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THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. APPENDIX A. TECH--ETC(U)
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THE Codorus Creek WASTEWATER MANAGEMENT STUDY

AUGUST 1972

APPENDIX A – TECHNICAL STUDIES – VOLUME IV

APPENDIX A – TECHNICAL STUDIES – VOLUME IV

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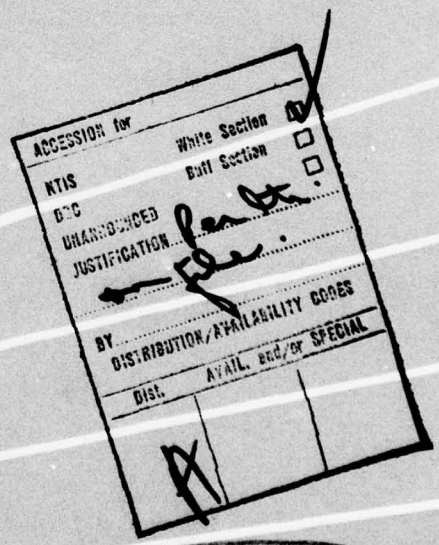
THE Codorus Creek WASTEWATER MANAGEMENT STUDY.

APPENDIX A, TECHNICAL STUDIES, VOLUME IV.



(11) Aug 72

(12) 266 p.

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VOLUME IV
CODORUS CREEK
WASTEWATER MANAGEMENT STUDIES

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INTRODUCTION

Analysis of wastewater management problems and solution opportunities in the Codorus Creek Study program has led to the formulation and analysis of a broad range of technology and design choices for area selection. The alternatives formulated have encompassed: (1) a range of specific solutions that have been generally advocated for the area; (2) a range of basic technology choices for achieving the high level of advanced treatment deemed ultimately required; (3) alternative levels of performance capability for initial improvements; and (4) a broad range of institutional management choices and limitations.

The alternatives formulation and technologic, policy and citizen review processes have led to the selection of a final group of choices for plan selection. This final group represents a refinement of the initial alternatives with respect to technical feasibility, design basis, facility elements and project costs.

This report presents each of these plans which constitute the finalized "Alternatives for Choice" applicable to the Codorus Creek Study Area.

The specific alternative plans proposed for final consideration encompass the following four basic action choices and related wastewater reuse opportunities:

1. Plan to Meet Current Standards - This plan represents a present trends choice with respect to the timing of facilities upgrading and the required area-wide institutional relationships. Proposed facilities aspects of this plan do, however, facilitate future incorporation of other process units for increased treatment performance.

2. All Water Treatment Plan - This plan provides for the development of sub-regionalized high level advanced waste treatment facilities to serve each of the development centers of the Study Area. The level of treatment performance would exceed that of the current standards plan. This plan would also require expansion of area-wide organization for facilities development and operation.

3. All Land Treatment Plan - This plan incorporates the use of land treatment to achieve high level advanced treatment performance for municipal wastewater flows occurring in the Study Area. Wastes from both the York urban area and each of the upper basin service areas would be land irrigated at selected sites after receiving secondary treatment by conventional facilities.

4. December Plan - This plan is a specific combination plan using components of the All Water and All Land Plans. The land treatment technology would be used for the upper basin communities whereas an advanced water process treatment plant would serve the York urban area.

5. Reuse Plans - The potential cost savings and facilities requirements associated with the reuse of secondary treated York urban area wastes at the P. H. Glatfelter paper mill are related to the selection of the specific municipal treatment plan.

Regional Study Area

The total area encompassed by each of the plan alternatives includes all of the Codorus Creek Basin and the adjacent urban and urbanizing areas that relate directly to the Basin. A total of sixteen (16) individual service areas are included as listed below:

York	Shrewsbury-New Freedom-Railroad
New Salem	Glen Rock
Springettsbury	Red Lion-Dallastown-Yoe
Dover Township	Winterstown
Hanover	Jacobus
Penn Township	Loganville
Spring Grove	Jefferson
P. H. Glatfelter Co.	Seven Valleys

Planning Period

The design planning period for all wastewater system alternatives is the year 2000. All transmission and interceptor pipelines are sized and costed for the flows projected for that design year. Treatment facilities for the larger installations are sized and costed as periodic shorter design period investments to meet year 1985 and 2000 flows. Treatment facilities for the smaller service areas and those projected to have negligible growth are sized for the year 2000 condition. A generalized plan to meet the projected needs through 2020 is presented but additional investments costs to that date are not evaluated.

Selection of different investment periods for transmission vs. treatment facilities is based on the fact that economies of scale are substantial for transmission and major interceptor pipelines. In comparison, economies of scale are substantially less for treatment facilities which are subject to obsolescence with new technology development and refinement. This is particularly relevant for the existing state of the art in advanced waste treatment.

Basis of Cost Comparison

The range of cost factors incorporated into the analysis of total cost for each of the alternative plans include the following items:

- estimated construction cost of required facilities
- land acquisition and relocation costs for residential and other activities
- engineering and overhead costs
- annual operation and maintenance costs
- periodic replacement costs for facilities
- salvage value of land and facilities at end of accounting period

Estimated construction costs for facilities, land and acquisition of structures include a 20 per cent contingency allowance over the actual detailed estimates made.

The cost analyses and comparisons are made on an average annual cost basis for a fifty (50) year facilities service period using an interest rate of 6 per cent. The bases of costs for each of the items included are detailed in the annex.

PLAN TO MEET CURRENT STANDARDS

The Plan To Meet Current Standards represents the baseline treatment performance cost analysis for the Study Area. It provides for the achievement of present water quality improvement objectives as reflected in discharge performance criteria established by the Commonwealth of Pennsylvania for the Codorus Basin which are to be achieved during the early 1970's.

These criteria which vary somewhat from plant to plant have been made uniform for the estimation of facilities required to meet baseline objectives. These criteria, which are classified as Level B performance in this study, are as follows:

BOD_5	7 mg/l
Dissolved Oxygen	6 mg/l
Total Phosphorus	80% removal
Color	50 units

Facilities Plan

The waste treatment plan entails the maintenance of a decentralized multi-plant scheme consistent with present trends in the Study Area. A total of eight major separate treatment plants would serve the Study Area. The specific plants are listed below:

City of York STP
Springettsbury Township STP
Dover Township STP
Hanover STP
Penn Township STP
Spring Grove STP
Glen Rock STP
Shrewsbury - New Freedom - Railroad STP

In this plan the present Dover Borough and Red Lion treatment plants would be abandoned. The Red Lion-Dallastown-Yoe area wastes would be received in a new interceptor constructed along Mill Creek and conveyed to the Springettsbury STP. The Dover Borough wastes would be transferred to the Dover Township STP.

The treatment facilities plan for the small upper basin communities would entail the construction of transmission facilities to convey the Jacobus-Loganville area wastes to York and the construction of the separate package type advanced treatment plants for the communities of Jefferson, Seven Valleys and Winterstown.

Conveyance of the Jacobus-Loganville wastes to York is required to avoid the discharge of treated wastes into the York Water Company reservoirs located on the east branch of Codorus Creek. The potential contamination problems of periodic plant upsets and the eutrophication effect on the impoundments of residual nutrients in the effluent make this choice desirable.

The package treatment plants would provide secondary treatment, chemical precipitation and final filtration processes to achieve a level of treatment consistent with that provided by the major plants.

A plan map (Figure IV-1) shows the location of each of the treatment plants. Expansion requirements for the component process elements for each of the plants is summarized in Table IV-1.

Cost Summary

The cost summary for the Study Area with implementation of this plan is presented in Table IV-2. The total cost requirements of this plan for the Study Area would entail capital investments of $16,301,000 during the 1972-1985 period and $14,242,000 during the 1986-2000 period. The average annual cost, taking into account operating, replacement and salvage cost factors, is estimated at $4,699,000 for the 1972-2020 planning period. The costs are itemized in more detail in Table IV-3.

Technology Choice

The treatment facility process units selected for achieving the equivalent of Class B performance would consist of the following component elements:

Primary and Secondary Biological Treatment	Use of conventional primary settling and activated sludge processes or contact stablization as practiced at present plants
Phosphorus Removal (80 percent level)	Chemical precipitation using primary and secondary units for reaction and settling operations
Tertiary Suspended Solids & BOD Removal	Mixed media filtration coupled with chemical treatment
Sludge Treatment and Disposal	Aerobic and anaerobic digestion with land application as agricultural soil builder

Although a number of alternate processes are available to accomplish reduction of BOD to 7 mg/l, this process grouping is considered as being most adaptable to the incorporation of additional process units for nitrogen removal and increased phosphorus removal at a later date. The filtration step also achieves a very high level of suspended solids removal which is likely to also come under regulation for increased removal.

TABLE IV-1

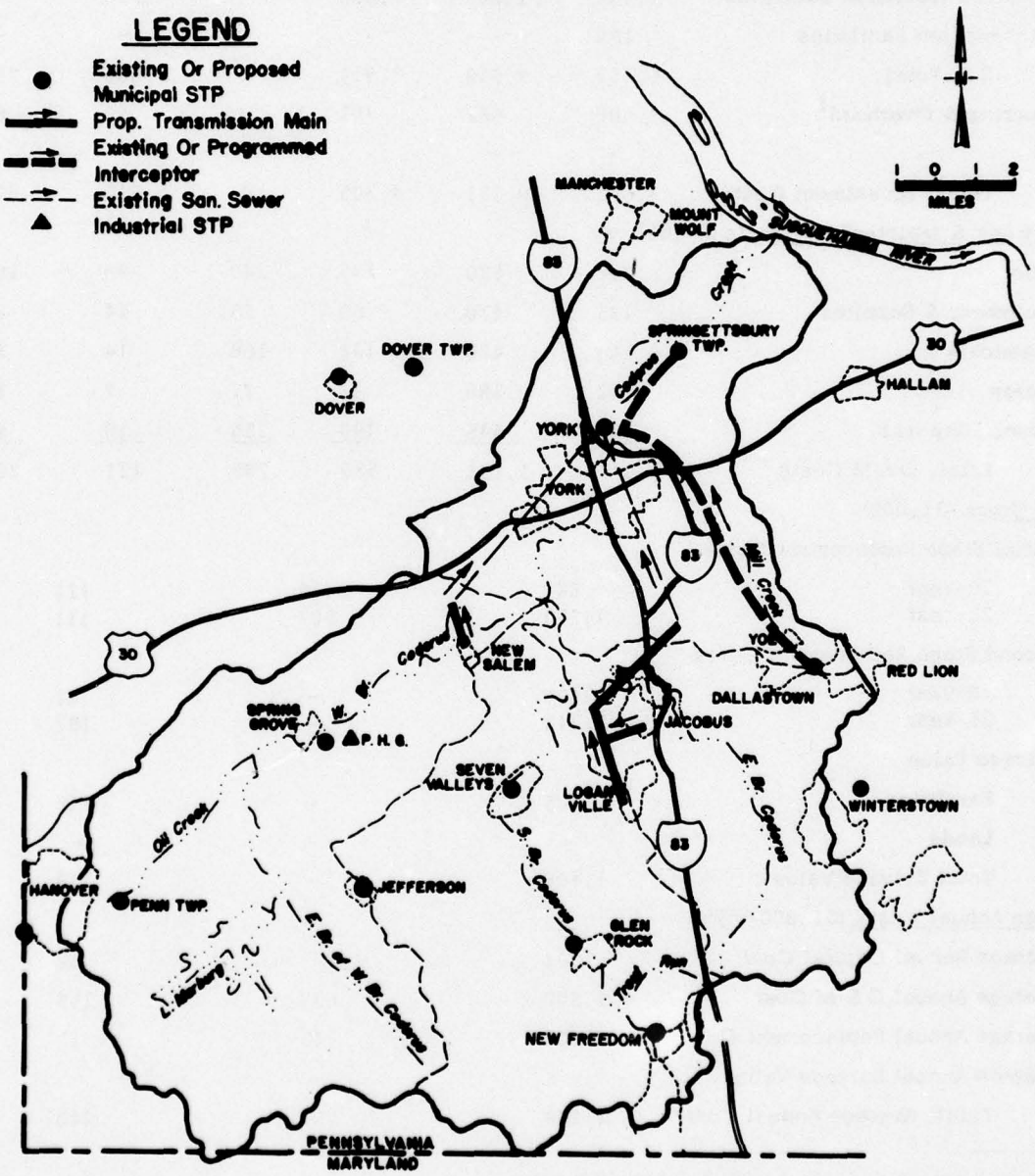
PLAN TO MEET CURRENT STANDARDS
TREATMENT PLANT FACILITY REQUIREMENTS

	Expansion Needs - MGD Average Flow Capacity Design Period	
	1972-1985	1986-2000
York STP		
Secondary Facilities	7	11
80%-P Removal Facilities	25	11
Filtration & Reaeration Facilities	25	11
Springettsbury STP		
Secondary Facilities	5	-
80%-P Removal Facilities	13	-
Filtration & Reaeration Facilities	13	-
Dover Township STP		
Secondary Facilities	-	1
80%-P Removal Facilities	1.75	1
Filtration & Reaeration Facilities	2.75	-
Hanover STP		
Secondary Facilities	1.5	-
80%-P Removal Facilities	4	-
Filtration & Reaeration Facilities	4	-
Penn Township STP		
Secondary Facilities	-	0.5
80%-P Removal Facilities	1.75	0.5
Filtration & Reaeration Facilities	2.2	-
Spring Grove STP		
Secondary Facilities	-	0.05
80%-P Removal Facilities	0.3	-
Filtration & Reaeration Facilities	0.3	-
Glen Rock STP		
Secondary Facilities	-	0.2
80%-P Removal Facilities	0.3	0.2
Filtration & Reaeration Facilities	0.5	-
Shrewsbury-New Freedom-Railroad STP		
Secondary Facilities	-	0.55
80%-P Removal Facilities	1.35	0.55
Filtration & Reaeration Facilities	1.9	-

FIGURE IV-1

CODORUS CREEK WASTEWATER MANAGEMENT STUDY

PLAN TO MEET CURRENT STANDARDS



PLAN TO MEET CURRENT STANDARDS

PROJECT COST SUMMARY

	YORK		SPRINGETTSBURY		DOVER TWP.	
Investment Costs ($1,000)	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Secondary Treatment Facilities	3,600	8,359	2,484	-	-	756
Advanced Treatment Facilities	2,304	1,260	1,430	-	556	41
Transmission Facilities	155	-	-	-	-	-
Sub-Total	6,059	9,619	3,914	-	556	797
Engineering & Overhead[1]	606	962	391	-	56	80
Lands	-	-	-	-	-	
Total, Investment Costs	6,665	10,581	4,305	-	612	877
Operations & Maintenance Costs ($1,000/yr)						
Labor	390	520	195	240	80	100
Equipment & Supplies	125	170	60	75	14	22
Chemicals	340	470	102	168	14	36
Energy	142	188	42	71	7	18
Sludge Disposal	320	445	140	235	16	45
Total, O & M Costs	1,317	1,793	539	789	131	221
Other Costs ($1,000)						
Initial Stage Replacement Costs						
10-Year	641		410		111	
25-Year	1,375		907		111	
Second Stage Replacement Costs						
10-Year	670		-		46	
25-Year	2,342		-		197	
Salvage Value						
Facilities	1,405		-		118	
Lands	-		-		-	
Total Salvage Value	1,405		-		118	
Average Annual Costs ($1,000/yr)						
Average Annual Capital Cost	703		273		62	
Average Annual O & M Cost	1,500		635		166	
Average Annual Replacement Cost	100		43		12	
Average Annual Salvage Value	5		-		-	
Total, Average Annual Cost	2,298		951		240	

[1] Engineering & Overhead includes 10% of facilities cost

NOTE: All Investment Costs above include 20% contingencies.

TABLE IV-2

HANOVER		PENN TWP.		SPRING GROVE		GLEN ROCK	
1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
1,044	840	-	480	-	233	-	397
688	-	497	30	154	-	210	19
-	-	-	-	-	-	-	-
1,732	840	497	510	154	233	21	416
173	84	50	51	15	23	210	42
-	-	-	-	-	-	-	-
1,905	924	547	561	169	256	231	458
120	130	90	95	40	40	40	45
25	30	15	20	3	3	3	5
44	57	24	33	4	5	4	7
21	28	11	17	2	2	2	3
57	77	30	42	5	6	5	9
267	322	170	207	54	56	54	69

190	99	31	42
399	99	31	42
42	30	12	24
210	126	58	103
126	76	35	62
-	-	-	-
126	76	35	62
145	50	18	27
288	184	55	60
22	10	3	5
-	-	-	-
455	244	76	92

PLAN TO MEET CURRENT STANDARDS

PROJECT COST SUMMARY

	Shrewsbury-New Freedom-Railroad		Loganville-Jacobus	
Investment Costs ($1,000)	1972-1985	1986-2000	1972-1985	1986-2000
Secondary Treatment Facilities	-	502	-	-
Advanced Treatment Facilities	455	30	-	-
Transmission Facilities	-	-	786	-
Sub-Total	455	532	786	-
Engineering & Overhead[1]	46	53	79	-
Lands	-	-	-	-
Total, Investment Costs	501	585	865	-
Operations & Maintenance Costs ($1,000/yr)				
Labor	80	95	-	-
Equipment & Supplies	14	18	-	-
Chemicals	21	26	-	-
Energy	8	13	1	1
Sludge Disposal	20	33	-	-
Total, O & M Costs	143	185	1	1
Other Costs ($1,000)				
Initial Stage Replacement Costs				
10-Year		91		-
25-Year		91		48
Second Stage Replacement Costs				
10-Year		31		-
25-Year		132		-
Salvage Value				
Facilities		79		-
Lands		-		-
Total Salvage Value		79		-
Average Annual Costs ($1,000/yr)				
Average Annual Capital Cost		47		55
Average Annual O & M Cost		159		1
Average Annual Replacement Cost		10		-
Average Annual Salvage Value		-		-
Total, Average Annual Cost		216		56

[1] Engineering & Overhead includes 10% of facilities cost

NOTE: All Investment Costs above include 20% contingencies.

