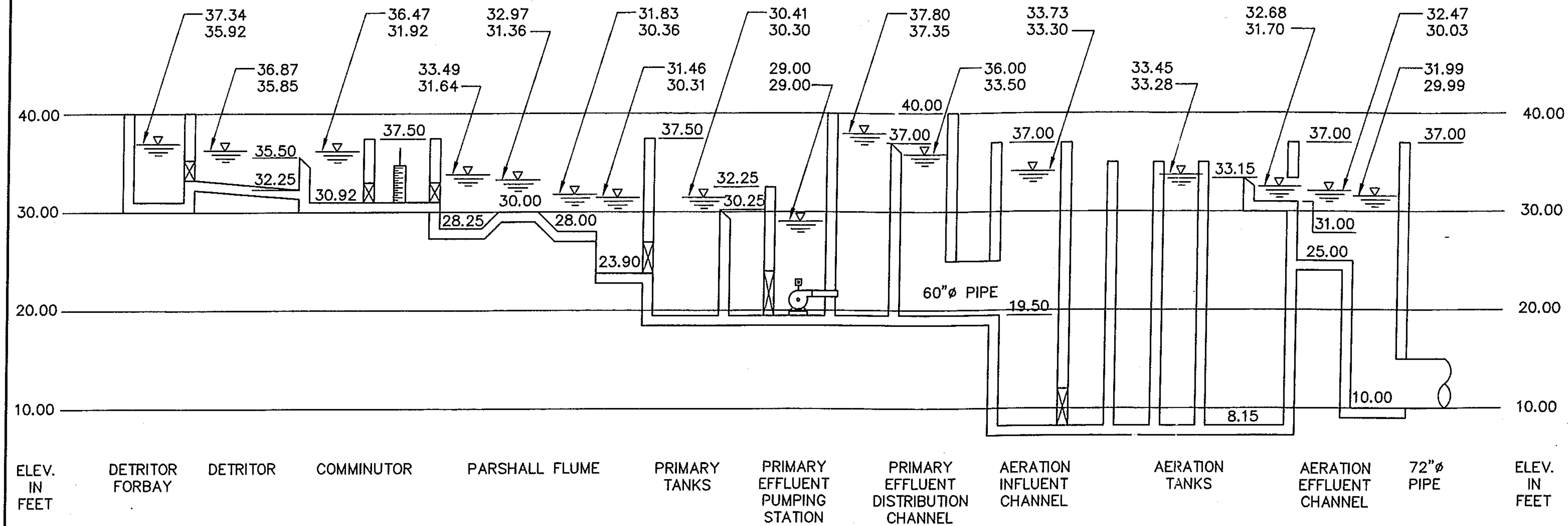
1. Installing a second 72" secondary effluent pipe parallel to the existing 72" effluent pipe. This second pipe would only operate during peak hour conditions. Submergence of the weirs at the final clarifiers and the aeration effluent distribution box would result at peak hour conditions. The final clarifier weirs would submerge 1.44 ft (1.21 ft below top of wall) and the aeration effluent distribution weirs would submerge 0.50 ft (2.03 ft below top of wall).

2. In addition to (1) above, replace the existing 60" outfall extension with a new 84" outfall extension. No weir submergences would result from peak hour flows with this piping configuration. This is the alternative presented on the hydraulic profile.

3. In addition to (1) above, install a secondary effluent pumping station with denitrification filters downstream of the final clarifiers. This pumping station would provide enough energy to push the peak hour flow through the existing 60" outfall extension.

- New Secondary Clarifiers - Four new secondary clarifiers would be constructed to the south of the existing secondary clarifiers. For the hydraulic computations it was assumed the four new clarifiers were mirror images of the existing secondary clarifiers (no significant changes to the hydraulic profile are anticipated if the site requires that the new clarifiers be laid out as two sets of two rather than one set of four). A new 72" secondary influent pipe would connect the new secondary clarifiers with the new aeration effluent distribution channel.

- Aeration Effluent Distribution Channel - A new aeration effluent distribution channel would need to be constructed to receive flow from both the six new aeration tanks and the four existing aeration tanks. This channel would properly distribute the aeration effluent to the eight secondary clarifiers. The 25' x 85' structure would need to be constructed due west of the existing secondary clarifiers. The invert of the channel is assumed to be at elevation 9.00 and 8, 15' weirs are set at elevation 29.5. The top of wall is set at elevation 32.50. Two 72" influent pipes would connect the aeration tanks to the aeration effluent distribution channel, one pipe would service the six new aeration tanks and one pipe would service the existing four aeration tanks.



BASIS FOR HYDRAULIC PROFILE									
FLOW DESCRIPTION	PLANT FLOW (mgd)	RAS FLOW (mgd)	PROCESS UNITS (NUMBER OF UNITS OPERATING/TOTAL NUMBER AVAILABLE)						CONNECTICUT RIVER ELEVATION (ft.)
			DETRITORS	COMMINUTORS	PRIMARY TANKS	AERATION TANKS	FINAL TANKS	CHLORINE CONTACT TANKS	
PEAK HOUR	120	60	2/2	6/6	3/4	9/10	7/8	1/1	20.00 (SEE NOTE 3)
AVERAGE	35	21	2/2	6/6	4/4	10/10	8/8	1/1	4.00

NOTES:

1. HYDRAULIC GRADE LINE ELEVATIONS:
   . PEAK HOUR CONDITIONS
   . AVERAGE CONDITIONS
2. SECOND 72"ø PIPE ONLY OPERATES DURING PEAK HOUR CONDITIONS.
3. CONNECTICUT RIVER ELEVATION 20.00 CORRESPONDS TO A 5-YR. STORM EVENT.