TABLE IV-2 (continued)

Jefferson		Seven Valleys		Winterstown		PROJECT TOTAL	
1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
-	-	-	-	-	-	7,128	11,567
144	-	192	-	120	-	6,750	1,380
-	-	-	-	-	-	941	-
144	-	192	-	120	-	14,819	12,947
14	-	19	-	12	-	1,482	1,295
-	-	-	-	-	-	-	-
158	-	211	-	132	-	16,301	14,242
8	8	6	6	6	6	1,055	1,285
1	1	1	1	1	1	262	346
1	1	1	1	1	1	556	805
1	1	1	1	1	1	239	344
2	2	1	1	1	1	597	896
13	13	10	10	10	10	2,709	3,676
29		38		24		1,706	
29		38		24		3,194	
-		-		-		855	
-		-		-		3,168	
-		-		-		1,901	
-		-		-		-	
-		-		-		1,901	
10		13		8		1,411	
13		10		10		3,081	
2		3		2		212	
-		-		-		5	
25		26		20		4,699	

TABLE IV-3

PLAN TO MEET CURRENT STANDARDS

INVESTMENT AND OPERATION AND MAINTENANCE COSTS

COST ($1,000)

SEWAGE TREATMENT PLANT	YORK		SPRINGETTSBURY		DOVER TOWNSHIP		HANOVER	
INVESTMENT COSTS	1972-1985	1986-2000	1972-1985	1886-2000	1972-1985	1986-2000	1972-1985	1986-2000
Expansion of Secondary Treatment Capacity	3,000	6,966	2,070	-	-	630	870	700
Chemical Treatment Facilities For Phosphorus Removal	195	104	121	-	43	34	53	-
Mixed Media Filtration	1,447	791	894	-	347	-	435	-
Reaeration Facilities	278	155	177	-	74	-	85	-
Transmission Facilities	129	-	-	-	-	-	-	-
SUB-TOTAL	5,049	8,016	3,262	-	464	664	1,443	-
Contingencies	1,010	1,604	652	-	92	133	289	140
SUB-TOTAL	6,059	9,620	3,914	-	556	797	1,732	840
Engineering & Overhead	606	962	391	-	56	80	173	84
TOTAL INVESTMENT COSTS[a]	6,665	10,582	4,305	-	612	877	1,905	924
OPERATION & MAINTENANCE COSTS			COST ($1,000/Yr.)					
Labor	390	520	195	240	80	100	120	130
Equipment & Supplies	125	170	60	75	14	22	25	30
Chemicals	340	470	102	168	14	36	44	57
Energy	142	188	42	71	7	18	21	26
Sludge Disposal	320	445	140	235	16	45	57	77
TOTAL OPERATING & MAINTENANCE COSTS	1,317	1,793	539	789	131	221	267	322

[a]No land costs are included because it was assumed that the present sites were adequate in size to accommodate filtration and reaeration facilities.

TABLE IV-3 (continued)

SEWAGE TREATMENT PLANT	PENN TOWNSHIP		SPRING GROVE		GLEN ROCK		SHREWSBURY-NEW FREEDOM-RAILROAD	
INVESTMENT COSTS	1972-1985	1986-2000	1972-1985	1886-2000	1972-1985	1986-2000	1972-1985	1986-2000
	COST ($1,000)							
Expansion of Secondary Treatment Capacity	-	400	-	194	-	331	-	416
Chemical Treatment Facilities For Phosphorus Removal	38	25	29	-	39	16	36	25
Mixed Media Filtration	310	-	69	-	100	-	277	-
Reaeration Facilities	66	-	30	-	36	-	66	-
Transmission Facilities	-	-	-	-	-	-	-	-
SUB-TOTAL	414	425	128	194	175	347	379	443
Contingencies	83	85	26	39	35	69	76	89
SUB-TOTAL	497	510	154	233	210	416	455	532
Engineering & Overhead	50	51	15	23	21	42	46	53
TOTAL INVESTMENT COSTS[a]	547	561	169	256	231	458	501	585
OPERATION & MAINTENANCE COSTS			COST ($1,000/Yr.)					
Labor	90	95	40	40	40	45	80	95
Equipment & Supplies	15	20	3	3	3	5	14	18
Chemicals	24	33	4	5	4	7	21	28
Energy	11	17	2	2	2	3	8	13
Sludge Disposal	30	42	5	6	5	9	20	33
TOTAL OPERATING & MAINTENANCE COSTS	170	207	54	56	54	69	143	185

[a]No land costs are included because it was assumed that the present sites were adequate in size to accommodate filtration and reaeration facilities.

TABLE IV-3 (Cont'd)

PLAN TO MEET CURRENT STANDARDS
UPPER BASIN SMALL COMMUNITIES
INVESTMENT AND OPERATING COSTS OF FACILITIES

Loganville-Jacobus to York interceptors

Reynolds Mill - Spray interceptor		
Pumping Station (2 Stage Station)	$100,000	
14,000 LF of 12" FM @$15	210,000	
3,100 LF of 10" GR @$17.41	54,000	$364,000
Loganville & Jacobus - Reynolds Mill interceptor		
7,100 LF of 8" GR @$14.08	$100,000	
9,700 LF of 8" & 10" GR @	155,000	
3,200 LF of 8" GR @$14.06	45,000	$300,000
Sub Total		$664,000
Contingencies		122,000
SUB-TOTAL		$786,000
Engineering & Overhead		79,000
INTERCEPTOR TOTAL		$865,000

Package Advanced Treatment Plants For Other Communities

Community	Plant Size (gpd)	Construction Cost
Jefferson	40,000	120,000
Seven Valleys	70,000	160,000
Winterstown	30,000	100,000
Sub Total		$380,000
Contingencies		76,000
SUB-TOTAL		$465,000
Engineering & Overhead		46,000
TREATMENT PLANTS TOTAL		$502,000

TABLE IV-3 (Cont'd)

PLAN TO MEET CURRENT STANDARDS
UPPER BASIN SMALL COMMUNITIES
INVESTMENT AND OPERATING COSTS OF FACILITIES

Operation and Maintenance Costs of Package Plants
1972-2000

Item	Jefferson	Seven Valleys	Winterstown
Labor	8,000	6,000	6,000
Equipment and Supplies	1,000	1,000	1,000
Chemicals	1,500	1,000	1,000
Energy	1,000	1,000	1,000
Sludge Disposal	1,500	1,000	1,000
TOTAL	13,000	10,000	10,000

BASIC ALL WATER PLAN

The Basic All Water Plan for the Study Area entails the construction of three sub-regional treatment facilities which would receive secondary treated wastes from local secondary plants. The advanced treatment facilities (or centers) in their initial basic capability would provide tertiary BOD and suspended solids removal, ammonia and total nitrogen reduction, high level phosphorus removal, chlorination and reaeration. The inclusion of carbon adsorption for the removal of refractory organics is also developed as a modified form of the Plan. One of the three advanced treatment facilities would serve the entire York urban area while the other two plants would serve the separate urban centers in the upstream parts of the Codorus Basin.

The general framework plan for this alternative is depicted by Figure IV-2. Performance and design aspects of the plan are summarized in Table IV-4. The plan is shown sub-divided into four component project elements for which separate cost estimates are developed. The component projects of the plan include:

- The York Urban Area
- The Hanover, Penn Township and Spring Grove Area
- The Glen Rock, Shrewsbury, Railroad and New Freedom Area
- The Small Upper Basin Communities (Jefferson, Seven Valleys Loganville, Jacobus and Winterstown)

Cost Summary

The cost summary for the Study Area using this plan is presented in Table IV-5. The total cost requirements of this plan for the Study Area would entail capital investments of $51,160,000 during the 1972-1985 period and $24,520,000 during the 1986-2000 period. The average annual cost, taking into account operating, replacement and salvage cost factors, is estimated at $8,961,000 for the 1972-2020 planning period.

York Urban Area Facilities Plan

For the York urban area initial treatment through the secondary level would be provided at one of three local plants - York, Springettsbury and Dover Township. All area wastes including most industrial wastes which are presently discharged directly to the surface waters would be received by one of the three secondary treatment facilities. This would include waste flows which are now treated at the Red Lion and Dover Borough plants which are proposed to be abandoned. The single advanced treatment facility would be located adjacent to the York secondary plant.

Secondary Treatment Facilities

The new Springettsbury Township and programmed Dover Township contact stabilization secondary facilities would be expanded as necessary to serve the areas tributary to them utilizing the same process as now installed. A 5 MGD expansion of the present 8 MGD facility at Springettsbury in 1980 and a 1 MGD expansion in 1987 of the programmed 1.75 MGD Dover facility are anticipated to meet the year 2000 needs.

The York treatment plant would serve the remainder of the area. The existing 18 MGD primary and secondary activated sludge facility would require a 7 MGD expansion in 1973 and another 11 MGD expansion in 1987. Site plans for each of the three facilities are presented by Exhibits IV-1, IV-2, IV-3.

Advanced Treatment

The proposed site location for the regional advanced waste treatment facility is shown by Exhibit IV-4. A total site area of 67 acres would be acquired of which 45 would be needed for the first phase project. This site is adjacent to the present York secondary plant. Effluent from each of the three secondary plants would be pumped to this facility.

The initial phase AWT facility would be sized for a 1985 average flow of 35 MGD and a design maximum rate of 60 MGD. Flows from the secondary plants would be regulated so as not to exceed the design maximum. In 1986 a 16 MGD expansion in average flow capacity would be necessary to meet the year 2000 flow projections.

AWT Facility Components

The initial construction program would involve the provision of the following process elements and related facilities:

- nitrification-denitrification
- chemical treatment and sedimentation
- lime recalcination
- recarbonation

CODORUS CREEK WASTEWATER MANAGEMENT STUDY

ALL WATER TREATMENT PLAN

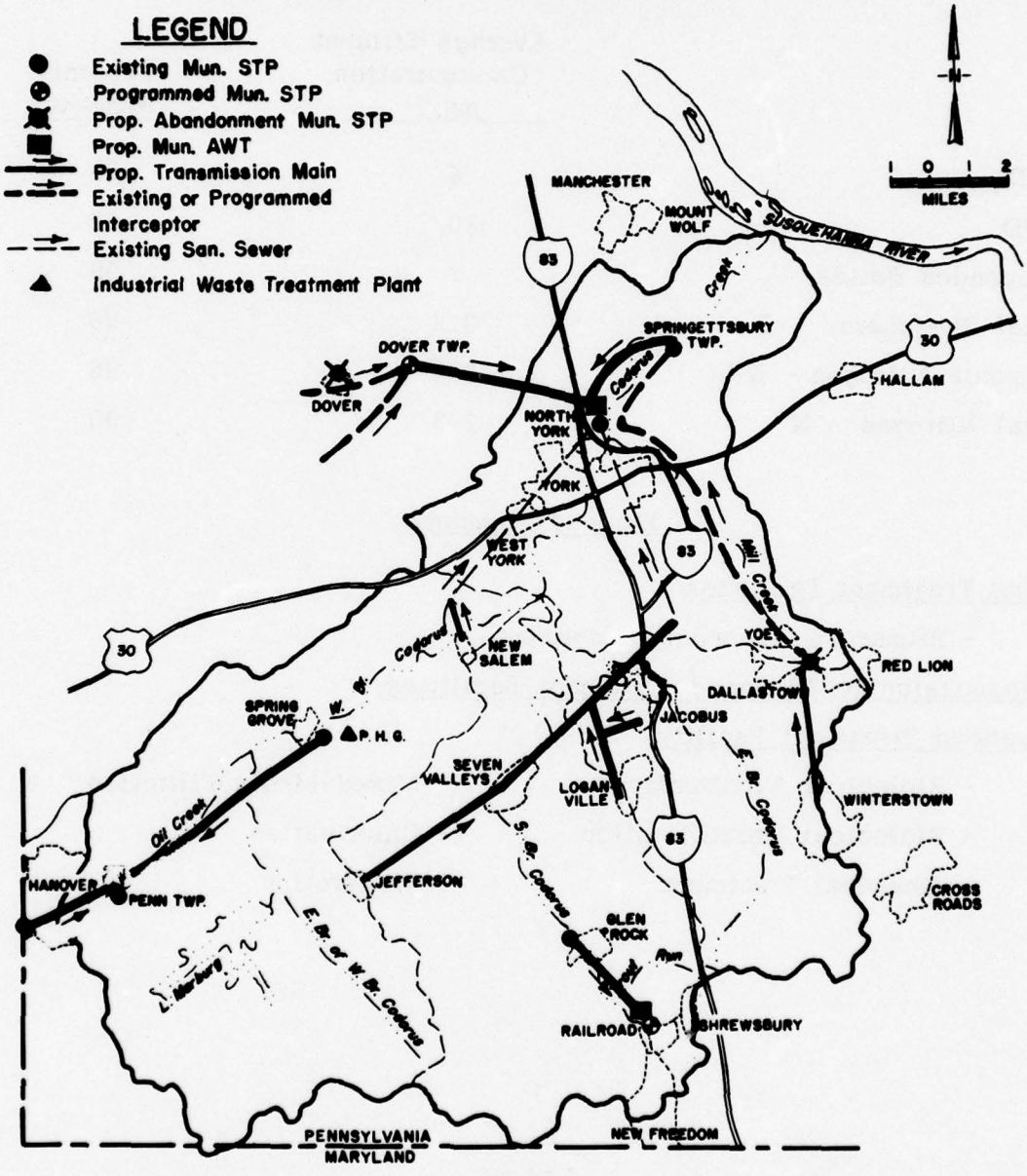


TABLE IV-4

BASIC ALL WATER PLAN
PERFORMANCE AND DESIGN ASPECTS

Treatment Performance Criteria

	Average Effluent Concentration mg/l	Percent Removal
BOD_5	4	98
COD	30	90
Suspended Solids	3	98
Total Phosphorus - P	0.2	98
Ammonia Nitrogen - NH_3	0.5	96
Total Nitrogen - N	2-3	90

Process Elements

Local Treatment Facilities

- Primary & Secondary Treatment

Transmission to Advanced Treatment Facilities

Advanced Treatment Facility

- Biological Nitrification
- Biological Denitrification
- Chemical Treatment
- Mixed-Media Filtration
- Chlorination
- Re-aeration

TABLE IV-4
(cont.)

Facilities Requirements

	Expansion in Capacity - MGD 1972-1985	1986-2000
York Urban Area		
Secondary Treatment Plants		
York	7	11 + R
Dover Township	-	1
Springettsbury Township	5	-
Advanced Treatment Facility	35.0	16.0
Hanover-Penn Twp.-Spring Grove Area		
Secondary Treatment Plants		R
Hanover	1.5	
Penn Township	-	0.5
Spring Grove	-	R
Advanced Treatment Facility	6.5	-
Glen Rock-Shrewsbury-New Freedom-Railroad Area		
Secondary Treatment Plants		
Glen Rock	-	0.2
New Freedom-Railroad	-	0.5
Advanced Treatment Facility	2.4	-

NOTES: R = plant rehabilitation
Expansions assume existence of programmed initial New Freedom and Dover Township secondary facilities.

BASIC ALL WATER PLAN - PROJECT COST SUMMARY

	YORK URBAN AREA		HANOVER-PENN TWP.-SPRING GROVE URBAN AREAS	
Investment Costs ($1,000)	1972-1985	1986-2000	1972-1985	1986-2000
Secondary Treatment Facilities	$ 6,084	$ 9,116	1,044	1,560
Advanced Treatment Facilities	20,104	10,716	7,140	-
Transmission Facilities	3,457	-	1,285	-
Sub-Total	29,645	19,832	9,469	1,560
Engineering & Overhead[1]	2,965	1,983	947	156
Lands	804	-	84	-
Total, Investment Costs	33,414	21,815	10,500	1,716
Operations & Maintenance Costs ($1,000/year)				
Labor	915	1,195	345	370
Equipment & Supplies	412	581	99	118
Chemicals	470	685	68	90
Energy	502	744	100	138
Sludge Disposal	476	725	92	125
Total, O & M Costs	2,775	3,930	704	841
Other Costs ($1,000)				
Initial Stage Replacement Costs				
10-Year		4,332		1,480
25-Year		5,933		1,759
Second Stage Replacement Costs				
10-Year		2,599		78
25-Year		4,422		1,759
Salvage Value				
Facilities		2,653		234
Lands		804		84
Total Salvage Value		3,457		318
Average Annual Costs ($1,000/year)				
Average Annual Capital Cost		2,698		712
Average Annual O & M Cost		3,218		757
Average Annual Replacement Cost		501		138
Average Annual Salvage Value		12		1
Total, Average Annual Cost		6,405		1,606

[1] Engineering & Overhead includes 10% of facilities cost

NOTE: All Investment Costs above include 20% contingencies

TABLE IV-5

GLEN ROCK-SHREWSBURY NEW FREEDOM-RAILROAD		JACOBUS-LOGANVILLE SEVEN VALLEYS JEFFERSON-WINTERSTOWN		PROJECT TOTAL	
1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
-	899	-	-	7,128	11,575
4,332	-	-	-	31,576	10,716
296	-	1,915	-	6,953	-
4,628	899	1,915	-	45,657	22,291
463	90	192	-	4,567	2,229
48	-	-	-	936	-
5,139	989	2,107	-	51,160	24,520
205	240	15	15	1,480	1,820
56	66	1	2	568	767
18	30	-	-	556	805
26	46	2	4	630	932
25	42	-	-	593	892
330	424	18	21	3,827	5,216

866	-	6,678
895	62	8,649
45	-	2,722
225	-	5,037
135	-	3,022
48	-	936
183	-	3,958
352	134	3,896
366	19	4,360
79	1	719
1	-	14
796	154	8,961

- multi-media filtration
- chlorination
- reaeration
- chemical treatment facilities building
- administration and laboratory building

A plan layout of the site facilities is shown by Exhibit IV-5. Architectural sketches of the site area, various structures and administration center are presented by Exhibits IV-6, IV-7, IV-8 & IV-9 .

Process Unit Description

A flow sheet showing the process elements and plant flow sequence is depicted in Exhibit IV-10. Typical design details of specific process units are shown in Exhibit IV-11. Details of the York STP pump station are presented in Exhibits IV-12 & IV-13.

The design aspects of facilities presented in the plan presentation are based on typical designs developed and found successful for mixed municipal wastes at existing plant and pilot scale operations. Modifications in process design aspects will undoubtedly be required based on pilot and laboratory test studies which should be conducted in the detail design phase.

Nitrification - Conversion of ammonia to nitrate nitrogen is achieved in a complete-mix nitrification sludge aeration basin. Mechanical aerators and mixers are provided for oxygen and mixing requirements. The process is sized for a sludge recirculation capability of 20 MGD and a minimum detention time of 3 hours at the maximum flow rate. Two aeration units are provided in the initial phase each with a volume of 500,000 cu. ft.

Denitrification - Conversion of the nitrate nitrogen to nitrogen gas to facilitate its escape to the atmosphere is accomplished in an anaerobic sludge reaction basin. Methanol is added as a carbon source to enhance biological reduction of the nitrate compound to N_2 and CO_2. Mechanical mixers are provided to enhance the reaction process. Two basins are provided each with a volume of 500,000 cu. ft. The process is sized for a 3 hour detention time at the 60 MGD design maximum flow rate. A return sludge capacity of 20 MGD is specified.

Nitrification and Denitrification Sludge Sedimentation - Sedimentation basins for both the nitrification and denitrification processes are sized for an overflow rate of 1,000 gpd/ft^2 at the maximum flow condition (60 MGD + 20 MGD sludge recirculation). Two 160 ft. diameter tanks are required for each sludge reaction basin.

Chemical Treatment - Chemical treatment for phosphorus removal is provided as a separate tertiary process consisting of lime addition, rapid mix, flocculation and sedimentation. A lime feed capability of up to 400 ppm is required. Two rapid-mix and flocculation basins are provided. Process specification for the various units is as follows:

Design Flow	- 60 MGD + 5 MGD filter and scrubber water backwash recirculation flow.
Rapid Mix	- 30 seconds
Flocculation	- 15 minutes
Sedimentation	- 1440 gpd/ft^2 overflow rate

Chemical Sedimentation - The effluent from the two chemical flocculation basins are discharged to three 140 ft. diameter sedimentation basins for settling and separation of the lime sludge. These clarifiers are designed for an overflow rate of 1,440 gpd/ft^2.

Lime Recalcination - The lime recalcination system includes the following elements:

- lime feed storage basins and pumps
- lime feed thickeners
- lime feed centrifuge
- multiple hearth recalcinator
- gas scrubber facilities
- CO_2 gas recovery system
- required piping and conveyance facilities

The system is sized to handle a 300 ppm feed rate at 50 MGD for a 150 hour per week operating schedule. This requires a system solids handling capacity of 6,000 lbs per hour.

Recarbonation - A two stage recarbonation step is provided after chemical clarification to reduce pH from 11 to between 7 and 8 and for calcium carbonate recovery. CO_2 gas is bubbled through the wastewater flow stream in a five minute first stage reaction step after which a half hour detention is provided in the combination reaction completion and sedimentation step. The overflow is then provided a final carbonation step prior to the filtration process. Two recarbonation units are provided for the process design flow rate of 65 MGD.

Multi-Media Filtration - The filtration step would utilize gravity filters of the mixed-media design (a combination of sand, coal and perhaps a third media). They are sized for a 6 gpm per ft^2 filter rate at 65 MGD (the 60 MGD design maximum flow rate plus 5 MGD recirculation from scrubber and backwash operations). A total filter area of 7,500 sq. ft. is required. Twelve 620 sq. ft. filter beds would be provided in the first stage with provision for extension of the filter bay area to provide an additional 12 bays in the future.

Chlorination - This step would follow filtration. Chlorination capability of up to 10 mg/l for the 60 MGD maximum flow rate would be provided. A 15 minute disinfection detention period is required. Actual chlorine dosages to achieve required disinfection are expected to be less than 5 mg/l for the tertiary filtered effluent.

Reaeration - Reaeration to achieve a final effluent dissolved oxygen of 6 mg/l or greater would be provided with the use of floating aerators in an aeration basin. A fifteen minute detention basin (630,000 gallons for the 60 MGD maximum flow) equipped with 4-25 HP floating aerators is proposed.

Chemical Feed Systems - Chemical feed and storage systems for the addition of methanol, lime and polymers are required as specified in Table IV-6.

Sludge Management - Waste sludges produced at the AWT plant include small amounts of excess nitrification and denitrification biological sludges and phosphorus enriched waste-lime chemical sludge. The waste biological sludges would be concentrated in a thickener and centrifuge and then incinerated in the lime recalcination furnace. The waste-lime chemical sludge would be thickened and disposed of in a landfill.

Project Costs - A detailed list of facilities and estimated construction costs for the York urban area is presented in Table IV-7. The estimated annual operating and maintenance costs are presented in Table IV-8.

TABLE IV-6
CHEMICAL FEED SYSTEMS - YORK AWT

Chemical	Type	Feed Rate	Process Feed Point	Storage and Feed Systems	Daily Chemical Usage at Design Average Flow mg/l	Daily Chemical Usage at Design Average Flow lbs/day
Methanol	liquid	20-40 mg/l for 60 MGD	Denitrification Basins	-Liquid Storage Tanks -Positive Displacement Metering Pumps	30	8,800
Lime	solid	200-400 mg/l for 65 MGD	Chemical Treatment Basin	-Solids Storage Bins -Feed Hoppers -Slakers	100[a]	40,000
Polymer	liquid	0.1-0.5 mg/l	Flocculation Basin	-Liquid Storage Tank -Positive Displacement Metering Pumps	0.2	65
Chlorine	liquid	2-10 mg/l	Chlorine Contact Basin	-2-ton Cylinders	4	1,200

[a] makeup lime

Upper Basin Communities Sub-Regional AWT Plants

The Basic All Water Plan for the upper basin communities entails the development of two sub-regional advanced waste treatment plants similar in design and performance to the York area AWT facility. One plant would serve the communities of Spring Grove, Hanover and Penn Township. The second would serve the communities of Glen Rock, Shrewsbury, New Freedom and Railroad. The small urban areas of Jacobus, Loganville, Jefferson, Seven Valleys and Winterstown would be collected in a regional interceptor and directed to the York secondary treatment plant.

Hanover-Penn Township-Spring Grove Area

Secondary Treatment - The existing secondary treatment plants serving these communities would be utilized and expanded as necessary to meet increases in flow. Secondary effluent from the three plants would be pumped to an advanced treatment plant located adjacent to the Penn Township secondary treatment facility.

Advanced Treatment Facility - The sub-regional advanced treatment plant would be sized for a year 2000 design average flow of 6.5 MGD and a maximum rate of 11.0 MGD. The plant would include the same facilities as the York area AWT facility. Discharge would be to Oil Creek.

Project Costs - A detailed list of facilities and estimated construction costs for the Hanover-Penn Township-Spring Grove area is presented in Table IV-9. The estimated annual operating and maintenance costs are presented in Table IV-10.

Glen Rock-Shrewsbury-Railroad-New Freedom Area

Secondary Treatment - The present Glen Rock and programmed Railroad contact stabilization plants would be utilized and expanded as necessary to provide initial treatment of all area wastes.

After secondary treatment all wastes would be pumped to an advanced treatment facility located adjacent to the New Freedom Railroad secondary plant.

Advanced Treatment Facility - The sub-regional AWT facility would be sized for a year 2000 average design flow of 2.4 MGD and a maximum flow rate of 4.1 MGD. This facility would also be similar in design to the York AWT plant. Discharge from the plant would be to the South Branch of Codorus Creek.

Project Costs - A detailed list of facilities and estimated construction costs for the Glen Rock-Shrewsbury-Railroad-New Freedom area is presented in Table IV-11. The estimated annual operating and maintenance costs are presented in Table IV-12.

Small Upper Basin Communities

Conveyance - To provide the level of treatment for the small communities with water process treatment approaching that of land treatment requires the conveyance of wastes collected in these areas to one of the regional treatment plants. The Basic All Water Plan includes the conveyance of collected wastes to the York area treatment plants. An interceptor would tie together wastes from Jefferson, Seven Valleys, Loganville and Jacobus for discharge to the City of York interceptor system. A separate transmission line would convey wastes from Winterstown to the Mill Creek interceptor at Red Lion.

Project Costs - A detailed list of facilities and estimated construction costs for the small upper basin communities is presented in Table IV-13. The estimated annual operating and maintenance costs are presented in Table IV-14.

TABLE IV-7

BASIC ALL WATER PLAN
YORK URBAN AREA SUB-REGIONAL AWT
FACILITIES COST ESTIMATE

1972-1985 Period

Date		Project Item	Cost
		1. Secondary Treatment Plants	
1973	1.	Seven (7) MGD expansion of York secondary treatment plant from 18 MGD capacity to 25 MGD capacity for 1985 design year flow, construction of complete mix or stop aeration activated sludge facility. Items included: sewage lift station, biological treatment cells, sedimentation basins, oxygen or air supply system, anaerobic miscellaneous yard piping, electrical and instrumentation.	$3,000,000
1980	2.	Five (5) MGD expansion of Springettsbury Sewage Treatment Plant from 8 MGD capacity to 13 MGD. A similar facility to the present contact stabilization plant would be provided. Facilities included: lift station, aeration basins with mechanical aerators, sludge conditioning basins with mechanical aerators, sedimentation basins, sludge thickener, aerobic sludge digestion basins, sludge storage basins, and flow equalization pond.	$2,070,000
		SUB-TOTAL	$5,070,000
		Contingencies	1,014,000
		ITEM TOTAL	$6,084,000

TABLE IV-7 (Cont.)

2. Conveyance System

York STP - York AWT treated waste pipeline		
Pumping Station	600,000	
1,400 LF of 48" FM	109,000	
		709,000
Springettsbury to York treated waste pipeline		
Pumping Station	105,000	
21,500 LF of 36" FM	1,180,000	
		1,285,000
Dover-York treated waste pipeline		
Pumping Station	70,000	
27,500 LF of 18" FM	688,000	
		758,000
New Salem-York Interceptor		
Pumping Station	30,000	
9,400 LF of 6" FM	82,000	
1,200 LF of 8" GR	17,000	
		129,000
SUB-TOTAL		2,881,000
Contingencies		576,000
ITEM TOTAL		$3,457,000

TABLE IV-7 (Cont.)

3. Advanced Treatment Facility

1973 Construction of York urban area advanced treatment facility

Process: Nitrification, denitrification, chemical treatment using lime with recalcination, recarbonation, filtration and reaeration.

Flow Basis of Design:
Average Daily Flow = 35 MGD
Peak Day Flow = 60 MGD

Nitrification Facilities	
60 MGD design basis - 3 hour detention	
2 - 15' x 50' x 225' basins @1.00 C/F	1,000,000
12 - 20 HP floating aerators @8,000 ea.	96,000
Nitrification Sedimentation Basins	
1,000 gpd/SF overflow rate for 60 MGD + 20 MGD return sludge	
4 - 160' dia. 8' deep tanks @$20/ft.^{2}	1,600,000
Nitrification Sludge Return Pump Stations	
2 - 10 MGD pumping stations	150,000
Denitrification Basin	
3 hour detention at 60 MGD	
2 - 150' x 225' x 15' units @$1.00/CF	1,000,000
12 - 5 HP mixers @$10,000 ea.	120,000
1,000 gpd/ft^2 overflow rate for 60 MGD + 20 MGD return sludge	
4 - 160' dia. 8' deep tanks @$20/ft.^{2}	1,600,000
Denitrification Sludge Return Pump Station	
2 - 10 MGD Stations	150,000

TABLE IV-7 (Cont.)

1973 (Cont.)	**Chemical Treatment Flocculation Unit**		
	Rapid Mix Tank - 30 sec. mix at 65 MGD		
	2 - 16' x 16' x 6' mixing tanks		
	2 - mechanical mixers	lump sum	40,000
	Flocculation Tank - 15 min. detention at 65 MGD		
	2 - 45' x 95' x 11' tanks	@$1.50/ft.^{3}	135,000
	2 - paddle wheel flocculators		45,000
	Lime Sedimentation Tanks		
	Overflow rate at 65 MGD - 1440 gpm/ft.^{2}		
	3 - 140' dia. tanks (15,000/sq. ft. ea.)	@$20.00/ft.^{2} 3 x $240,000	960,000
	Recarbonation Units		
	Recarbonation with sludge removal		
	CO_2 diffusion piping	lump sum	40,000
	2 - 90' x 140' x 10' basins with sludge collection scraper units	@$20/ft.^{2}	640,000
	Chemical Treatment Building & Facilities		
	Recalcination facilities		2,000,000
	Methanol feed & storage system		100,000
	Lime feed & storage system		200,000
	100' x 225' 100' x 75 (2)	@$20/ft.^{2}	750,000
	Filter Building & Facilities		
	6 gpm/ft^2 filter rate for 65 MGD		1,600,000
	Sludge Management System		
	Sludge thickener - 5' dia. tank		30,000
	Biological sludge holding tank 20,000 gallon tank		20,000
	Centrifuge - 800 lbs/hr. capacity		75,000
	Reaeration Facilities		400,000

TABLE IV-7 (Cont.)

1973 (Cont.)	Yard Piping	2,000,000
	Electrical & Instrumentation	1,000,000
	Outfall Pipe - 600' of 96" sewer	150,000
	Chlorination	200,000
	Administration, Control & Laboratory Bldg.	
	160' x 100' @$30.00/ft.^{2}	480,000
	Site Landscaping	
	Court Yard paving	
	3,400 sq. yd. @$5.00/sq.yd.	17,000
	Trees & plantings	
	300 trees @$100 ea.	30,000
	Grass & shrubs	6,000
	Road & Parking Area Construction	
	12,000 sq. yd. @$10.00/sq. yd.	120,000
	SUB-TOTAL	$16,754,000
	Land Requirements 67 Acres @$10,000	670,000
	FACILITY TOTAL	17,424,000
	Contingencies	3,484,000
	ITEM TOTAL	$20,908,000
1972-1985 CONSTRUCTION TOTAL		$30,449,000

TABLE IV-7 (Cont.)

1986-2000 Period

Date	Project Item	Cost
	1. Secondary Treatment Plants	
1987	Eleven (11) MGD expansion of York Sewage Treatment Plant from 25 MGD capacity to 36 MGD capacity for year 2000 design capacity. Rehabilitation of original 18 MGD York facility.	$6,967,000
	One (1) MGD expansion of Dover Township Sewage Treatment Plant from 1.75 MGD capacity to 2.75 MGD capacity for year 2000 design flow.	630,000
	SUB-TOTAL	$7,597,000
	Contingencies	1,519,000
	ITEM TOTAL	$9,116,000
	2. Advanced Treatment Facility	
1986	Expansion of York Advanced Treatment Facility 16 MGD Average Flow Addition for Year 2000 design condition	
	Process: Nitrification, denitrification, chemical treatment using lime with recalcination, recarbonation, filtration and reaeration.	
	Flow Basis of Design: Average Daily Flow = 16 MGD Peak Day Flow = 27.5 MGD	

TABLE IV-7 (Cont.)