W: TECH\3395001\DRAWINGS\FIGURE1 Scale: 1:1 Date: 05/29/1998

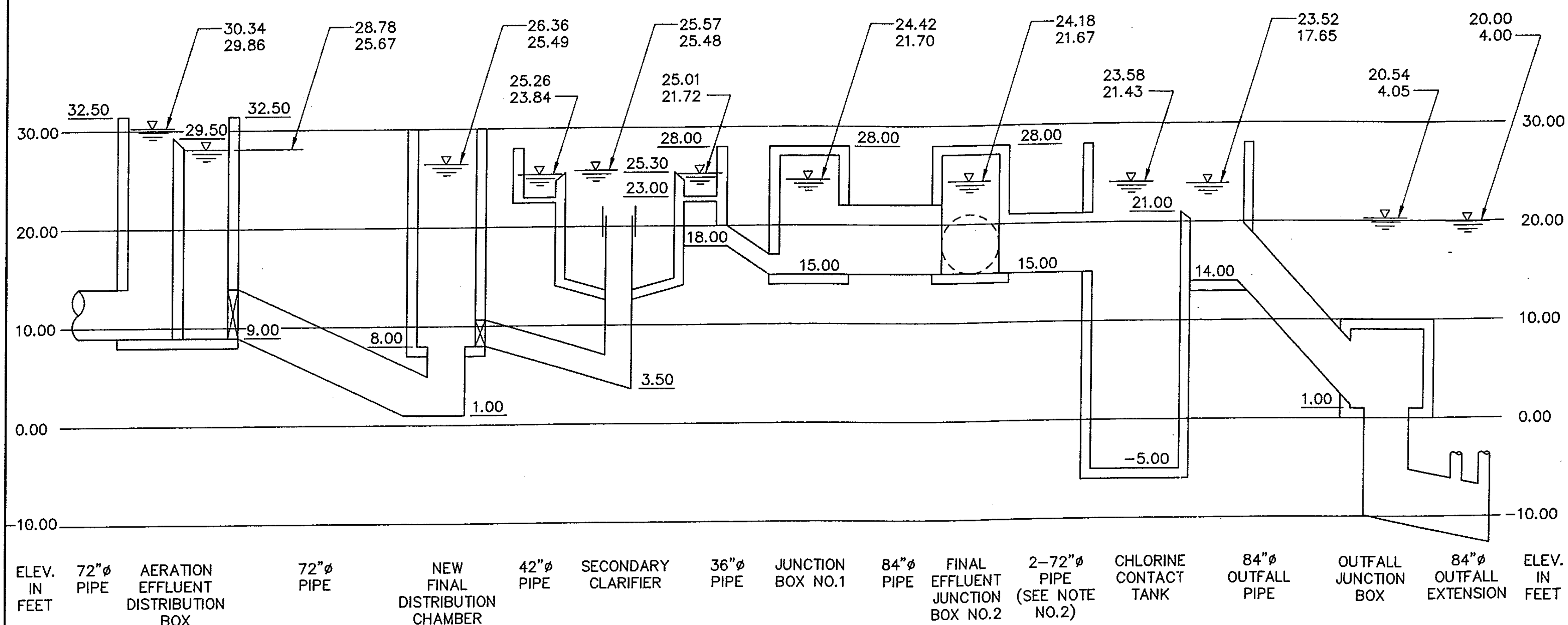
MALCOLM PIRNIE

THE CITY OF MIDDLETOWN
MIDDLETOWN, CONNECTICUT

MATTABASSETT INTER-MUNICIPAL STUDY – CONCEPTUAL HYDRAULIC PROFILE

MALCOLM PIRNIE, INC.

FIGURE 1



BASIS FOR HYDRAULIC PROFILE									
FLOW DESCRIPTION	PLANT FLOW (mgd)	RAS FLOW (mgd)	PROCESS UNITS (NUMBER OF UNITS OPERATING/TOTAL NUMBER AVAILABLE)						CONNECTICUT RIVER ELEVATION (ft.)
			DETRITORS	COMMINUTORS	PRIMARY TANKS	AERATION TANKS	FINAL TANKS	CHLORINE CONTACT TANKS	
PEAK HOUR	120	60	2/2	6/6	3/4	9/10	7/8	1/1	20.00 (SEE NOTE 3)
AVERAGE	35	21	2/2	6/6	4/4	10/10	8/8	1/1	4.00

NOTES:

1. HYDRAULIC GRADE LINE ELEVATIONS:
   . PEAK HOUR CONDITIONS
   . AVERAGE CONDITIONS
2. SECOND 72"ø PIPE ONLY OPERATES DURING PEAK HOUR CONDITIONS.
3. CONNECTICUT RIVER ELEVATION 20.00 CORRESPONDS TO A 5-YR. STORM EVENT.