1986 (Cont.)	Nitrification Facilities	$ 610,000
	Nitrification Sedimentation Basins	890,000
	Nitrification Sludge Return Pump Stations	80,000
	Denitrification Basin	620,000
	Denitrification Sedimentation Basins	890,000
	Denitrification Sludge Return Pump Stations	80,000
	Chemical Treatment Flocculation Unit	120,000
	Lime Sedimentation Tanks	530,000
	Recarbonation Units	380,000
	Chemical Treatment Building & Facilities	1,690,000
	Filter Building & Facilities	890,000
	Sludge Management System	70,000
	Reaeration Facilities	220,000
	Yard Piping	1,110,000
	Electrical & Instrumentation	560,000
	Outfall Pipe	80,000
	Chlorination	110,000
	SUB-TOTAL	$8,930,000
	Contingencies	1,786,000
	ITEM TOTAL	$10,716,000
1986-2000 CONSTRUCTION TOTAL		$19,832,000

TABLE IV-8

BASIC ALL WATER PLAN
YORK URBAN AREA SUB-REGIONAL AWT
DETAILED OPERATING AND MAINTENANCE COSTS

Secondary Treatment Facilities	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
York STP		
- Labor	$ 340,000	$ 460,000
- Energy	85,000	110,000
- Equipment & Supplies	100,000	135,000
- Chemicals	-	-
- Sludge Disposal	320,000	445,000
TOTAL	845,000	1,150,000
Springettsbury STP		
- Labor	170,000	205,000
- Energy	25,000	43,000
- Equipment & Supplies	45,000	57,000
- Chemicals	-	-
- Sludge Disposal	140,000	235,000
TOTAL	380,000	540,000
Dover Township STP		
- Labor	60,000	85,000
- Energy	4,000	10,000
- Equipment & Supplies	10,000	20,000
- Chemicals	-	-
- Sludge Disposal	16,000	45,000
TOTAL	90,000	160,000
Subtotal Secondary Treatment Facilities		
- Labor	570,000	750,000
- Energy	114,000	163,000
- Equipment & Supplies	155,000	212,000
- Chemicals	-	-
- Sludge Disposal	476,000	725,000
TOTAL	1,315,000	1,850,000

TABLE IV-8 (Cont'd)

Secondary Treatment Facilities	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
York AWT Plant		
- Labor	$ 315,000	$ 415,000
- Energy	365,000	540,000
- Equipment & Supplies	250,000	360,000
- Chemicals	470,000	685,000
TOTAL	1,400,000	2,000,000
Transmission Facilities		
- Labor	30,000	30,000
- Energy	23,000	41,000
- Equipment & Supplies	7,000	9,000
TOTAL	60,000	80,000
TOTAL PROJECT OPERATING & MAINTENANCE COST	$2,775,000	$3,930,000

TABLE IV-9

BASIC ALL WATER PLAN
HANOVER-PENN TOWNSHIP-SPRING GROVE URBAN AREAS
SUB-REGIONAL AWT
FACILITIES COST ESTIMATE

1972-1985 Period

Date	Project Item		Cost
	1. Secondary Treatment Plants		
1975	Expansion of Hanover secondary treatment facility by 1.5 MGD capacity for year 2000 design flow		$ 870,000
		SUB-TOTAL	$ 870,000
		Contingencies	174,000
		ITEM TOTAL	$1,044,000
	2. Conveyance Systems		
	Hanover-Penn Township treated waste pipeline		
	Pumping Station	74,000	
	20,000 L.F. of 20" FM.	560,000	
			$ 634,000
	Penn Township STP - Penn Township AWT		
	Pumping Station	37,000	
	400 L.F. of 16" FM.	10,000	
			$ 47,000
	Spring Grove - Penn Township treated waste pipeline		
	Pumping Station	35,000	
	35,500 L.F. of 8" FM.	355,000	
			$ 390,000
		SUB-TOTAL	$1,071,000
		Contingencies	214,000
		ITEM TOTAL	$1,285,000

TABLE IV-9 (Cont'd)

HANOVER-PENN TOWNSHIP-SPRING GROVE URBAN AREAS (Cont'd)

1972-1985 Period

Date	Project Item		Cost
	3. Advanced Treatment Facility		
1973	Construction of 6.5 MGD Type D AWT plant at Penn Township for year 2000 design flow		
	Flow Basis of Design: Avg. Daily Flow = 6.5 MGD Peak Day Flow = 11.0 MGD		
	Nitrification Facilities		
	- Aeration basins	$450,000	
	- Sedimentation basins	500,000	
	- Sludge return pump station	60,000	
			$1,010,000
	Denitrification Facilities		
	- Anaerobic denitrification basins	$450,000	
	- Sedimentation basins	500,000	
	- Sludge return pump station	60,000	
			$1,010,000
	Chemical Treatment Facilities		
	- Rapid mix basin	$ 20,000	
	- Flocculation units	90,000	
	- Sedimentation basins	400,000	
	- Recarbonation basin & equipment	250,000	
	- Lime feed & storage equipment	100,000	
	- Methanol feed & storage equip.	50,000	
	- Lime sludge dewatering and re-calcination equipment	800,000	
	- Chemical building	200,000	
			$1,910,000
	Sludge Management Facilities		
	- Sludge thickener	$ 15,000	
	- Sludge storage tank	10,000	
	- Centrifuge	35,000	
			$ 60,000

TABLE IV-9 (Cont'd)

HANOVER-PENN TOWNSHIP-SPRING GROVE URBAN AREAS (Cont'd)

1972-1985 Period

Date	Project Item		Cost
1973	Filter Building & Facilities		$ 800,000
	Reaeration Facilities		
	- Aeration basin with mechanical aerators		$ 130,000
	Chlorination Facilities		
	- Chlorination contact tank	$ 70,000	
	- Chlorination feed & storage equipment	25,000	
			$ 95,000
	Yard Piping		$ 500,000
	Electrical & Instrumentation		$ 250,000
	Control & Laboratory Building		$ 150,000
	Site Development		
	- Roadwork & Paving	$ 25,000	
	- Landscaping	10,000	
			$ 35,000
	Land Acquisition		
	- 10 acres @7,000		$ 70,000
	FACILITY TOTAL		$ 6,020,000
	Contingencies		1,204,000
	ITEM TOTAL		$ 7,224,000
	1972-1985 CONSTRUCTION TOTAL		$ 9,553,000

TABLE IV-9 (Cont'd)

HANOVER-PENN TOWNSHIP-SPRING GROVE URBAN AREAS (Cont'd)

1986-2000 Period

Date		Cost
	1. Secondary Treatment Plants	
1986	Rehabilitation of Hanover original 2.5 MGD trickling filter treatment facility	$ 700,000
1986	Rehabilitation and expansion of Spring Grove trickling filter treatment plant to 0.3 MGD year 2000 design capacity	200,000
1987	Expansion of Penn Township contact stabilization plant by 0.5 MGD for year 2000 design capacity of 2.2 MGD	400,000
	SUB-TOTAL	$1,300,000
	Contingencies	260,000
	ITEM TOTAL	$1,560,000
	1986-2000 CONSTRUCTION TOTAL	$1,560,000

TABLE IV-9 (Cont'd)

HANOVER-PENN TOWNSHIP-SPRING GROVE URBAN AREAS (Cont'd)

1986-2000 Period

Date		Cost
	1. Secondary Treatment Plants	
1986	Rehabilitation of Hanover original 2.5 MGD trickling filter treatment facility	$ 700,000
1986	Rehabilitation and expansion of Spring Grove trickling filter treatment plant to 0.3 MGD year 2000 design capacity	200,000
1987	Expansion of Penn Township contact stabilization plant by 0.5 MGD for year 2000 design capacity of 2.2 MGD	400,000
	SUB-TOTAL	$1,300,000
	Contingencies	260,000
	ITEM TOTAL	$1,560,000
	1986-2000 CONSTRUCTION TOTAL	$1,560,000

TABLE IV-10

BASIC ALL WATER PLAN
HANOVER-PENN TOWNSHIP-SPRING GROVE URBAN AREAS
SUB-REGIONAL AWT
DETAILED OPERATING AND MAINTENANCE COSTS

Project	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
Hanover-Penn Twp.-Spring Grove		
Secondary Treatment Plants[1]		
- Labor	$190,000	$205,000
- Energy	19,000	27,000
- Equipment & Supplies	32,000	40,000
- Chemicals	-	-
- Sludge Disposal	92,000	125,000
Subtotal	333,000	397,000
Transmission		
- Labor	15,000	15,000
- Energy	4,000	6,000
- Equipment & Supplies	2,000	3,000
Subtotal	21,000	24,000
Regional AWT Plant		
- Labor	140,000	150,000
- Energy	77,000	105,000
- Equipment & Supplies	65,000	75,000
- Chemicals	68,000	90,000
Subtotal	350,000	420,000
TOTAL PROJECT O&M COST	704,000	841,000

TABLE IV-11

BASIC ALL WATER PLAN
GLEN ROCK-SHREWSBURY-NEW FREEDOM-RAILROAD URBAN AREAS
SUB-REGIONAL AWT
FACILITIES COST ESTIMATE

1972-1985 Period

Date	Project Item		Cost
	1. Secondary Treatment Plants		
	NONE		
	2. Conveyance Systems		
	Glen Rock - New Freedom treated waste pipelines		
	Pumping Station	$ 37,000	
	16,500 LF of 8" FM	165,000	
			$202,000
	New Freedom STP - New Freedom AWT		
	Pumping Station	35,000	
	400 LF of 16" FM	10,000	
			45,000
	SUB-TOTAL		$247,000
	Contingencies		49,000
	ITEM TOTAL		$296,000

TABLE IV-11 (Cont'd)

GLEN ROCK-SHREWSBURY-NEW FREEDOM-
RAILROAD URBAN AREAS

1972-1985 Period

Date	Project Item		Cost
	3. Advanced Treatment Facility		
1973	Construction of 2.4 MGD Type D AWT plant at New Freedom for year 2000 design.		
	Flow Basis of Design:		
	Average Daily Flow = 2.4 MGD		
	Maximum Day Flow = 5.0 MGD		
	Nitrification Facilities		
	Aeration basins	$250,000	
	Sedimentation basins	275,000	
	Sludge retention pump stations	50,000	
	ITEM TOTAL		$575,000
	Denitrification Facilities		
	Anaerobic denitrification basins	250,000	
	Sedimentation basins	275,000	
	Sludge return pump station	50,000	
	ITEM TOTAL		$575,000
	Chemical Treatment Facilities		
	Rapid mix basin	15,000	
	Flocculation units	60,000	
	Sedimentation basins	275,000	
	Recarbonation basin & equipment	150,000	
	Lime feed & storage equipment	75,000	
	Methanol feed & storage equipment	40,000	
	Lime Sludge dewatering and recalcination equipment	500,000	
	Chemical building	100,000	
	ITEM TOTAL		$1,215,000

TABLE IV-11 (Cont'd)

GLEN ROCK-SHREWSBURY-NEW FREEDOM-
RAILROAD URBAN AREAS

1972-1985 Period

Date	Project Item		Cost
1973 (Cont.)	Filter Building & Facilities		$550,000
	Reaeration Facilities		
	Aeration basin with mechanical aerators		70,000
	Chlorination Facilities		
	Chlorination contact tank	50,000	
	Chlorination feed & storage equipment	20,000	
	ITEM TOTAL		70,000
	Sludge Management Facilities		
	Sludge thickener	10,000	
	Sludge storage tank	10,000	
	Centrifuge	30,000	
	ITEM TOTAL		50,000
			240,000
	Yard Piping		250,000
	Electrical & Instrumentation		150,000
	Control & Laboratory Building		90,000
	Site Development		
	Roadwork & Paving	15,000	
	Landscaping	10,000	
	ITEM TOTAL		25,000
	Land Acquisition		
	10 acres @ $4,000		40,000
	FACILITY TOTAL		$3,650,000
	Contingencies		730,000
	ITEM TOTAL		$4,380,000
	1972-1985 CONSTRUCTION TOTAL		$4,676,000

TABLE IV-11 (Cont'd)

GLEN ROCK-SHREWSBURY-NEW FREEDOM-
RAILROAD URBAN AREAS

1986-2000 Period

Date	Project Item		Cost
	1. Secondary Treatment Plants		
1987	Expansion of Glen Rock contact stabilization plant by 0.2 MGD for year 2000 design capacity of 0.5 MGD	$331,000	
1987	Expansion of Shrewsbury-New Freedom-Railroad and contact stabilization plant by 0.55 MGD for year 2000 design capacity of 1.9 MGD	418,000	
	SUB-TOTAL		$749,000
	Contingencies		150,000
	ITEM TOTAL		$899,000
	2. Conveyance Systems		
	NONE		
	3. Advanced Treatment Facilities		
	NONE		
	1985-2000 CONSTRUCTION TOTAL		$899,000

TABLE IV-12

BASIC ALL WATER PLAN
GLEN ROCK-SHREWSBURY-NEW FREEDOM-RAILROAD URBAN AREAS
SUB-REGIONAL AWT
DETAILED OPERATING AND MAINTENANCE COSTS

Shrewsbury-New Freedom-Railroad and Glen Rock		
Secondary Treatment Plants[1]		
- Labor	90,000	105,000
- Energy	5,000	9,000
- Equipment & Supplies	10,000	15,000
- Chemicals	-	-
- Sludge Disposal	25,000	42,000
Subtotal	130,000	171,000
Transmission		
- Labor	$ 5,000	$ 5,000
- Energy	1,000	2,000
- Equipment & Supplies	1,000	1,000
Subtotal	7,000	8,000
Regional AWT Plant		
- Labor	110,000	130,000
- Energy	20,000	35,000
- Equipment & Supplies	45,000	50,000
- Chemicals	18,000	30,000
Subtotal	193,000	245,000
TOTAL PROJECT O&M COST	$330,000	$424,000

TABLE IV-13

BASIC ALL WATER PLAN
SMALL UPPER BASIN COMMUNITIES
(JACOBUS-LOGANVILLE-SEVEN VALLEYS-JEFFERSON-WINTERSTOWN)
FACILITIES COST ESTIMATE

1972-1985 Period

Date	Project Item		Cost
	2. Conveyance Facilities		
	Transmission to York Treatment Facilities:		
	Jefferson - Seven Valleys interceptor		
	25,200 LF of 8" GR		$ 352,000
	Seven Valleys - Reynolds Mill interceptor		
	27,300 LF of 8" GR		$ 382,000
	Reynolds Mill - Spray interceptor		
	Pumping Station (2 Stage Station)	$100,000	
	14,000 LF of 12" FM	210,000	
	3,100 LF of 10" GR	54,000	
			$ 364,000
	Loganville & Jacobus - Reynolds Mill interceptor		
	7,100 LF of 8" GR	$100,000	
	9,700 LF of 8" & 10" GR	155,000	
	3,200 LF of 8" GR	45,000	
			$ 300,000
	Winterstown - Red Lion interceptor		
	Pumping Station	$ 30,000	
	22,400 LF of 6" FM	168,000	
			$ 198,000
	SUB-TOTAL		$1,596,000
	Contingencies		319,000
	1972-1985 CONSTRUCTION TOTAL		$1,915,000

1986-2000 PERIOD - NO ADDITIONAL FACILITIES REQUIRED

TABLE IV-14

BASIC ALL WATER PLAN
SMALL URBAN COMMUNITIES
(JACOBUS-LOGANVILLE-SEVEN VALLEYS-JEFFERSON-WINTERSTOWN)
DETAILED OPERATING AND MAINTENANCE COSTS

	Annual Average Operating & Maintenance Cost of Facilities	
	1972-1985	1986-2000
Transmission to York AWT		
- Labor	15,000	15,000
- Energy	2,000	4,000
- Equipment & Supplies	1,000	2,000
SUB-TOTAL	18,000	21,000

MODIFIED ALL WATER PLAN

This plan considers the cost implications of adding carbon adsorption and regeneration processes to the advanced treatment sequence for the purpose of achieving the maximum performance obtainable with present technology. Addition of the carbon step would reduce the concentration of dissolved refractory organics remaining in the effluent as reflected in the COD concentration by approximately 50 percent. Typical effluent COD would therefore be reduced from the 20 to 30 mg/l level achievable with mixed media filtration to 10 to 15 mg/l with the inclusion of the carbon adsorption step. Other benefits of the carbon step would include a slight improvement in BOD removal and also the removal of a major portion of the residual color. System performance with and without the carbon step is summarized in Table IV-15. Inclusion of the carbon step would make the All Water Plan roughly equivalent to the All Land Plan in the removal of residual organics.

Facilities Requirements

The carbon system costed for this study utilizes granular carbon in a series of adsorption columns. Design criteria are a 6 gpm/ft^2 adsorption throughput rate, a 45 minute retention time, and a counter current flow system which features the use of the freshly regenerated carbon at the tail end of the flow system and the spent carbon at the head end.

The spent carbon is regenerated in a controlled oxidation, fluidized-bed reactor at 1400°F. A wet scrubber is required for control of atmospheric emissions.

Carbon adsorption and regneration facilities would be added at each of the three advanced treatment facilities as shown in Table IV-15. The carbon step would follow the mixed-media filters.

Project Costs

The additional costs for inclusion of carbon adsorption and regeneration to the Basic All Water Plan are summarized in Table IV-16. The additional capital investment would be $17,318,000 for the 1972-1986 period and $6,336,000 for the 1986-2000 period. The increase in average annual cost is estimated at $2,674,000 for the 1972-2020 planning period. Detailed capital and operating and maintenance costs for the carbon adsorption and regeneration facilities are presented in Tables IV-17 and IV-18, respectively.

TABLE IV-15

MODIFIED ALL WATER PLAN
PERFORMANCE CAPABILITIES & FACILITIES REQUIREMENTS

Performance Capabilities of Carbon Adsorption

Parameter	Basic All Water Plan (without carbon)	Modified All Water Plan (with carbon)
COD	20-30 mg/l	10-15 mg/l
BOD_5	4 mg/l	3 mg/l
COLOR	15-25 units	5-10 units

Facilities Requirements - MGD of Capacity

	Planning Periods 1972-85	1986-2000
York Urban Area Plant	35.0	16
Hanover-Penn Township Plant	6.5	-
Glen Rock-Shrewsbury-New Freedom-Railroad Plant	2.4	-

TABLE IV-16

MODIFIED ALL WATER PLAN - PROJECT COST SUMMARY

	Cost of Basic All Water Plan		Incremental Cost of Modified All Water Plan		PROJECT TOTAL	
Investment Costs ($1,000)	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Secondary Treatment Facilities	7,128	11,575	-	-	7,128	11,575
Advanced Treatment Facilities	31,576	10,716	-	-	31,576	10,716
Transmission Facilities	6,953	-	-	-	6,953	-
Carbon Adsorption & Regeneration Facilities	-	-	15,744	5,760	15,744	5,760
Sub-Total	45,657	22,291	15,744	5,760	61,401	28,051
Engineering & Overhead	4,567	2,229	1,574	576	6,141	2,805
Lands	936	-	-	-	936	-
Total, Investment Costs	51,160	24,520	17,318	6,336	68,478	30,856
Operations & Maintenance Costs ($1,000/year)						
Labor	1,480	1,820	323	386	1,803	2,206
Equipment & Supplies	568	767	115	132	683	899
Chemicals	556	805	257	406	813	1,211
Energy	630	932	257	403	887	1,335
Sludge Disposal	593	892	-	-	593	892
Total, O & M Costs	3,827	5,216	952	1,327	4,779	6,543
Other Costs ($1,000)						
Initial Stage Replacement Costs						
10-Year	6,678		3,149		9,827	
25-Year	8,649		3,149		11,798	
Second Stage Replacement Costs						
10-Year	2,722		1,152		3,874	
25-Year	5,037		1,152		6,189	
Salvage Value						
Facilities	3,022		715		3,737	
Lands	936		-		936	
Total Salvage Value	3,958		715		4,673	
Average Annual Costs ($1,000/yr)						
Average Annual Capital Cost	3,896		1,266		5,162	
Average Annual O & M Cost	4,360		1,096		5,456	
Average Annual Replacement Cost	719		314		1,033	
Average Annual Salvage Value	14		2		16	
Total, Average Annual Cost	8,961		2,674		11,635	

[1] Engineering & Overhead includes 10% of facilities cost

NOTE: All Investment Costs above include 20% contingencies.

TABLE IV-17
MODIFIED ALL WATER PLAN
COST SUMMARY

Treatment Facility	Cost of Basic All Water Plan 1972-1985	Cost of Basic All Water Plan 1986-2000	Incremental Cost of Modified All Water Plan 1972-1985	Incremental Cost of Modified All Water Plan 1986-2000	Total Cost of Modified All Water Plan 1972-1985	Total Cost of Modified All Water Plan 1986-2000
Investment Costs[1] ($1,000)						
York Urban Area	33,414	21,815	12,936	6,336	46,350	28,151
Hanover-Penn Township-Spring Grove	10,500	1,716	2,917	-	13,417	1,716
Glen Rock-Shrewsbury-New Freedom-Railroad	5,139	989	1,465	-	6,604	989
Jacobus-Loganville-Seven Valleys-Jefferson-Winterstown	2,107	-	-	-	2,107	-
TOTAL Investment Costs	51,160	24,520	17,318	6,336	68,478	30,856
Operation and Maintenance Costs ($1,000/year)						
York Urban Area	2,775	3,930	755	1,090	3,530	5,020
Hanover-Penn Township-Spring Grove	704	841	126	158	830	999
Glen Rock-Shrewsbury-New Freedom-Railroad	330	424	71	79	401	503
Jacobus-Loganville-Seven Valleys-Jefferson-Winterstown	18	21	-	-	18	21
TOTAL Operation & Maintenance Costs	3,827	5,216	952	1,327	4,779	6,543

[1] All costs include contingencies, engineering and overhead.

TABLE IV-18

MODIFIED ALL WATER PLAN
INVESTMENT COST OF CARBON ADSORPTION
& REGENERATION FACILITIES

York Urban Area Facility	1972-1985	1986-2000
Carbon Adsorption & Carbon Regeneration Facilities	9,800,000	4,800,000
Contingencies	1,960,000	960,000
SUB-TOTAL	11,760,000	5,760,000
Engineering & Overhead	1,176,000	576,000
TOTAL	12,936,000	6,336,000
Hanover-Penn Township-Spring Grove Urban Area Facility		
Carbon Adsoprtion & Carbon Regeneration Facilities	2,210,000	
Contingencies	442,000	
SUB-TOTAL	2,652,000	-
Engineering & Overhead	265,000	
TOTAL	2,917,000	
Glen Rock-Shrewsbury-New Freedom-Railroad Urban Area Facility		
Carbon Adsorption & Carbon Regeneration Facilities	1,110,000	
Contingencies	222,000	
SUB-TOTAL	1,332,000	-
Engineering & Overhead	133,000	
TOTAL	1,465,000	

TABLE IV-19

MODIFIED ALL WATER PLAN
OPERATING & MAINTENANCE COST OF
CARBON ADSORPTION & REGENERATION FACILITIES

	1972-1985	1986-2000
York Urban Area Facility		
Labor	215,000	260,000
Energy	230,000	370,000
Equipment & Supplies	80,000	90,000
Chemicals	230,000	370,000
TOTAL	755,000	1,090,000
Hanover-Penn Township-Spring Grove Urban Area Facility		
Labor	61,000	75,000
Energy	21,000	26,000
Equipment & Supplies	23,000	28,000
Chemicals	21,000	29,000
TOTAL	126,000	158,000
Glen Rock-Shrewsbury-New Freedom-Railroad Facility Urban Area Facility		
Labor	47,000	51,000
Energy	6,000	7,000
Equipment & Supplies	12,000	14,000
Chemicals	6,000	7,000
TOTAL	71,000	79,000

ALL LAND TREATMENT PLAN

Land treatment of wastes as proposed in the Codorus Basin Study Area as an alternative to tertiary water based processes entails the land application of liquid wastes after receiving the equivalent of secondary treatment. Low rate (typically 2 in/week) sprinkler application systems would be required to achieve nutrient removals consistent with Study objectives.

Extensive land use, geological, soils and hydrogeological studies were conducted in the alternatives evaluation process to identify opportunities for land treatment of the major York area wastewater flows in addition to the upper basin community sources. These studies indicated that the Schist and Phyllite terrainal areas were the most suitable geophysical units based on analysis of soils, topography and hydrogeology.

Land Treatment of York Area Wastes

The optimum site location for the development of a large integrated land treatment site capable of treating flows of 30 to 50 MGD was established as the upland region between the West and South Branches of Codorus Creek above Indian Rock Dam. Slope conditions, useful site area, soil permeability and sub-drainage management capabilities were most favorable at this location. A potential project site area of over 13,000 acres (Exhibit IV-14) was identified.

The total project site area would be divided into the following uses:

Storage pond surface area	- 700 acres
Unusable steep slope area	- 2,753 acres
Potential irrigation area	- 9,600 acres

The basis of analysis used for relating land requirements to wastewater flows has been an irrigation rate capability of 2" per week for 8 months per year. At this rate and assuming that 8,600 acres total site area is utilized, a site capacity of 44 MGD is developable. Under the above assumptions this site could handle York area flows until the year 1993.

A number of site management options makes it possible for this site to handle the flows to the year 2000 (estimated at 51 MGD) and beyond. These include:

1. Incorporation of reuse of the secondary treated wastewater as a raw water supply to the P. H. Glatfelter Company. The pipeline to the irrigation site returns the wastewater to the Glatfelter location. Approximately 20 to 28 MGD of wastewater flow could be reused which would reduce irrigation flows to 30 MGD or less in the year 2000.

2. Incorporation of a thermal power plant at the irrigation site storage lagoon. A 1,000 MW power plant would evaporate up to 16 MGD of wastewater which would concentrate nutrients to desirable levels.

3. Extension of the annual irrigation period to 9 months (40 weeks). Virtual year-round wastewater irrigation is currently practiced at the Penn State University facility and many industrial operations.

To maximize utilization of the site, two types of irrigation equipment would be utilized. Approximately 7,000 acres would be covered using the center pivot rotating rig equipment as discussed previously for the upstream community land sites. The remaining 1,600 acres in various small parcels would be irrigated with the higher cost fixed nozzle system. Water distribution to the irrigation equipment would be accomplished from a central pumping station augmented by a group of booster pump stations located at various points along the main distribution pipeline network. This system achieves the efficient distribution of water at adequate pressure (30 to 60 psi at the rotating rig pivot point) from the storage pond located at elevation 645 to the irrigation sites which range in elevation from 600 to 850 feet.

The irrigation site area would be developed in two stages. The first stage would involve installation of only the required number of rotating rigs sufficient to handle the 1985 projected flows. Additional rotating rigs and the provision of fixed nozzle systems to maximize site usage would be undertaken after 1985. Equipment and site requirements for the two stage program are shown below:

Design Period (year)	Flow (MGD)	Irrigation Area at 2" per week 40 wks per year	Equipment Rotating Rigs (No. of)	(Acres)	Fixed Systems (Acres)
1985	35	5900 Acres	29-1300' radius	3500	-
			80-650' radius	2400	-
2000	51	8600 Acres	37-650' radius	1100	1600

Land Treatment for Wastes from Upper Basin Communities

Land irrigation to achieve high level advanced waste treatment can accomplish the highest level of dependable performance for the communities in the upper basin with only moderate land requirements. For the ten communities in this group, the total year 2000 estimated flow is 9.35 MGD. This would require 1,800 acres of irrigation area at the design basis rate of 2" per week for 8 months annual operation.

For the communities of Hanover, Penn Township, Spring Grove, Glen Rock and Railroad-New Freedom, secondary biological treatment would continue to be provided at the present treatment plants. After treatment the wastes would be pumped to the irrigation site storage pond and then irrigated during the appropriate climatological conditions. Land treatment sites would be located in the Schist and Phyllite terrainal areas of the upper basin.

The land treatment system for the communities of Loganville, Seven Valleys, Jacobus, Jefferson and Winterstown would have incorporated an aerated lagoon or package type treatment plant to provide secondary treatment before discharge to the storage pond.

Design Aspects of Land Treatment Systems

The land treatment component of the land treatment system is composed of three basic facilities elements: water storage, irrigation and drainage. The design aspects of each of these is discussed separately.

Site Storage Facilities

Storage will be provided for approximately four months each year when cold weather will not permit irrigation or effective land treatment. The storage will also be used during the irrigation season to buffer the fluctuations in flow and the fluctuations in application rates due to climatic conditions.

At the three larger project sites and at Jacobus-Loganville detention ponds will be formed by damming local drainage ways. The maximum pond depth will vary up to 130 feet; however, the pond surface fluctuation will be limited to 20 feet. The pond area exposed during maximum drawdown will be minimized by sculpturing the pond rim to a one on five slope over the drawdown depth.

Irrigation Facilities

Center pivot irrigation machines are proposed for use in the Codorus Basin. Other methods considered have been a fixed system with individual risers (similar to the Penn State Experimental Station). and a travelling gun type system with a water trajectory similar to that of a fire hose. A schematic drawing of the center pivot machine and a typical project site area are shown on Exhibits IV-15 and IV-16.

The considerations involved in the selection of equipment include:

1. Uniformity of application.
2. Ease of operation under widely varying slope, soil, and climatic conditions.
3. Reliability.
4. Minimization of spray drift.
5. Minimization of soil compaction and permeability reduction under long term operation.

6. Coverage given the peculiar geometry of suitable land in the Codorus Basin.
7. Capital and operating cost.

Of all these considerations, except coverage, center pivot machines perform best; and the differences are relatively minor under the coverage consideration. This type of machine is compatible with any kind of agricultural practices that are otherwise suitable.

The pre-treated wastewater would be pumped from the storage ponds to the irrigation machines through a network of buried pipe with the last reach connecting to the machine being 6 inch diameter plastic pipe. The wastewater would be delivered to the pivot of the irrigation machine at a minimum pressure of 30 psi. In many cases, the machine will be operating on approximately 10 per cent slope, therefore, the static head differential between the pivot and the end of a 650 foot radius machine will vary from +65 feet to -65 feet. A series of pressure regulating valves will be installed along the irrigation machine to equalize the pressure at each nozzle head. Nozzles will be arranged so as to spray down rather than up and the droplet size will be adjusted so as to maximize the trade-off between large droplets to minimize drift, and small droplets to minimize soil compaction.

At the smaller project sites only one center pivot irrigation machine is needed, and the scheme shown in Exhibits IV-17 and IV-18 has been devised where a round storage pond has been formed with the irrigation machine pivoting from a tower in the center of the storage pond. The outside perimeter of the storage pond would be irrigated. This arrangement eliminates all distribution piping and provides a built-in buffer around the storage lagoon.

Site Drainage Facilities

Under present climatic, soil and agricultural conditions, the project areas are free draining with the groundwater at a depth of approximately 30 feet. The wastewater application program will supplement the natural precipitation by about 69 inches per year, and it will do it in such a way as to minimize surface runoff. It is anticipated that the soils and bedrock will not be able to effectively handle the increased flow while maintaining an aerated root zone and that supplemental drainage will be necessary.

Two systems of supplemental drainage are available - wells and tile drains. Both systems are effective and can be employed in the Codorus Basin. The choice is primarily a question of cost including both capital and operating costs. Due to the relatively low permeability (compared to say, sandy soil) in the Codorus Basin, the wells will be either fairly deep and/or fairly close together; and the tile spacing will be very close. The layouts and cost estimates in this report are based on a well system since its design parameters and unit costs can be more precisely identified at this time.

The cost of a tile system using currently standard practices would be very high; however, newer techniques have been developed and are being tested. These are based on giant, laser guided trenching machines which install corrugated, perforated plastic pipe in a continuous operation. These newer techniques could dramatically reduce the costs of tile systems to less than the cost of well systems especially since the tiles have virtually zero operating costs. During design studies the alternative of tile drainage should be thoroughly explored.

After the renovated wastewater is drained by either wells or tiles it will be discharged to the immediately adjacent waterways. To accomplish re-aeration before return to the surface water a rapid fall turbulent flow segment will be provided at each discharge point.

Design Alternatives

Two separate design plans have been formulated for implementation of an all land treatment plan. One is designated the Basic All Land Plan and the other the Modified All Land Plan.

The Basic All Land Plan features the abandonment of the existing York Area secondary treatment plants and the development of a single aerated lagoon complex adjacent to the land disposal site to provide secondary treatment for all York Area wastes. The

Modified All Land Plan provides for the maintenance of the present secondary plants. In both plans land treatment of the upper basin urban areas would encorporate utilization of the existing or programmed secondary plants at Penn Township, Hanover, Spring Grove, Glen Rock and New Freedom-Railroad. Figure IV-3 depicts the general facilities plan.

Other differences between the Basic and Modified Plans include the following:

1. The use of aerated lagoons for pre-treatment of wastes from the small upper basin communities in the Basic Plan versus the use of conventional package treatment plants in the Modified Plan.

2. The institution of a greater site isolation discipline in the Modified Plan requiring the acquisition of a larger number of dwellings.

Basic All Land Treatment Plan - York Urban Area

In this alternative the York Area secondary treatment plants would initially or subsequently be replaced by an aerated lagoon biological treatment cell facility located at the land treatment site for this area. The aerated lagoon offers the most economical choice for achieving the equivalent of secondary biological treatment required for the wastes prior to land treatment. This entails obtaining 70-90% stabilization of the biochemical oxygen demanding material.

Transmission Facilities

The points of access to the land site transmission system would be located at the present municipal treatment plants: York, Springettsbury Township and Dover Township. Pumping stations would replace these plants. Wastes collected from the areas served by the Dover and Springettsbury plants would be pumped to a point where they would be joined by the York service area flows. Flows from all three areas would then be pumped a distance of 11 miles upstream to the location of the new pre-treatment facility. The transmission pipeline from the York urban area to the treatment site would be a 60 inch diameter pipeline sized to handle a peak flow of 90 mgd.

Pre-Treatment Facility

A complete mix three cell aeration facility would be constructed to provide a 3-day treatment detention time for the 51MGD design flow. Mechanical aerators and mixers would be used to maintain all solids in suspension during the treatment period. After treatment the effluent would be discharged to storage ponds which would be used for solids separation and sludge detention.

The storage ponds would be formed by constructing two dams (Exhibit IV-19). A total working volume of 6,120 million gallons (51 MGD x 120 days) can be obtained in the 710 acre combined lake (shown in Exhibit IV-20) with a drawdown of 40 feet. Contouring the perimeter of the storage pond to a slope of one on five would minimize land exposure at maximum drawdown (indicated by the shaded perimeter area shown in Exhibit IV-20). Floating aerators (one 75 HP unit for each 10 acres of surface area) would be provided to maintain adequate dissolved oxygen conditions for the maintenance of aerobic processes at all times.

The clarified effluent from Pond B would be discharged after 30 days detention into Pond A which would be used as the regulation and storage pond prior to irrigation. The deeper area of reservoir B (which is 80 feet deep at the dam) would be used for sludge storage. Fluctuation of this pond would be minimized and supplemental oxygen would be provided with mechanical aerators.