W: TECH\3395001\DRAWINGS\FIGURE2 Scale: 1:1 Date: 05/29/1998

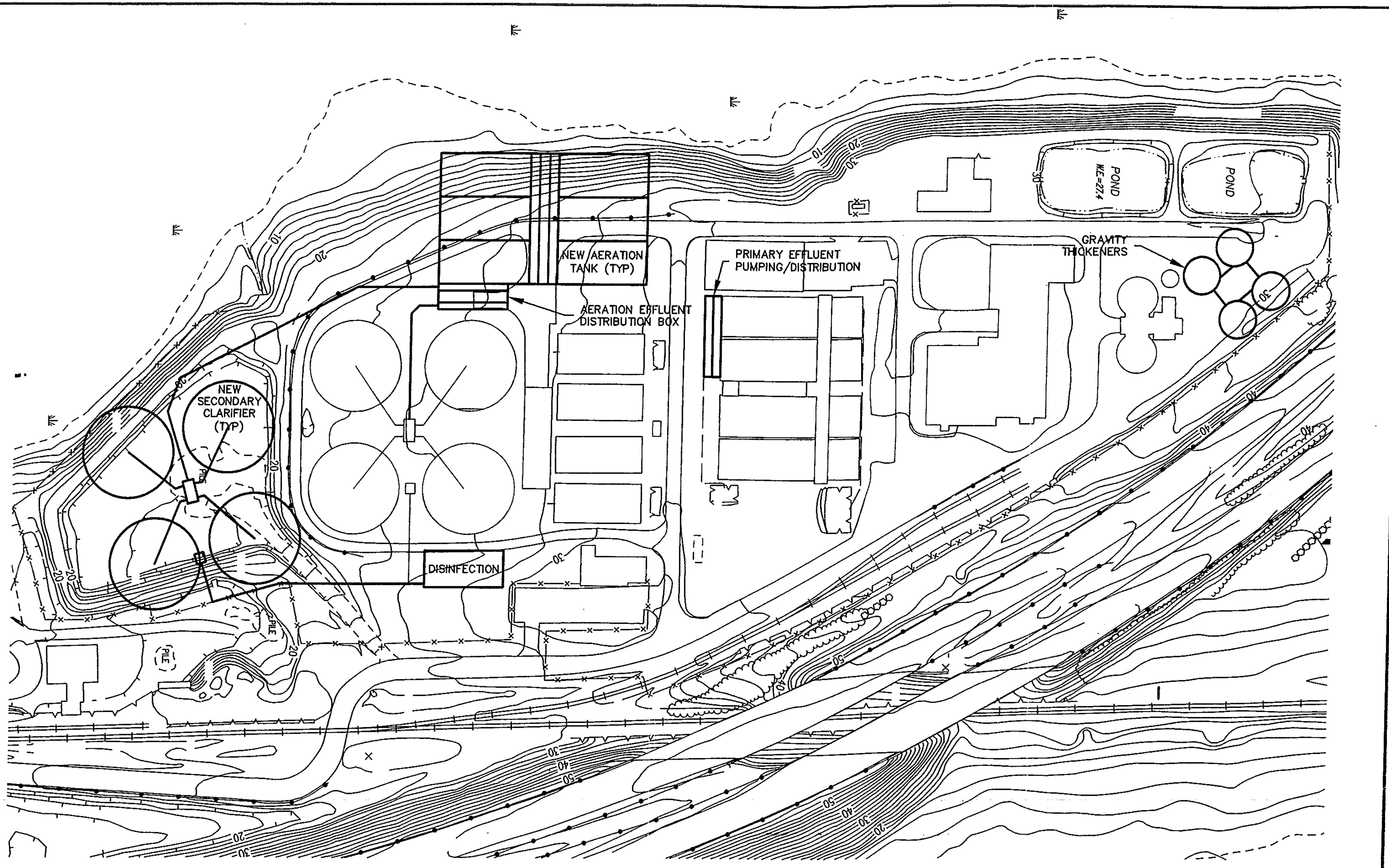
MALCOLM PIRNIE

THE CITY OF MIDDLETOWN
MIDDLETOWN, CONNECTICUT

MATTABASSETT INTER-MUNICIPAL STUDY – CONCEPTUAL HYDRAULIC PROFILE

MALCOLM PIRNIE, INC.

FIGURE 2



W:TECH\3395001\Drawings\FIGURE3 Scale: 1:1i Date: 05/29/1998

MALCOLM PIRNIE

THE CITY OF MIDDLETOWN
MIDDLETOWN, CONNECTICUT

MATTABASSETT INTER-MUNICIPAL STUDY – CONCEPTUAL PLANT LAYOUT

MALCOLM PIRNIE, INC.

FIGURE 3

Appendix C

MALCOLM PIRNIE

INTEROFFICE CORRESPONDENCE

To: Chris Pierce (HAR) **Date:** June 1, 1998

Copy: Joe Husband (WHI), Mark Barmasse (HAR)

From: Sana Barakat, WHI

Re: Mattabasett Local & Regional Alternatives Process Design

1. PURPOSE

This memo presents and discusses the basis of our process design recommendations for the expansion and upgrade of the Mattabasett District Water Pollution Control Facility (WPCF). A summary of all process design criteria at the current and future flow conditions is presented in the attached Table 1.

We based our design on two future scenarios. The first scenario assumes expansion within the existing service areas while the second scenario assumes regionalization in which additional wastewaters from neighboring municipalities would be incorporated at the existing facility.

2. INFLUENT WASTEWATER CHARACTERISTICS & FLOWS

Flow projections for each scenario are presented in Table 2. These flows were determined and provided by Maguire Group of CT, Inc., the project's contractor.

Projected flows in Table 2 are presented for the design year 2000 assuming no sewer rehabilitation and are equivalent to projected flows for the design year 2020 with sewer rehabilitation.

Table 2

Condition	Average Day (mgd)	Sustained wet Weather (mgd)	Peak Hour (mgd)
Local Expansion	25	30	90(76)*
Regionalization	35	40	120

*90 MGD represents the peak hour for year 2000 without rehabilitation, and 76 MGD is based on design year 2020 with rehabilitation.

We analyzed three years of plant raw influent and secondary influent flow and wastewater quality data (January 1995 through September 1997) obtained from the WPCF's operating records. We developed 30-day, 7-day and 3-day moving averages of flows, TSS, BOD, and temperature. We also analyzed monthly averages of nitrogen data including Total Nitrogen (TN), TKN, $_{NH}$-N, NO_2 and NO_3 loads for the same time period.

Current influent and primary effluent wastewater characteristics based on the three year average loadings are presented in Table 3. We assumed future flows to have the same influent characteristics as existing flows at the District for both scenarios. Primary clarifier performance was assumed to remain unchanged in the future as well.

Table 3
Raw and Secondary Influent Wastewater Characteristics
Existing and Future Conditions

Parameter	Raw Wastewater Concentration (mg/l)	Secondary Influent Concentration (mg/l)
TSS	170	75
BOD	131	107
TN	20	22*
NH_3-N	10	15*
TKN	18	22*
NO_3+NO_2	1.6	0.4

* these values are higher due to the effects of the plant recycle stream.

3. EXISTING FACILITY

The existing secondary facility is a complete-mix activated sludge system. It performs well and treats an average flow of 18 MGD, with a reported maximum month flow of 29 MGD, to an average effluent TSS and BOD quality of 12 mg/l.

Currently during wet weather events, secondary treatment and chlorination is provided to a maximum of 40 MGD with flows in excess of 40 MGD receiving primary treatment.

The facility usually operates three of its four 0.92 MG aeration tanks at an SRT of 3.4 days and an average MLSS of 2,200 mg/l. Solids production currently averages 1 lb TSS/ lb BOD removed. Waste Activated Sludge (WAS) is returned to the head of the primary clarifiers and mixed with primary influent.

4.0 REGULATORY ISSUES

Three specific regulatory issues need to be addressed by the Mattabassett District WPCF as part of their upcoming NPDES permit renewal, which will influence WPCF upgrade needs in association with any inter-municipal sewage treatment. These issues include:

- Nitrogen Reduction
- Peak Flow Management
- Chlorine Contact Time/Dechlorination

Each of these issues will need to be addressed whether or not additional municipalities are connected to the Mattabassett District. A discussion of each of these issues is presented below.