Sludge Disposal

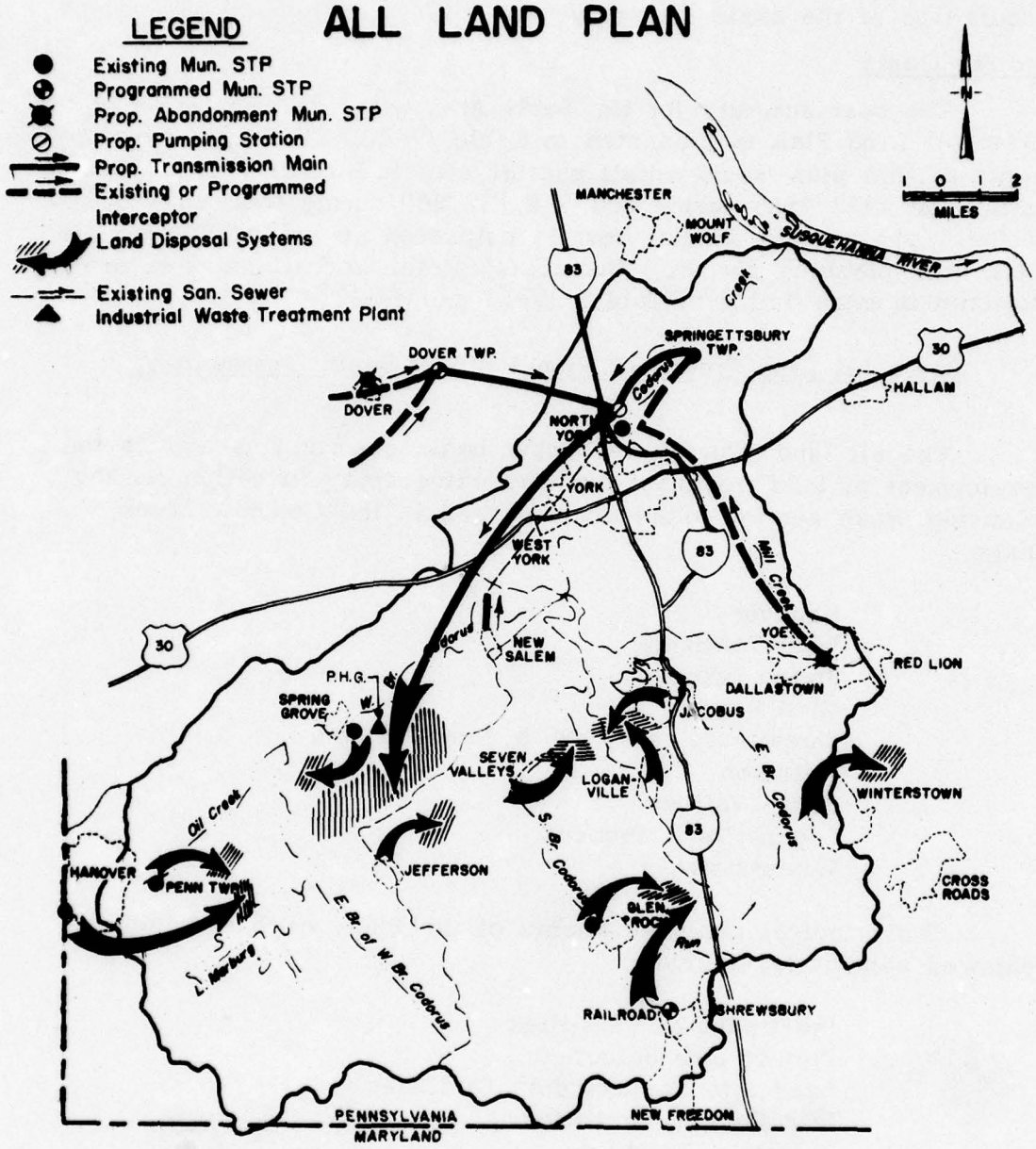
The sludge deposited in Pond B would be applied to the land at the site as soil conditioner during the warmer months of the year. This would be accomplished by dredging Pond B and chemically treating the sludge prior to land application. Land sites used would be those parts of the site not initially used for irrigation and those areas where irrigation will not be practiced at any time. Sludge would be applied to the land through a moveable sludge pipeline and automatic application equipment which would spread the material and immediately disc it into the soil.

Site Acquisition and Housing Relocation

A significant number of non-farm residences are located on and in the vicinity of the prospective land treatment site for the York area. A total of 275 residential units are located within the basic site and an additional 185 are located in areas adjacent to the site. Depend-

CODORUS CREEK WASTEWATER MANAGEMENT STUDY

ALL LAND PLAN



ing on site isolation requirements (beyond the minimum 500 ft. isolation from the nearest residence provided by the basic site) and acquisition procedures (whether or not to acquire the small urban nodes near the site), project costs for site acquisition can vary substantially. Cost estimates for the Basic All Land Plan were developed for acquisition of the basic site only.

Project Costs

The cost summary for the Study Area with implementation of the Basic All Land Plan is presented in Table IV-20. The total cost requirements of this plan would entail capital investments of $79,101,000 during the 1972-1985 period and $ 8,732,000 during the 1986-2000 period. The average annual cost is estimated at $8,044,000 for the 1972-2000 planning period. The costs for the York Urban Area are itemized in more detail in Tables IV-21 and IV-22.

Basic All Land Treatment Plan - Upper Basin Communities

The all land plan for the upper basin communities entails the development of land treatment systems using spray irrigation for the following urban service areas encompassed in the Codorus Creek Study:

Hanover
Penn Township
Spring Grove
Glen Rock
Shrewsbury, Railroad & New Freedom
Jefferson
Seven Valleys
Loganville & Jacobus
Winterstown

The principal design elements of the Plan, each of which are reviewed separately, include:

Pre-treatment Facilities
Project Site Selection
Land Site Transmission Facilities
Site Storage Facilities
Irrigation Facilities
Site Drainage Facilities
Land Acquisition

TABLE IV-20

BASIC ALL LAND PLAN - PROJECT COST SUMMARY

	York Urban Area		Upper Basin Communities		PROJECT TOTAL	
	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Investment Costs ($1,000)						
Secondary Treatment System	6,152		1,220	2,459	7,372	2,459
Conveyance Facilities	2,606		-	-	2,606	-
Transmission Facilities	8,604		2,548	-	11,152	-
Storage Facilities	6,624		4,516	-	11,140	-
Distribution Piping & Pumping	6,048		1,347	-	7,395	2,155
Irrigation Machines	3,030		747	-	3,777	1,386
Drainage Wells	4,242		1,474	-	5,716	1,938
Sub-Total	37,306		11,852	2,459	49,158	7,938
Engineering & Overhead[1]	3,731		1,185	246	4,916	794
Lands	19,686		5,341	-	25,027	-
Total, Investment Costs	60,723		18,378	2,705	79,101	8,732
Operations & Maintenance Costs ($1,000/year)						
Labor	675	866	363	415	1,038	1,281
Equipment & Supplies	96	126	68	94	164	220
Chemicals	10	14	3	3	13	17
Energy	551	747	121	169	672	916
Sludge Disposal	225	315	121	171	346	486
Total, O & M Costs	1,557	2,068	676	852	2,233	2,920
Other Costs ($1,000)						
Initial Stage Replacement Costs						
10 Year	2,377		646		3,023	
25 Year	4,253		1,487		5,740	
Second Stage Replacement Costs						
10 Year	294		123		417	
25 Year	1,200		615		1,815	
Salvage Value						
Facilities	720		369		1,089	
Lands	9,708		3,190		12,898	
Total Salvage Value	10,428		3,559		13,987	
Average Annual Costs ($1,000/year)						
Average Annual Capital Cost	4,011		1,238		5,249	
Average Annual O & M Cost	1,753		744		2,497	
Average Annual Replacement Cost	251		76		327	
Average Annual Salvage Value	36		12		48	
Total, Average Annual Cost	5,979		2,046		8,025	

[1] Engineering & Overhead includes 10% of facilities cost.

NOTE: All Investment Costs above include 20% contingencies.

BASIC ALL LAND PLAN - PROJECT COST SUMMARY

	Hanover-Penn Twp. Urban Area		Shrewsbury-New Freedom-Railroad Glen Rock Area		Spring Grove Service Area	
	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Investment Costs ($1,000)						
Secondary Treatment System	1,044	1,320	-	899	-	240
Conveyance Facilities	-	-	-	-	-	-
Transmission Facilities	1,309	-	601	-	196	-
Storage Facilities	1,955	-	2,014	-	204	-
Distribution Piping & Pumping	686	-	442	-	47	-
Irrigation Machines	480	-	180	-	24	-
Drainage Wells	821	-	505	-	47	-
Sub-Total	6,295	1,320	3,742	899	518	240
Engineering & Overhead [1]	630	132	374	90	52	24
Lands	3,502	-	1,362	-	144	-
Total, Investment Costs	10,427	1,452	5,478	989	714	264
Operations & Maintenance Costs ($1,000/year)						
Labor	206	234	101	124	35	35
Equipment & Supplies	46	65	14	21	4	4
Chemicals	2	2	1	1	-	-
Energy	81	111	26	40	4	5
Sludge Disposal	87	119	25	42	5	6
Total, O & M Costs	422	531	167	228	48	50
Other Costs ($1,000)						
Initial Stage Replacement Costs						
10 Year	388		168		21	
25 Year	895		315		59	
Second Stage Replacement Costs						
10 Year	66		45		12	
25 Year	330		225		60	
Salvage Value						
Facilities	198		135		36	
Lands	1,854		977		106	
Total Salvage Value	2,052		1,112		142	
Average Annual Costs ($1,000/year)						
Average Annual Capital Cost	700		374		52	
Average Annual O & M Cost	464		191		49	
Average Annual Replacement Cost	45		19		3	
Average Annual Salvage Value	7		4		-	
Total, Average Annual Cost	1,202		580		104	

[1] Engineering & overhead includes 10% of facilities cost.

NOTE: All investment costs above include 20% contingencies.

TABLE IV-20 (continued)

Jacobus-Loganville Service Area		Seven Valleys Service Area		Jefferson Service Area		Winterstown Service Area	
1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
110	-	24	-	22	-	20	-
-	-	-	-	-	-	-	-
300	-	46	-	48	-	48	-
104	-	104	-	76	-	59	-
54	-	40	-	39	-	39	-
36	-	10	-	9	-	8	-
79	-	10	-	6	-	6	-
683	-	234	-	200	-	180	-
68	-	23	-	20	-	18	-
238	-	35	-	30	-	30	-
989	-	292	-	250	-	228	-
4	5	5	5	6	6	6	6
1	1	1	1	1	1	1	1
-	-	-	-	-	-	-	-
6	8	2	3	1	1	1	1
2	2	1	1	1	1	-	-
13	16	9	10	9	9	8	8
26		17		13		13	
88		48		41		41	
-		-		-		-	
-		-		-		-	
-		-		-		-	
158		35		30		30	
158		35		30		30	
63		19		16		14	
14		9		9		8	
3		2		2		2	
-		-		-		-	
80		30		27		24	

Pre-Treatment Facilities

For most of the indicated communities pre-treatment would be provided by the existing secondary treatment facility now serving that community. These include:

Hanover
Penn Township
Spring Grove
Glen Rock
Shrewsbury, Railroad & New Freedom (under construction)

The treated wastes would then be conveyed to the land treatment site proposed for each area. For the remaining service areas (Jefferson, Seven Valleys, Loganville, Jacobus and Winterstown) a pre-treatment facility would be constructed at the land treatment site. This facility could be either a manufactured package type activated sludge plant or an aerated lagoon. Cost estimates have been developed for the Basic Plan using the lower cost aerated lagoons as the design basis.

Site plans for the five secondary treatment plants located at the urban service areas are given by the following exhibits:

Exhibit IV-21	Hanover Treatment Plant
Exhibit IV-22	Penn Township Treatment Plant
Exhibit IV-23	Spring Grove Treatment Plant
Exhibit IV-24	Glen Rock Treatment Plant
Exhibit IV-25	Shrewsbury-New Freedom-Railroad Treatment Plant

Project Site Selection

Geological, soils and engineering studies presented in the back-up studies (Phase I, II & III Reports) have identified the Schist and Phyllite terrainal areas as being the only environmental units generally suitable for land irrigation of wastewater in the Codorus Basin.

Land application project sites are available nearby to each of the upper basin communities. The soils within each project site have been identified in the York County Soil Survey as being primarily of the Chester series except Seven Valleys where primarily Manor Soils are involved. The Chester and Manor Soils have been identified during the field exploration program associated with this study as having the best characteristics of the soils in the Codorus Basin for land application of pre-treated wastewater from the point of view of depth of soil profile, permeability of soil and underlying rock and reasonable slope conditions.

Site plans for the individual facilities are shown in the following exhibits:

Exhibit IV-26	Hanover & Penn Township Land Treatment System
Exhibit IV-27	Spring Grove Land Treatment System
Exhibit IV-28	Glen Rock & Shrewsbury-Railroad New Freedom Land Treatment System
Exhibit IV-29	Loganville & Jacobus Land Treatment System
Exhibit IV-30	Seven Valleys Land Treatment System
Exhibit IV-31	Jefferson Land Treatment System
Exhibit IV-32	Winterstown Land Treatment System

Land Site Transmission Facilities

Effluent from existing and expanded secondary treatment plants at Hanover-Penn Township, Glen Rock-Shrewsbury, et. al., and Spring Grove will be pumped to storage ponds at the project site areas. Raw sewerage will be pumped from the smaller service areas of Jacobus-Loganville, Jefferson, Seven Valleys and Winterstown to pre-treatment facilities at the project site areas - then to storage ponds. These facilities are shown on the Site Plan exhibits for the individual areas.

Project Costs

Detailed capital cost estimates and facilities requirements for the upper basin communities are given in Table IV-23 . Detailed operating and maintenance costs for the upper basin communities are given in Table IV-24 . These same costs are also summarized in Table IV-20 .

TABLE IV-21
BASIC ALL LAND PLAN
(Utilizing Aerated Lagoons for Pre-Treatment)
YORK URBAN AREA
FACILITIES COST ESTIMATE

1972-1985 Period

1. Secondary Treatment Facilities

Lagoon Treatment System
51 MGD Three Cell Complete
Mix System with 3 Days Detention

	Unit	Quantity	Rate	Amount
Site Clearing	Acre	50	500	25,000
Earthwork	Cu.Yd.	600,000	1.50	900,000
Concrete-Slabs on Earth	Cu.Yd.	7,700	100	770,000
Concrete-Flume Walls	Cu.Yd.	1,100	200	220,000
Concrete-Gate Towers	Cu.Yd.	220	200	44,000
Gate Systems in Towers	Each	4	15,000	60,000
Lagoon Lining	Sq.Yd.	165,000	2.50	413,000
Aerators (75 HP)	Each	35	17,000	595,000
Mixers (75 HP)	Each	15	22,000	330,000
Electrical	Lump Sum			100,000
Inlet & Outlet Weirs	Lump Sum			60,000
Interconnecting Structures	Lump Sum			50,000
Fencing	Lump Sum			25,000
Seeding, Fertilizing, Mulching	Acre	25	1,000	25,000
Roadways on Dikes	Sq.Yd.	20,000	5.00	100,000
Pump Station to Reservoir(95 MGD)	Lump Sum			500,000
Service & Administration Building	Lump Sum			400,000
Land Acquisition	Acre	50	1,000	50,000
		Sub-Total		4,667,000
		Contingencies		933,000
		ITEM TOTAL		5,600,000

TABLE IV-21 (Cont'd)

1972-1985 Period

Sludge Disposal System

25 MGD Sludge Pump Station -60,000/MGD		150,000
10"diameter Drawoff Pipeline - 10,000'@12.50		125,000
12"diameter Aluminum Header Pipe - 25,000'@4.00		100,000
2-Ag.Rain Sludge Spreader @1,000 gpm		20,000
1-Booster Pump Station L.S.		30,000
8" Aluminum Laterals-10,000'@3.50		35,000
	Sub-Total	460,000
	Contingencies	92,000
	ITEM TOTAL	552,000
SECONDARY TREATMENT FACILITIES TOTAL		$6,152,000

2. Conveyance Facilities

Springettsbury to York treated waste pipeline		
Pumping Station	$ 105,000	
21,500 LF of 36" FM @$55/ft	1,180,000	
		$1,285,000
Dover-York treated waste pipeline		
Pumping Station	$ 70,000	
27,500 LF of 18" FM @$25/ft	688,000	
		$ 758,000
New Salem - York Interceptor		
Pumping Station	$ 30,000	
9,400 LF of 6" FM @$8.75/ft	82,000	
1,200 LF of 8" GR @$14.00/ft	17,000	
		$ 129,000
SUB-TOTAL		$2,172,000
Contingencies		434,000
CONVEYANCE FACILITIES TOTAL		$2,606,000

TABLE IV-21 (Cont'd)

3. Land Treatment Site

1973 TRANSMISSION FACILITIES

From York STP to Storage Ponds:
Pumping Station - Q(Peak)=90 MGD;
TDH (Peak) = 412' $1,870,000
Pipeline - 56,000 L.F. of 60" FM $5,300,000

$7,170,000

1972-1985 Period

STORAGE FACILITIES

Foundation Treatment	Lump Sum	$ 200,000	
Fill Material	3,000,000 c.y.@$1.25/c.y.	3,750,000	
Rip rap	73,300 c.y.@$8.00/c.y.	586,000	
Clearing	355 Ac. @$800.00/Ac.	284,000	
Aerators	70-50 HP@$10,000/Aerator	700,000	
			$5,520,000

DISTRIBUTION PIPING AND PUMPING

Piping:	Diameter	Unit Price	Length	
	42"	$42.00	20,000 L.F.	$ 840,000
	30"	30.00	28,000 L.F.	840,000
	24"	24.00	18,000 L.F.	432,000
	16"	16.00	75,000 L.F.	1,200,000
	6"	4.80	120,300 L.F.	578,000

Pumping:	Number	Discharge	Head	
	1	41.7 mgd	500'	1,251,000
	3	14.0	122'	975,000
	1	12.8	115'	245,000
	1	12.0	362'	475,000
				$6,836,000
			x 35 MGD(1985) / 51 MGD(2000) =	$5,040,000