4.1 Nitrogen Reduction

The Comprehensive Conservation and Management Plan (CCMP) for the Long Island Sound Study (LISS) calls for the overall reduction in total nitrogen (TN) discharges to Long Island Sound by 58.5 percent from both point and non-point sources from 1990 base load levels by 2014. While the contribution of non-point sources is quantifiable based on empirical data, accurate and enforceable control strategies are not currently available. Therefore the watershed reduction will be primarily met by actual reductions in point sources to achieve the overall 58.5 percent target. The Connecticut Department of Environmental Protection (DEP) has projected that a reduction in all point sources of approximately 70 percent TN will achieve this goal without any significant reduction in non-point sources. The policy committee of the LISS has set targets of 40 percent of the 58.5 percent goal by 2004, 75 percent of the goal by 2009, and the full 58.5 percent by 2014. To meet these interim targets by reducing TN discharges from point sources only would require a state-wide reduction in TN of 27.5 percent (40 percent of the 70 percent TN reduction goal) by 2004, a reduction in TN of 51.5 percent (75 percent of the approximately 70 percent reduction goal) by 2009, and a reduction of 68.5 percent (100 percent of the goal) by 2014. Nitrogen Baseload

The current 1990 baseload for the Mattabassett District WPCF is 2,350 pounds nitrogen/day. To validate this baseload value, the nitrogen data from 1989 through 1997 was reviewed. In 1990, the effluent nitrogen data does not include organic nitrogen. This was the only year when TKN data was not reported. Instead, only effluent ammonia was reported in 1990. To develop an estimate of the likely 1990 organic nitrogen loading in the plant effluent, the difference between TKN and ammonia in 1989 and in the time period of 1991 through 1997 was compared as shown in Table 4.

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Table 5
Nitrogen Baseload Values and Required Effluent Total Nitrogen (TN) Concentrations

Plant	1990 DEP TN Baseload, lb/day	Local Alternative TN at 25 mgd, mg/L		Inter-municipal Alternative TN at 35 mgd, mg/L	
		2009 Target	2014 Target	2009 Target	2014 Target
Mattabassett District	3,000	7.0	4.5		
- Middletown - Plainville - Portland	334 305 126				
Total	3765			6.3	4.1

4.2 Peak Flow Management

As described above, the Mattabassett WPCF is currently designed to provide secondary treatment for flows up to 40 mgd. Flows in excess of 40 mgd overflow a weir in the primary effluent channel and are blended with chlorinated secondary effluent prior to discharge. Based on discussions with the Connecticut Department of Environmental Protection (CTDEP), because the Mattabassett District is not a CSO community, bypassing can not incorporated into the WPCF's discharge permit. Therefore, as part of both the local and inter-municipal alternatives, the WPCF will have to be upgraded to provide secondary treatment for the peak hour flow rate. While the required aeration tank volume to provide BOD_5 removal and nitrogen reduction is based on average flow rates, the number of clarifiers, the chlorine contact tank volume, and the size of piping in the upgraded secondary facilities will be dependent on the peak hour flow rate.

4.3 Chlorine Contact Time/Dechlorination

The Mattabassett District NPDES permit requires and effluent chlorine residual of between 0.2 and 1.5 mg/L between May 1 and September 31. Based on discussions with the DEP, the Mattabassett District WPCF's permit will likely include a maximum total residual chlorine concentration of 0.2 to 0.5 mg/L when it is renewed. In addition, a chlorine contact time of 15 minutes must be provided at the peak hour flow rate. These requirements will require the addition of a chlorine contact tank as well as dechlorination facilities to the WPCF. As an alternative, the use of UV disinfection could also be considered.

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We reviewed the hydraulic and solids loading on the final clarifiers based on the following assumptions.

- Future clarifiers would have the same surface area with rapid sludge return mechanisms
- The average RAS recycle rate would be 50% of the primary effluent flow
- The underflow concentration from the final clarifier would be 7,000 mg/l..
- The hydraulic loading rates of 800 gpd/sf at average flow and 1,200 gpd/sf would be reasonable for secondary treatment with good settling sludge (SVI 150 or less),.
- The maximum design solids loading rate with all clarifiers in-service would be 35 to 40 lbs./d/sf during peak hydraulic conditions.

Based on the above assumptions, we evaluated the number of clarifiers needed for each scenario.

6.0 EVALUATION OF ALTERNATIVES

We evaluated two treatment alternatives: secondary treatment only (BOD removal), and advanced treatment or biological nutrient removal (BNR). Both alternatives for the local expansion and regionalization are discussed below.

6.1 Secondary Treatment (BOD removal)

Local and Regional Expansion

We evaluated the capacity of the existing aeration tanks and secondary clarifiers to achieve secondary limits at the future flows. Since the existing facility operates well at the current SRT and detention time, we based our design on this demonstrated performance.

The four 0.92 MG aeration tanks will be sufficient to operate the facility at 25 MGD and provide adequate secondary treatment. At 35 MGD flow, 1 more aeration tank is required in order to maintain the same SRT and detention time as in the current operations. The facility would be operating in a complete-mix mode as in current operations.

For the purpose of this evaluation, we assumed during wet weather events, as in current operations, a maximum of 50 MGD and 70 MGD (by the same ratio of average design flow to maximum secondary flow) will be treated through secondary system and disinfected. Flows in excess of these will be bypassed. At these flows, additional secondary clarifiers will be required: 1 at 25 MGD and 3 at 35 MGD. This would result in a flow rate of 440 gpd/sf at average conditions for both flow alternatives. At peak flow conditions the overflow rate is approximately 1,000 gpd/sf for both flow alternatives.

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Among these five, Alternatives 1 & 2 were selected for use at the Mattabasett WPCF because they are most technically and economically feasible given the space limitations, and the TN removal goals set by the CTDEP.

Alternative 1 can achieve effluent TN concentrations of 6-8 mg/l (CTDEP year 2009 goal = 52% removal). Alternative 2 can achieve effluent TN concentrations of 3-4 mg/l (CTDEP year 2014 goal = 69% removal).

This section includes a description of each of the two process alternative selected, the BNR design criteria, and the recommended BNR process design for future flows.

6.2.3 BNR Processes Selected For Design

Alternative 1 (A&B) - Anoxic/Oxic (A/O)

The A/O process is an activated sludge system for nitrogen removal that combines carbonaceous BOD removal, ammonia oxidation and nitrate reduction within a single activated sludge system followed by sedimentation for separation of the biological sludge. Figure 1 presents the process flow diagram of two alternatives (1A and 1B) of the A/O process.

Alternative 1A

This alternative presents the general A/O process which includes an anoxic zone followed by an oxic (aerobic) zone. Nitrification occurs in the aerobic zone, while denitrification occurs in the anoxic zone where nitrates returned in the internal mixed liquor recycle (IMLR) and combine with the readily biodegradable soluble BOD of the primary effluent. The IMLR flow is typically between 100 and 200 percent of the influent flow.

Alternative 1B

Alternative 1B shows the A/O process using a modified four-pass step feed arrangement. In this system activated sludge from the final clarifier underflow (RAS) is returned to the first pass of the aeration tank where it is aerated. Primary effluent is split equally to the head of the remaining three passes. Each pass include an anoxic zone followed by an oxic zone. This is referred to as a contact stabilization and three pass step feed A/O process. As in the general A/O process, denitrification occurs in the anoxic zone and nitrification occurs in the oxic zone. By feeding primary effluent at the beginning of each pass, a readily available carbon source is available for the heterotrophic denitrifying bacteria.

Due to the fact that it can increase the SRT by approximately 40% over an equivalent sized conventional complete mix type A/O system, we selected the step-feed contact stabilization process for design.

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Due to the fact that it can increase the SRT by approximately 40% over an equivalent sized conventional complete mix type A/O system, we selected the step-feed contact stabilization process for design.

A final TN effluent of approximately 6-8 mg/L would be expected for a primary effluent containing approximately 20 mg/L of total nitrogen with Alternative 1.

Alternative 2- A/O Followed by Denitrification Filters

The process flow diagram for this alternative is shown in Figure 2. This alternative would utilize the A/O system for nitrification and denitrification, followed by an attached growth process for supplemental effluent denitrification. Due to the fact that partial nitrate removal will be achieved in the A/O process, this alternative requires less denitrification filters and less methanol thus reducing capital and maintenance costs.

There are two types of denitrification filters; the packed-bed filter and the fluidized bed system. We selected the proven conventional down flow packed-bed denitrification sand system for our evaluation and for planning purposes. In the packed-bed filter denitrifying microorganisms attach to the filter media and with a supplemental organic carbon source will denitrify the wastewater. In addition to nitrate removal, suspended solids removal can be achieved in some packed bed systems.

Recommended design criteria for sand media units are approximately 2 gpm/sf at average flow.

Following denitrification filters, post aeration will be required to raise the wastewater dissolved oxygen from zero to permit levels.

A final TN effluent of approximately 3-4 mg/L would be expected for a primary effluent containing approximately 20 mg/L of total nitrogen with Alternative 2.

6.2.4 BNR Design Criteria

Nitrification

The rate of nitrification is affected by dissolved oxygen, pH, inhibitory compounds, and temperature.

Nitrification would be inhibited at low D.O. concentrations. The basis of design assumes dissolved oxygen concentrations in the nitrification tank to be maintained at 2.0 mg/l (at least) at all times.

pH has a significant effect on the rate of nitrification. Below a pH of 7, nitrification may drop significantly but will not be inhibitory. For this evaluation, we assumed that pH would be maintained at 7. In addition, some alkalinity would be recovered in the denitrification process, however because alkalinity data are not available, we assumed that enough alkalinity is present in the WPCF's wastewater to achieve nitrification.

A final TN effluent of approximately 6-8 mg/L would be expected for a primary effluent containing approximately 20 mg/L of total nitrogen with Alternative 1.

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The process flow diagram for this alternative is shown in Figure 2. This alternative would utilize the A/O system for nitrification and denitrification, followed by an attached growth process for supplemental effluent denitrification. Due to the fact that partial nitrate removal will be achieved in the A/O process, this alternative requires less denitrification filters and less methanol thus reducing capital and maintenance costs.

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It not expected that the WPCF would contain any inhibitory compounds, since it receives minimal industrial wastewaters.

The most important factor to consider when designing the BNR process is the lowest wastewater temperature. Cold temperature slows the nitrification process, thereby requiring larger aeration tankage. The nitrification rate drops in half when wastewater temperature drops from 20°C to 10°C. Accordingly, the Sludge Retention Time (SRT) must be increased for cold weather nitrification. SRT is defined as the mass in the biological reactor under aeration divided by the mass leaving the secondary system. Operation at lower SRT values causes the wash-out of the nitrifiers with the waste activated sludge, and nitrification would cease.

Table 6 below shows the SRT values at selected temperatures for complete nitrification. The table includes the theoretical oxic (aeration) SRT required to achieve effluent $_{NH}$-N concentrations of 2 mg/l. The design oxic SRT is then obtained by multiplying the theoretical SRT by a "safety factor" of 1.5. The "safety factor" accounts for the decrease in efficiency due to the diurnal ammonia fluctuation, need for redundancy (units out of service), influent loading variability and to provide for a necessary margin of error with the assumption of the kinetic coefficients when calculating the design SRT.

The anoxic zone volume for denitrification is typically 25% of the total activated sludge tank volume. Therefore, the total activated sludge reactor SRT is increased by a factor of 1.33.

Table 6
Design SRT versus Temperature

Temp (deg. C)	**Theoretical Oxic SRT (days)**	**Design Oxic SRT* (days)**	**Design Total SRT** (days)**
10	9.9	14.9	19.8
12	**8.0**	**12.0**	**16**
15	5.3	8.0	10.6
20	3.0	4.5	6.0

* Based on a safety factor = 1.5
** Total includes nitrification & denitrification

The minimum 3-day average temperature at the Mattabasett facility is 12 C. Therefore this is the critical temperature that we used in our design.

It not expected that the WPCF would contain any inhibitory compounds, since it receives minimal industrial wastewaters.