TABLE IV-21 (Cont'd)

1972-1985 Period

IRRIGATION MACHINES

29 - 1300' Radius (120 ac) Center Pivot Machines @$17,000	$ 493,000
117 - 650' Radius (30 ac) Center Pivot Machines @$10,000	1,170,000
1,600 acres fixed risers @$950 per acre	1,520,000
	3,183,000
Electrical Distribution (both Irrigation Machines and Drainage Wells 250,000 L.F. @$2.00/L.F. (including appurtenances)	500,000
	$3,683,000

$$\times \frac{35 \text{ MGD (1985)}}{51 \text{ MGD (2000)}} = \$2,525,000$$

DRAINAGE WELLS

392 Wells
each 215' Deep, Pumping 120 gpm, spaced 1,000 on center

Item	Number	Unit Cost	
Drilling & Casing			
12" Wells	215 L.F.	$30/L.F.	$6,450
Pump	1	L.S.	2,500
Electrical Connection	1	L.S.	1,000
Discharge Pipe	1,000 L.F.	$3.20/L.F.	3,200
			$13,150
			$5,150,000

$$\times \frac{35 \text{ MGD (1985)}}{51 \text{ MGD (2000)}} = \$3,535,000$$

TABLE IV-21 (Cont'd)

1972-1985 Period

Land, Residences, Relocations and Moving

Land:		
9,653 acres (slopes<15%) @$750/ac	$7,240,000	
3,400 acres (slopes>15%) @$250/ac	850,000	
Residences:		
275 residences @$25,000 per unit	6,875,000	
Relocations and Moving:		
275 residences @$3,500	963,000	
159 farmsteads @$3,000	477,000	
SUB-TOTAL		$ 16,405,000
LAND SITE SUB-TOTAL		40,195,000
Contingencies		8,039,000
LAND SITE TOTAL		48,234,000
1972-1985 CONSTRUCTION TOTAL		$ 56,992,000

1986-2000 Period

1. Secondary Treatment Plants

NONE

2. Conveyance Facilities

NONE

3. Land Treatment Site

1986	Distribution Piping and Pumping	$ 1,796,000
	Irrigation Machines	1,155,000
	Drainage Wells	1,617,000
	SUB-TOTAL	$ 4,566,000
	Contingencies	913,000
	ITEM TOTAL	$ 5,479,000
	1986-2000 PROJECT TOTAL	$ 5,479,000

TABLE IV-22
BASIC ALL LAND PLAN
(Utilizing Aerated Lagoons for Pre-Treatment)
YORK URBAN AREA
DETAILED OPERATING AND MAINTENANCE COSTS

	Annual Average Operating & Maintenance Cost of Facilities	
	1972-1985	1986-2000
Local Transmission to York STP		
- Labor	$ 30,000	$ 30,000
- Energy	9,000	21,000
- Equipment & Supplies	3,000	4,000
Subtotal	42,000	55,000
Transmission from York to Aerated Lagoons		
- Energy	150,000	210,000
- Labor	45,000	63,000
- Chemicals	-	-
- Equipment & Supplies	5,000	7,000
Subtotal	200,000	280,000
PROJECT SITE AREA:		
Aerated Lagoons		
- Labor	240,000	300,000
- Energy	95,000	139,000
- Equipment & Supplies	45,000	60,000
- Chemicals	-	-
- Sludge Disposal	225,000	315,000
Subtotal	605,000	814,000
Storage Ponds and Aerators		
- Energy	57,500	57,500
- Labor	-	-
- Chemicals	-	-
- Equipment & Supplies	-	-
Subtotal	57,500	57,500

TABLE IV-22 (Cont'd)

	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
PROJECT SITE AREA:		
Pumping and Distribution		
- Energy	$ 115,000	$ 159,000
- Labor	10,000	13,000
- Chemicals	10,000	14,000
- Equipment & Supplies	3,000	5,000
Subtotal	138,000	191,000
Irrigation Machines		
- Energy	25,000	30,000
- Labor	350,000	460,000
- Chemicals	-	-
- Equipment & Supplies	40,000	50,000
Subtotal	415,000	540,000
Drainage Facilities		
- Energy	99,000	130,000
- Labor	-[1]	-[1]
- Chemicals	-	-
- Equipment & Supplies	-[1]	-[1]
Subtotal	99,000	130,000
TOTAL PROJECT O&M COST	$1,557,000	$2,068,000

[1] Included under Irrigation Machines

TABLE IV-23

BASIC ALL LAND PLAN
(Utilizing Aerated Lagoons for Pre-Treatment)
UPPER BASIN COMMUNITIES
FACILITIES COST ESTIMATE

HANOVER-PENN TOWNSHIP URBAN AREA

SECONDARY TREATMENT				
Hanover STP expansion of 1.5 mgd in 1975				$ 870,000
Penn Township expansion of 0.5 mgd in 1987				$ 400,000
Hanover Trickling Filter Rehabilitation in 1986				$ 700,000
SUB-TOTAL SECONDARY TREATMENT				$1,970,000
TRANSMISSION FROM SERVICE AREA TO IRRIGATION SITE				
Pipeline:	Diameter	Unit Price	Length	
	20"	$25.00	30,500 L.F.	$ 763,000
	16"	$22.00	8,100 L.F.	178,000
Pumping Station:	Number	Discharge	Head	
	1	3.9 mgd	288	80,000
	1	2.2 mgd	210	70,000
SUBTOTAL TRANSMISSION FACILITIES				$1,091,000
STORAGE FACILITIES				
Fill Material	883,000 c.y. @$1.25/c.y.			$1,104,000
Foundation Treatment	Lump Sum			100,000
Rip rap	27,000 c.y. @$8.00/c.y.			216,000
Clearing	74 Ac. @$800.00/Ac.			59,000
Aerators	15-50 HP @$10,000/Aerator			150,000
SUBTOTAL STORAGE FACILITIES				$1,629,000
DISTRIBUTION PIPING AND PUMPING				
Piping:	Diameter	Unit Price	Length	
	16"	$16.00	10,000 L.F.	160,000
	14"	$14.00	10,000 L.F.	140,000
	6"	$ 4.80	28,000 L.F.	135,000
Pumping:	Number	Discharge	Head	
	4	2.3 mgd	225'	137,000
SUBTOTAL DISTRIBUTION PIPING & PUMPING				$ 572,000

TABLE IV-23 (Cont.)

HANOVER-PENN TWP. SERVICE AREA (Cont.)

IRRIGATION MACHINES

40 Center Pivot Irrigation Machines each 650' Radius (30 Acres) @$10,000 per machine	400,000
SUBTOTAL IRRIGATION MACHINES	$ 400,000

DRAINAGE WELLS

52 Wells
each 215' Deep, Pumping 120 gpm, spaced 1,000' on center

Item	Number	Unit Cost		
Drilling & Casing 12" Well	215 L.F.	$30/L.F.	$6,450	
Pump	1	L.S.	2,500	
Electrical Connection	1	L.S.	1,000	
Discharge Pipe	1,000 L.F.	$3.20/L.F.	3,200	
				684,000
SUBTOTAL DRAINAGE WELLS				$ 684,000

LAND, RESIDENCES, RELOCATION AND MOVING

Land:	
1,900 Acres (Slopes < 15%)@$750 per acre	1,430,000
460 Acres (Slopes > 15%)@$250 per acre	115,000
Residences:	
45 Residences @$25,000	1,125,000
Relocations and Moving:	
45 Residences @$3,500	157,500
30 Farmsteads @$3,000	90,000
SUB-TOTAL LAND, RESIDENCES, RELOCATIONS AND MOVING	$2,918,000
SUB-TOTAL ALL FACILITIES	9,264,000
Contingencies	1,853,000
TOTAL CONSTRUCTION COSTS	11,117,000
CONSTRUCTION COSTS 1972-1985 PERIOD	9,797,000
CONSTRUCTION COSTS 1986-2000 PERIOD	1,320,000

TABLE IV-23 (Cont.)

SHREWSBURY-NEW FREEDOM-RAILROAD
AND GLEN ROCK SERVICE AREA

SECONDARY TREATMENT

Glen Rock STP expansion of 0.2 MGD in 1987	$ 331,000
New Freedom STP expansion of 0.55 MGD in 1987	418,000
SUBTOTAL SECONDARY TREATMENT	$ 749,000

TRANSMISSION FROM SERVICE AREA TO IRRIGATION SITE

Pipeline:	Diameter	Unit Price	Length	
	8"	$10.00	12,200 L.F.	122,000
	16"	$20.00	12,700 L.F.	254,000
Pumping Station	Number	Discharge	Head	
	1	0.5 mgd	368'	55,000
	1	1.9 mgd	276'	70,000
SUBTOTAL TRANSMISSION FACILITIES				$ 501,000

STORAGE FACILITIES

Fill Material	1,120,000 c.y. @$1.25/c.y.	1,400,000
Foundation Treatment	Lump Sum	50,000
Rip rap	15,000 c.y. @$8.00/c.y.	120,000
Clearing	60 Ac. @$800.00 /Ac.	48,000
Aerators	6-50 H.P. @$10,000	60,000
SUBTOTAL STORAGE FACILITIES		$1,678,000

DISTRIBUTION PIPING AND PUMPING

Piping	Diameter	Unit Price	Length	
	14"	$14.00	8,000 L.F.	112,000
	10"	$10.00	8,000 L.F.	80,000
	6"	$ 4.80	10,700 L.F.	51,000
Pumping:	Number	Discharge	Head	
	2	1.8 mgd	360'	125,000
SUBTOTAL DISTRIBUTION PIPING & PUMPING				$ 368,000

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TABLE IV- 23 (Cont'd)

SHREWSBURY-NEW FREEDOM-RAILROAD
AND GLEN ROCK SERVICE AREA

IRRIGATION MACHINES

15 Center Pivot Irrigation Machines each 650' Radius (30 Acres) @$10,000 per machine	150,000
SUBTOTAL IRRIGATION MACHINES	$ 150,000

DRAINAGE WELLS

32 Wells
each 215' Deep, Pumping 120 gpm, spaced 1,000' on center

Item	Number	Unit Cost		
Drilling & Casing 12" Well	215 L.F.	$30/L.F.	$6,450	
Pump	1	L.S.	2,500	
Electrical Connection	1	L.S.	1,000	
Discharge Pipe	1,000 L.F.	$ 3.20/L.F.	3,200	
				421,000
SUBTOTAL DRAINAGE WELLS				$ 421,000

LAND, RESIDENCES, RELOCATION AND MOVING

Land:	
1,085 acres (Slopes < 15%)@$750 per acre	814,000
Residences:	
10 Residences @$25,000	250,000
Relocation and Moving	
10 Residences @$3,500	35,000
12 Farmsteads @$3,000	36,000
SUBTOTAL LAND, RESIDENCES, RELOCATIONS AND MOVING	$1,135,000
SUBTOTAL ALL FACILITIES	5,002,000
TOTAL CONSTRUCTION CONTINGENCIES	
SUBTOTAL ALL FACILITIES	5,002,000
Contingencies	1,000,000
TOTAL CONSTRUCTION COSTS	6,002,000
CAPITAL COSTS 1972-1985	5,103,000
CAPITAL COSTS 1986-2000	899,000

TABLE IV-23 (Cont.)

SPRING GROVE SERVICE AREA

SECONDARY TREATMENT				
Spring Grove STP rehabilitation and expansion to 0.3 mgd in 1986				$ 200,000
SUBTOTAL SECONDARY TREATMENT				$ 200,000
TRANSMISSION FROM SERVICE AREA TO IRRIGATION SITE				
Pipeline:	Diameter	Unit Price	Length	
	6"	$7.50	17,000 L.F.	$ 128,000
Pumping Station	1	0.3 mgd	255'	35,000
SUBTOTAL TRANSMISSION FACILITIES				$ 163,000
STORAGE FACILITIES				
Fill Material	80,000 c.y. @$2.00 /c.y.			$ 160,000
Aerators	1-50 H.P. @$10,000 per aerator			10,000
SUBTOTAL STORAGE FACILITIES				$ 170,000
DISTRIBUTION PIPING AND PUMPING				
Piping:	Diameter	Unit Price	Length	
	6"	$6.00	1,500 L.F.	$ 9,000
Pumping:	Number	Discharge	Head	
	1	0.45 mgd	120'	30,000
SUBTOTAL DISTRIBUTION PIPING AND PUMPING				$ 39,000
IRRIGATION MACHINES				
2 Center Pivot Irrigation Machines each 650' Radius (30 Acres) @$10,000				$ 20,000
SUBTOTAL IRRIGATION MACHINES				$ 20,000

TABLE IV-23 (Cont.)

SPRING GROVE SERVICE AREA (Cont.)

DRAINAGE WELLS

3 Wells
each 215' Deep, Pumping 120 gpm, spaced 1,000' on center

Item	Number	Unit Cost		
Drilling & Casing				
12" Well	215 L.F.	$30/L.F.	$6,450	
Pump	1	L.S.	2,500	
Electrical Connection	1	L.S.	1,000	
Discharge Pipe	1,000 L.F.	$3.20/L.F.	3,200	
				39,000
SUBTOTAL DRAINAGE WELLS				$ 39,000

LAND, RESIDENCES, RELOCATIONS AND MOVING

Land:	
118 Acres (Slopes < 15%)@$750 per acre	88,500
Residences:	
1 Residence @ $25,000	25,000
Relocations and Moving:	
1 Residence @$3,500	3,500
1 Farmstead @$3,000	3,000
SUB-TOTAL LAND, RESIDENCES, RELOCATIONS AND MOVING	$ 120,000
SUB-TOTAL ALL FACILITIES	751,000
Contingencies (20%)	150,000
TOTAL CONSTRUCTION COSTS	901,000
CONSTRUCTION COST 1972-1985 PERIOD	661,000
CONSTRUCTION COST 1986-2000 PERIOD	240,000

TABLE IV-23 (Cont.)

JACOBUS-LOGANVILLE SERVICE AREA

SECONDARY TREATMENT

Install 0.41 MGD Aerated Lagoon Treatment Plant				$ 92,000
SUBTOTAL SECONDARY TREATMENT				$ 92,000

TRANSMISSION FROM SERVICE AREA TO IRRIGATION SITE

Pipeline:	Diameter	Unit Price	Length	
	10"	$12.50	5,200 L.F.	65,000
	8"	$14.00 (GR)	5,300 L.F.	74,000
	10"	$12.50	3,300 L.F.	41,000
Pumping Station:	Number	Discharge	Head	
	1	0.24 mgd	60'	30,000
	1	0.41 mgd	130'	40,000
SUBTOTAL TRANSMISSION FACILITIES				$ 250,000

STORAGE FACILITIES

Fill Material	41,000 c.y.@$2.00/c.y.	82,000
Aerators:	1-20 H.P. @$5,000	5,000
SUBTOTAL STORAGE FACILITIES		$ 87,000

DISTRIBUTION PIPING AND PUMPING

Piping:	Diameter	Unit Price	Length	
	6"	$6.00	2,500 L.F.	15,000
Pumping Station:	Number	Discharge	Head	
	1	0.6 mgd	190'	30,000
SUBTOTAL DISTRIBUTION PIPING & PUMPING				$ 45,000

IRRIGATION MACHINES

3 Center Pivot Irrigation Machines each 650' Radius (30 Acres) @$10,000	30,000
SUBTOTAL IRRIGATION MACHINES	$ 30,000

TABLE IV-23 (Cont.)

JACOBUS-LOGANVILLE SERVICE AREA (Cont.)

DRAINAGE WELLS

5 Wells
each 215' Deep, Pumping 120 gpm, spaced 1,000' on center

Item	Number	Unit Cost		
Drilling & Casing 12" Well	215 L.F.	$30/L.F.	$6,450	
Pump	1	L.S.	2,500	
Electrical Connection	1	$ L.S.	1,000	
Discharge Pipe	1,000 L.F.	$3.20/L.F.	3,200	
				66,000
SUBTOTAL DRAINAGE WELLS				$ 66,000

LAND, RESIDENCES, RELOCATIONS AND MOVING

Land:	
176 Acres (Slopes < 15%)@$750 per acre	132,000
Residences:	
2 Residences @$25,000	50,000
Relocations and Moving:	
2 Residences @$3,500	7,000
3 Farmsteads @$3,000	9,000
SUBTOTAL LAND, RESIDENCES, RELOCATIONS AND MOVING	$ 198,000
SUBTOTAL ALL FACILITIES	768,000
Contingencies	153,000
TOTAL CONSTRUCTION COST	921,000

TABLE IV-23 (Cont.)

SEVEN VALLEYS SERVICE AREA

SECONDARY TREATMENT				
Install 0.07 MGD Aerated Lagoon Treatment Plant				$ 20,000
SUBTOTAL SECONDARY TREATMENT				$ 19,000
TRANSMISSION FROM SERVICE AREA TO IRRIGATION SITE				
Pipeline:	Diameter	Unit Price	Length	
	6"	$7.50	1,000 L.F.	8,000
Pumping Station:	Number	Discharge	Head	
	1	0.07 mgd	196'	30,000
SUBTOTAL TRANSMISSION FACILITIES				$ 38,000
STORAGE FACILITIES				
Fill Material	41,000 c.y.@$2.00/c.y.			82,000
Aerators	1-20 H.P. @$5,000			5,000
SUBTOTAL STORAGE FACILITIES				$ 87,000
DISTRIBUTION PIPING AND PUMPING				
Piping:	Diameter	Unit Price	Length	
	6"	$4.80	600'	3,000
Pumping Station:	Number	Discharge	Head	
	1	0.10 mgd	120'	30,000
SUBTOTAL DISTRIBUTION PIPING AND PUMPING				$ 33,000

TABLE IV- 23 (Cont.)