The most important factor to consider when designing the BNR process is the lowest wastewater temperature. Cold temperature slows the nitrification process, thereby requiring larger aeration tankage. The nitrification rate drops in half when wastewater temperature drops from 20°C to 10°C. Accordingly, the Sludge Retention Time (SRT) must be increased for cold weather nitrification. SRT is defined as the mass in the biological reactor under aeration divided by the mass leaving the secondary system. Operation at lower SRT values causes the wash-out of the nitrifiers with the waste activated sludge, and nitrification would cease.

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The minimum 3-day average temperature at the Mattabasett facility is 12 C. Therefore this is the critical temperature that we used in our design.

**Figure 3 - The Mattabassett District
Aeration Volume Required vs. AVERAGE MLSS
for Q = 25 mgd
Critical Temperature = 12 deg. C**

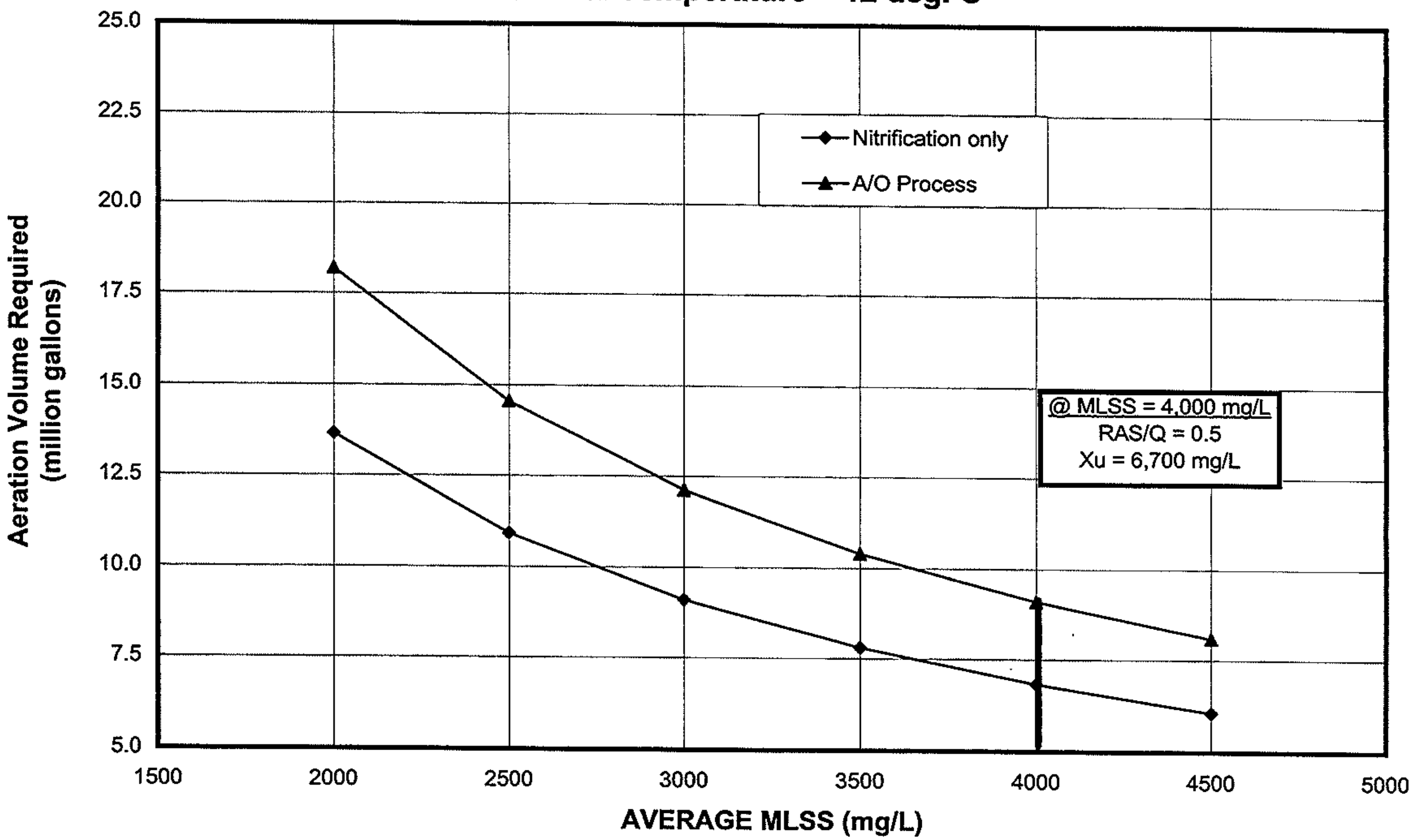
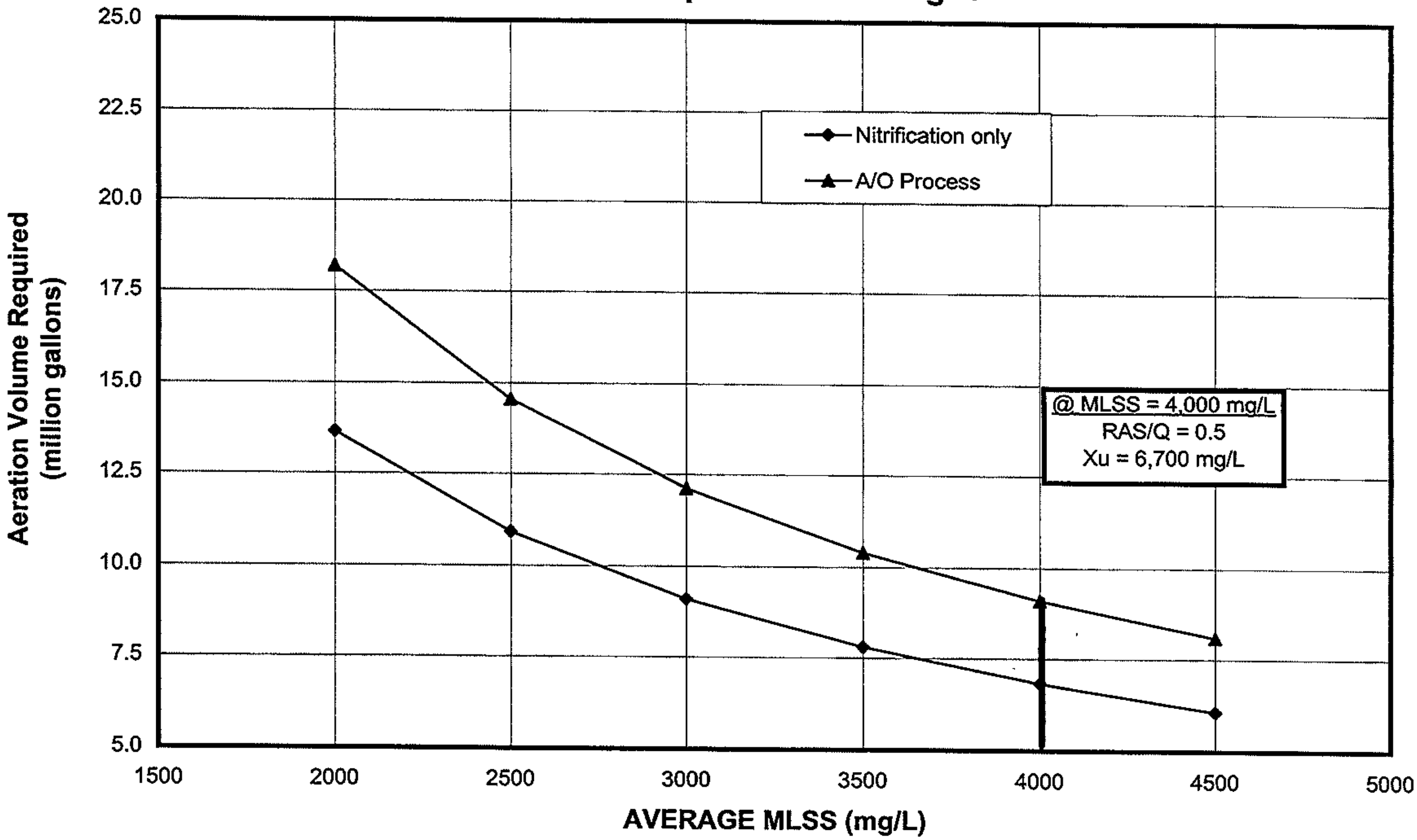


Figure 3 - The Mattabassett District
Aeration Volume Required vs. AVERAGE MLSS
for Q = 25 mgd
Critical Temperature = 12 deg. C



In the future, for the BNR evaluation, we assumed peak hourly flows will not be permitted to bypass secondary treatment. Therefore, additional secondary clarifiers are required to maintain reasonable solids loading rates and overflow rates during peak flow conditions. Future clarifiers would have the same surface area as current ones.

At average flows, the overflow rate is 400 gpd/sf which is similar to current operations. At peak flow, the overflow rate is 1,300 gpd/sf with all units in service. Although this value exceeds our acceptable design value of 1,200 gpd/f however we are limited given the space limitations on the site. The solids loading rate is approximately 40 lb/d/sf at peak flow conditions. It should be noted that the additional selectors in the aeration tanks will enhance the sludge settleability.

Additional chlorination and dechlorination systems will also be required to accommodate the increase in flows. Design criteria of 15 minutes and 45 seconds at peak flows were used in the design.

In summary the required modifications for the local and regional scenarios to meet 6-8 mg/l of effluent TN are:

Local Scenario:

- Raise the water surface in the existing tanks by 5 feet
- Modify the existing aeration tanks to be contact stabilization, 3-step feed process (with 30% primary effluent feed to each of the 3 passes)
- Install 4 additional aeration tanks to provide necessary aeration volume
- Install two additional secondary clarifiers
- Install chlorine/contact tank/dechlorination system

Regional Scenario:

- Raise the water surface in the existing tanks by 5 feet
- Modify the existing aeration tanks to be contact stabilization, 3-step feed process (with 30% primary effluent feed to each of the 3 passes)
- Install 6 additional aeration tanks to provide necessary aeration volume
- Install 4 additional secondary clarifiers
- Install chlorine/contact tank/dechlorination system

Effluent TN Removal of 3-4 mg/l

In order to achieve the 3-4 mg/l of TN, denitrification filters will have to be added to complete the denitrification process. Post-aeration tanks are also required following the denitrification filters to raise the denitrified effluent dissolved oxygen to meet permit limits.

In the future, for the BNR evaluation, we assumed peak hourly flows will not be permitted to bypass secondary treatment. Therefore, additional secondary clarifiers are required to maintain reasonable solids loading rates and overflow rates during peak flow conditions. Future clarifiers would have the same surface area as current ones.

At average flows, the overflow rate is 400 gpd/sf which is similar to current operations. At peak flow, the overflow rate is 1,300 gpd/sf with all units in service. Although this value exceeds our acceptable design value of 1,200 gpd/f however we are limited given the space limitations on the site. The solids loading rate is approximately 40 lb/d/sf at peak flow conditions. It should be noted that the additional selectors in the aeration tanks will enhance the sludge settleability.

Additional chlorination and dechlorination systems will also be required to accommodate the increase in flows. Design criteria of 15 minutes and 45 seconds at peak flows were used in the design.

In summary the required modifications for the local and regional scenarios to meet 6-8 mg/l of effluent TN are:

Local Scenario:

- Raise the water surface in the existing tanks by 5 feet
- Modify the existing aeration tanks to be contact stabilization, 3-step feed process (with 30% primary effluent feed to each of the 3 passes)
- Install 4 additional aeration tanks to provide necessary aeration volume
- Install two additional secondary clarifiers
- Install chlorine/contact tank/dechlorination system

Regional Scenario:

- Raise the water surface in the existing tanks by 5 feet
- Modify the existing aeration tanks to be contact stabilization, 3-step feed process (with 30% primary effluent feed to each of the 3 passes)
- Install 6 additional aeration tanks to provide necessary aeration volume
- Install 4 additional secondary clarifiers
- Install chlorine/contact tank/dechlorination system

Effluent TN Removal of 3-4 mg/l

In order to achieve the 3-4 mg/l of TN, denitrification filters will have to be added to complete the denitrification process. Post-aeration tanks are also required following the denitrification filters to raise the denitrified effluent dissolved oxygen to meet permit limits.

Table 1
HARTFORD WPCF
SUMMARY OF WET STREAM UNITS OPERATIONS
Basis of Design

	Existing(1)		BOD ONLY		A/O		A/O & Denitrification Filters	
AVERAGE FLOW, mgd	18		25	35	25	35	25	35
SUSTAINED WET WEATHER FLOW, mgd	29		30	40	30	40	30	40
MAX. FLOW THROUGH SECONDARY TREATMENT, mgd	40		50	70	90	120	90	120
PEAK HOUR FLOW, mgd	-		90	120	90	120	90	120
Proposed Effl. TN Conc.(mg/l)	-		-	-	6-8	6-8	3-4	3-4
AVERAGE PLANT INFLUENT								
TSS Load, lb/d	25,520		35,450	49,620	35,450	49,620	35,450	49,620
BOD Load, lb/d	19,670		27,310	38,240	27,310	38,240	27,310	38,240
TN Load, lb/d	3,000		4,170	5,840	4,170	5,840	4,170	5,840
NH3-N Load, lb/d	1,500		2,090	2,920	2,090	2,920	2,090	2,920
TKN Load, lb/d	2,700		3,750	5,250	3,750	5,250	3,750	5,250
PRIMARY CLARIFIERS	with WAS		with WAS	with WAS	w/o WAS	w/o WAS	w/o WAS	w/o WAS
Number of Units	4		4	4	4	4	4	4
Surface Area per unit (sf)	8,568		8,568	8,568	8,568	8,568	8,568	8,568
Total Surface Area (sf)	34,272		34,272	34,272	34,272	34,272	34,272	34,272
Surface Overflow Rate (gpd/sf)								
@ average Flow	525		729	1021	729	1021	729	1021
@ Peak Hour	-		2626	3501	2626	3501	2626	3501
Primary Sludge								
Flow, mgd	0.07		0.09	0.13	0.04	0.06	0.04	0.06
Concentration, mg/l	26,000		26,000	26,000	60,000	60,000	60,000	60,000
load, lb/d	14,261	(2)	19,813	27,728	19,813	27,728	19,813	27,728
	(2) Calculation does not incl.WAS recycle							
AERATION TANKS								
TSS Load, lb/d	11,259		15,638	21,893	15,638	21,893	15,638	21,893
BOD Load, lb/d	16,063		22,310	31,233	22,310	31,233	22,310	31,233
Process Type	C. Mix		C. Mix	C.Mix	Contact Stab. + 3-pass step feed	Contact Stab. + 3-pass step feed	Contact Stab. + 3-pass step feed	Contact Stab. + 3-pass step feed
Number of Tanks	4		4	5	8	10	8	10
Number of Passes/tank	-		3	3	4	4	4	4
Tank dimension								
length (ft)	115		115	115	115	115	115	115
Width (ft)	52.5		52.5	52.5	52.5	52.5	52.5	52.5
SWD (ft)	20.3		21.3	21.3	25	25	25	25
Volume per Tank (MG)	0.92		0.96	0.96	1.13	1.13	1.13	1.13
Actual Total Volume (MG)(4)	3.7		3.8	4.8	9.0	11.3	9.0	11.3
Required Volume for Process (MG) (5)	-		3.5	4.4	8.0	11.0	8.0	11.0
Hydraulic Detention time (hours)	3.7	(3)	3.7	3.3	8.7	7.7	8.7	7.7
	(3)based on 3 tanks in operation							
Return Sludge Rate (%)	50		50	50	50	50	50	60
MLSS (mg/L) average	2,240		2,240	2,240	4,000	4,000	4,000	4,000
last pass	-		-	-	2,230	2,230	2,230	2,230
Temp, C	12		12	12	12	12	12	12
SRT (days)	-							
Total	3.4	(3)	3.6	3.2	18	16	18	16
Oxic	3.4	(3)	3.6	3.2	14	12	14	12
SECONDARY CLARIFIERS								
Number of Units	4		5	7	6	8	6	8
Dimensions:								
Diameter (ft)	120		125	125	125	125	125	125
Surface Area each unit (sf)	11,310		11,310	11,310	11,310	11,310	11,310	11,310
Total Surface Area (sf)	45,240		56,550	79,170	67,860	90,480	67,860	90,480
Surface Overflow Rate (gpd/sf)								
@Average Flow	398		442	442	368	387	368	387
@ Max. Flow Through Secondary	884		884	884	1,326	1,326	1,326	1,326
Average solids Loading rate (lb/d/sf)	11		12	12	10	11	10	12
WAS conc. (mg/L)	8,000		8,000	8,000	8,000	8,000	8,000	8,000
WAS Flow (MGD)	0.21		0.30	0.42	0.22	0.31	0.22	0.31
Sec. Sludge (lb/d)	14,251		19,808	27,731	14,856	20,798	14,856	20,798
DENITRIFICATION FILTERS (Packed Bed)								
Total surface Area (sf)	-		-	-	-	-	8,681	12,153
HLR (gpm/sf) @ avg. flow	-		-	-	-	-	2	2
Methanol dosage (mg/l)	-		-	-	-	-	15 -30	15 -30
POST-AERATION								
Tank Volume (MG)	-		-	-	-	-	0.65	0.91
Detention Time (min)@ 2.5 x average flow	-		-	-	-	-	15	15
CHLORINATION								
Tank Volume (MG)	0.0136		0.52	0.73	0.94	1.25	0.94	1.25
Average Cl2 Dosage (mg/l)	4		4	4	4	4	4	4
Detention Time (min) @ Peak Flow	0.5		15	15	15	15	15	15
Detention Time (min) @ Peak Flow -with outfall pipe	20		31	26	24	21	24	21
DECHLORINATION								
Tank Volume (MG)			0.03	0.04	0.05	0.06	0.05	0.06
Average Sodium Bisulfite Dosage (mg/l)			3	3	3	3	3	3
Detention Time (min) @ Peak Flow	-		0.75	0.75	0.75	0.75	0.75	0.75

(1): Based on average of 1995, 1996 & 1997

(4) : Required volume for process design

(5): Actual volume is the volume required to account for internal walls, Hydraulic requirements, etc.

Assumptions: Secondary Effluent BOD= 12 mg/l
Yield = 0.75 lb TSS/lb BOD removed @ SRT = 12 days
Yield = 1.0 lb TSS/lb BOD removed @ SRT = 2-3 days