SEVEN VALLEYS SERVICE AREA (Cont.)

IRRIGATION MACHINES		
1 Center Pivot Irrigation Machines each 450' Radius (13.6 Acres) @$8,000		8,000
SUBTOTAL IRRIGATION MACHINES	$	8,000
DRAINAGE WELLS		
1 Well 175' Deep Pumping 70 gpm		8,000
SUBTOTAL DRAINAGE WELLS	$	8,000
LAND		
Land: 39 Acres (Slopes < 15%) @$750 per Acre		29,000
SUBTOTAL LAND	$	29,000
SUBTOTAL ALL FACILITIES		223,000
Contingencies		45,000
TOTAL CONSTRUCTION COST		268,000

TABLE IV- 23 (Cont.)

JEFFERSON SERVICE AREA

SECONDARY TREATMENT				
Install 0.04 MGD Aerated Lagoon Treatment Plant				$ 18,000
SUBTOTAL SECONDARY TREATMENT				$ 18,000
TRANSMISSION FROM SERVICE AREA TO IRRIGATION SITE				
Pipeline:	Diameter	Unit Price	Length	
	4"	$5.00	2,000 L.F.	10,000
Pumping Station:	Number	Discharge	Head	
	1	0.04 mgd	86'	30,000
SUBTOTAL TRANSMISSION FACILITIES				$ 40,000
STORAGE FACILITIES				
Fill Material	29,000 c.y.@$2.00/c.y.			58,000
Aerator	1-20 H.P. @$5,000			5,000
SUBTOTAL STORAGE FACILITIES				$ 63,000
DISTRIBUTION PIPING AND PUMPING				
Piping:	Diameter	Unit Price	Length	
	6"	$4.80	500 L.F.	2,400
Pumping Station:	Number	Discharge	Head	
	1	0.06 mgd	110'	30,000
SUBTOTAL DISTRIBUTION PIPING & PUMPING				$ 32,400

TABLE IV-23 (Cont.)

JEFFERSON SERVICE AREA (Cont.)

IRRIGATION MACHINES		
1 Center Pivot Irrigation Machine 400' Radius (7.5 Acres)@$7,300 per machine		7,300
SUBTOTAL IRRIGATION MACHINE	$	7,300
JEFFERSON SERVICE AREA (Cont'd)		
DRAINAGE WELLS		
1 Well 150' Deep Pumping 40 gpm		5,000
SUBTOTAL DRAINAGE WELL	$	5,000
LAND		
Land: 33 Acres (Slopes < 15%)@$750 per acre		25,000
SUBTOTAL LAND	$	25,000
SUBTOTAL ALL FACILITIES		191,000
Contingencies		38,000
TOTAL CONSTRUCTION COST		229,000

TABLE IV-23 (Cont.)

WINTERSTOWN SERVICE AREA

SECONDARY TREATMENT				
Install 0.03 MGD Aerated Lagoon Treatment Plant				$ 17,000
SUBTOTAL SECONDARY TREATMENT				$ 17,000
TRANSMISSION FROM SERVICE AREA TO IRRIGATION SITE				
Pipeline:	Diameter	Unit Price	Length	
	4"	$5.00	2,000 L.F.	10,000
Pumping Station:	Number	Discharge	Head	
	1	0.03 mgd	50'	30,000
SUBTOTAL TRANSMISSION FACILITIES				$ 40,000
STORAGE FACILITIES				
Fill Material:	22,000 c.y. @$2.00/c.y.			44,000
Aerator	1-20 H.P. @$5,000 per aerator			5,000
SUBTOTAL STORAGE FACILITIES				$ 49,000
DISTRIBUTION PIPING AND PUMPING				
Piping:	Diameter	Unit Price	Length	
	6"	$4.80	500 L.F.	2,400
Pumping:	Number	Discharge	Head	
	1	0.045 mgd	110'	30,000
SUBTOTAL DISTRIBUTION PIPING & PUMPING				$ 32,400

TABLE IV-23 (Cont.)

WINTERSTOWN SERVICE AREA (Cont.)

IRRIGATION MACHINES		
1 Center Pivot Irrigation Machine each 400 Radius (7.5 Acres)@$7,300		7,300
SUBTOTAL IRRIGATION MACHINE	$	7,300
DRAINAGE WELLS		
1 Well 150' Deep Pumping 40 gpm		5,000
SUBTOTAL DRAINAGE WELLS	$	5,000
LAND		
Land: 33 Acres (Slopes 15%)@$750 per acre		25,000
SUBTOTAL LAND	$	25,000
SUBTOTAL ALL FACILITIES	$	176,000
Contingencies		35,000
TOTAL CONSTRUCTION COST		211,000

TABLE IV-24

BASIC ALL LAND PLAN
(Utilizing Aerated Lagoons for Pre-Treatment)
UPPER BASIN COMMUNITIES
DETAILED OPERATING AND MAINTENANCE COSTS

Project	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
Hanover-Penn Twp.		
Secondary Treatment Plants		
Hanover STP		
- Labor	$ 90,000	$100,000
- Energy	12,000	16,000
- Equipment & Supplies	20,000	25,000
- Sludge Disposal	57,000	77,000
Subtotal	179,000	218,000
Penn Twp. STP		
- Labor	70,000	75,000
- Energy	6,000	10,000
- Equipment & Supplies	10,000	13,000
- Sludge Disposal	30,000	42,000
Subtotal	116,000	140,000
Land Treatment Site		
- Labor	39,000	49,000
- Energy	39,000	53,000
- Equipment & Supplies	15,000	26,000
- Chemicals	2,000	2,000
Subtotal	95,000	130,000
Transmission		
- Labor	7,000	10,000
- Energy	23,600	32,200
- Equipment & Supplies	1,000	1,000
Subtotal	32,000	43,000
TOTAL PROJECT O&M COST	$422,000	$531,000

TABLE IV- 24 (Cont'd)

Project	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
Spring Grove		
Secondary Treatment Plant		
- Labor	$ 30,000	$ 30,000
- Energy	1,000	1,000
- Equipment & Supplies	2,000	2,000
- Sludge Disposal	5,000	6,000
Subtotal	38,000	39,000
Land Treatment Site		
- Labor	5,000	5,000
- Energy	2,000	3,000
- Equipment & Supplies	2,000	2,000
- Chemicals	-	-
Subtotal	9,000	10,000
Transmission		
- Labor	200	200
- Energy	1,100	1,100
- Equipment & Supplies	100	100
	1,000	1,000
TOTAL PROJECT O&M COST	$ 48,000	$ 50,000
Glen Rock-Shrewsbury		
Secondary Treatment Plants		
Glen Rock STP		
- Labor	$ 30,000	$ 35,000
- Energy	1,000	2,000
- Equipment & Supplies	2,000	3,000
- Sludge Disposal	5,000	9,000
Subtotal	38,000	49,000

TABLE IV-24 (Cont.)

Project	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
Glen Rock-Shrewsbury(Cont)		
Secondary Treatment Plants		
Shrewsbury STP		
- Labor	$ 60,000	$ 70,000
- Energy	4,000	7,000
- Equipment & Supplies	8,000	12,000
- Sludge Disposal	20,000	33,000
Subtotal	92,000	122,000
Land Treatment Site		
- Labor	10,000	18,000
- Energy	18,000	27,000
- Equipment & Supplies	4,000	6,000
- Chemicals	1,000	1,000
Subtotal	33,000	52,000
Transmission		
- Labor	800	1,300
- Energy	2,600	4,300
- Equipment & Supplies	100	100
Subtotal	4,000	6,000
TOTAL PROJECT O&M COST	$167,000	$229,000
Jacobus-Loganville		
Land Treatment Site		
- Labor	$ 4,000	$ 5,000
- Energy	5,000	7,000
- Equipment & Supplies	1,000	1,000
- Chemicals	-	-
- Sludge Disposal	2,000	2,000
Subtotal	12,000	15,000
Transmission		
- Energy	500	700
TOTAL PROJECT O&M COST	$ 13,000	$ 16,000

TABLE IV-24 (Cont.)

Project	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
Seven Valleys		
Land Treatment Site		
- Labor	$ 5,000	$ 5,000
- Energy	2,000	3,000
- Equipment & Supplies	1,000	1,000
- Chemicals	-	-
- Sludge Disposal	400	500
Subtotal	8,400	9,500
Transmission		
- Energy	300	300
TOTAL PROJECT O&M COST	$ 9,000	$ 10,000
Jefferson		
Land Treatment Site		
- Labor	6,000	6,000
- Energy	1,500	1,500
- Equipment & Supplies	1,000	1,000
- Chemicals	-	-
- Sludge Disposal	300	300
Subtotal	9,000	9,000
Transmission		
- Energy	80	80
TOTAL PROJECT O&M COST	$ 9,000	$ 9,000
Winterstown		
Land Treatment Site		
- Labor	6,000	6,000
- Energy	1,000	1,000
- Equipment & Supplies	1,000	1,000
- Chemicals	-	-
- Sludge Disposal	200	200
Subtotal	8,000	8,000
Transmission		
- Energy	40	40
TOTAL PROJECT O&M COST	$ 8,000	$ 8,000

Modified All Land Treatment Plan - York Urban Area

In this plan the York, Springettsbury and Dover Township plants would provide secondary biological treatment as programmed in the Basic All Water Plan. Effluent from the Springettsbury and Dover plants would be pumped to the York plant location. The effluents from all three plants would then be pumped upstream a distance of 11 miles to the irrigation site storage lagoon.

Primary and secondary solids would be digested at the secondary treatment plants and trucked to agricultural application sites. This plan also features the acquisition of an additional 185 residential dwellings that would have to be eliminated with a policy of maximum site isolation.

Project Costs

Construction and O & M costs for the Modified Plan are given in Tables IV-27 and IV-28 . The summary of project costs for the Modified Land Treatment Plan (Table IV-26) indicates that the Modified Plan is substantially more costly than the Basic Plan for the York area.

Modified All Land Treatment Plan - Upper Basin Communities

The Modified Plan for these areas encompasses the acquisition of additional residential housing units at three land application site areas as listed below:

	Basic Plan	Modified Plan	Difference
Hanover-Penn Twp.	32	69	37
Shrewsbury-New Freedom Railroad-Glen Rock	10	19	9
Jacobus-Loganville	2	7	5
Other areas	1	1	0
TOTALS	45	96	51

The other principal change is the substitution of conventional secondary package treatment plants for aerated lagoons for the following communities:

Jacobus-Loganville
Seven Valleys
Jefferson
Winterstown

Project Costs

Construction and O & M costs for the Upper Basin Communities Modified All Land Plan are presented in Tables IV-27 and IV-28, respectively. The summary of project costs (Table IV-26) shows the Modified Plan to be slightly more expensive than the Basic Plan for all of the upper basin communities combined.

TABLE IV-25

MODIFIED ALL LAND PLAN - PROJECT COST SUMMARY

	Cost of Basic All Land Plan		Incremental Cost of Modified All Land Plan		PROJECT TOTAL	
	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Investment Costs ($1,000)						
Secondary Treatment System	7,372	2,459	31	9,116	7,403	11,575
Conveyance Facilities	2,606	-	-	-	2,606	-
Transmission Facilities	11,152	-	-	-	11,152	-
Storage Facilities	11,140	-	-	-	11,140	-
Distribution Piping & Pumping	7,395	2,155	-	-	7,395	2,155
Irrigation Machines	3,777	1,386	-	-	3,777	1,386
Drainage Wells	5,716	1,938	-	-	5,716	1,938
Sub-Total	49,158	7,938	31	9,116	49,189	17,054
Engineering & Overhead	4,916	794	3	912	4,919	1,706
Lands	25,027	-	8,073	-	33,100	-
Total, Investment Costs	79,101	8,732	8,107	10,028	87,208	18,760
Operations & Maintenance Costs ($1,000)						
Labor	1,038	1,281	330	450	1,368	1,731
Equipment & Supplies	164	220	19	24	183	244
Chemicals	13	17	-	-	13	17
Energy	672	916	110	152	782	1,068
Sludge Disposal	346	486	251	410	597	896
Total, O & M Costs	2,233	2,920	710	1,036	2,943	3,956
Other Costs ($1,000)						
Initial Stage Replacement Costs						
10 Year	3,023		1		3,024	
25 Year	5,740		8		5,748	
Second Stage Replacement Costs						
10 Year	417		460		877	
25 Year	1,815		2,280		4,095	
Salvage Value						
Facilities	1,089		1,212		2,301	
Lands	12,898		-		12,898	
Total Salvage Value	13,987		1,212		15,199	
Average Annual Costs ($1,000/year)						
Average Annual Capital Cost	5,268		780		6,048	
Average Annual O & M Cost	2,597		835		3,332	
Average Annual Replacement Cost	327		27		354	
Average Annual Salvage Value	48		4		52	
Total, Average Annual Cost	8,044		1,638		9,682	

[1] Engineering & overhead includes 10% of facilities cost.

NOTE: All investment costs above include 20% contingencies.

TABLE IV-26
MODIFIED ALL LAND PLAN
COST SUMMARY

Treatment Facility	Cost of Basic All Land Plan 1972-1985	Cost of Basic All Land Plan 1986-2000	Incremental Cost of Modified All Land Plan 1972-1985	Incremental Cost of Modified All Land Plan 1986-2000	Total Modified All Land Cost 1972-1985	Total Modified All Land Cost 1986-2000
Investment Costs[1] ($1,000)						
York Urban Area	60,723	6,027	6,253	10,028	66,976	16,055
Hanover-Penn Township	10,427	1,452	1,265	-	11,692	1,452
Shrewsbury-New Freedom-Railroad-Glen Rock	5,478	989	308	-	5,786	989
Spring Grove	714	264	-	-	714	264
Jacobus-Loganville	989	-	202	-	1,191	-
Seven Valleys	292	-	37	-	329	-
Jefferson	250	-	20	-	270	-
Winterstown	228	-	22	-	250	-
TOTAL Investment Costs	79,101	8,732	8,107	10,028	87,208	18,760
Operation & Maintenance Costs ($1,000/year)						
York Urban Area	1,557	2,068	710	1,036	2,267	3,104
Hanover-Penn Township	422	531	-	-	422	531
Shrewsbury-New Freedom-Railroad-Glen Rock	167	228	-	-	167	229
Spring Grove	48	50	-	-	48	50
Jacobus-Loganville	13	16	-	-	13	16
Seven Valleys	9	10	-	-	9	10
Jefferson	9	9	-	-	9	9
Winterstown	8	8	-	-	8	8
TOTAL Operation & Maintenance Costs	2,233	2,920	710	1,036	2,943	3,956

[1] All costs include contingencies, engineering and overhead.

TABLE IV-27

MODIFIED ALL LAND PLAN
(Utilizing secondary treatment plants for pre-treatment)

FACILITIES COST ESTIMATE

YORK URBAN AREA

1972-1985 Period

1. Secondary Treatment Facility

Utilization and expansion of urban area secondary treatment plants - York, Springettsbuty and Dover Townships (see Table IV- 5 from Basic All Water Plan)

Secondary Treatment Plant Construction Cost and Contingencies	$6,084,000
Less: Cost of aerated lagoon secondary treatment facility (including sludge disposal) for the York Urban Area (see Table IV-21 from Basic All Land Plan) Construction Cost and Contingencies	$6,152,000
Incremental Cost	-$ 68,000

2. Conveyance Facilities

Same as Basic All Land Plan

3. Land Treatment Site

Acquisition and relocation of additional residences

Acquisition	
185 Residences @$25,000 per residence	$4,625,000
Relocation	
185 Residences @$ 3,500	648,000
Sub-Total	5,273,000
Contingencies	1,055,000
TOTAL	$6,328,000

TABLE IV- 27 (Cont.)

4. Other items same as Basic All Land Plan

Total Additional Cost of Modified Plan = $6,253,000

1986-2000 Period

Expansion of York Areas Secondary Treatment (See Table IV-7)	
Other items same as Basic All Land Plan	9,116,000
Engineering & Overhead	912,000
TOTAL	10,028,000

UPPER BASIN COMMUNITIES

1972-1985 Period

Acquisition and relocation of additional housing at specified sites.

	Hanover Penn Twp.	New Freedom Glen Rock	Jacobus Loganville
Number of residential units	37	9	5
Unit Cost	28,500	28,500	28,500
TOTAL COST	1,054,500	256,500	142,500
Contingencies	210,500	51,500	29,500
TOTAL INCREMENTAL COST	1,265,000	308,000	172,000

TABLE IV-27 (Cont'

Substitution of package treatment plants for aerated lagoons at specified sites

	Jacobus Loganville	Seven Valleys	Jefferson	Winterstown
Package secondary treatment plant	114,000	49,000	33,000	33,000
Contingencies	23,000	9,000	7,000	7,000
ITEM TOTAL	137,000	58,000	40,000	40,000
Less: Cost (including contingencies) of aerated lagoon secondary treatment plant (see Table IV-23, Basic All Land Plan)	110,000	24,000	22,000	20,000
Incremental cost	27,000	34,000	18,000	20,000
Additional Cost of Modified Plan	199,000*	34,000	18,000	20,000
Additional Engineering and Overhead	3,000	3,000	2,000	2,000
TOTAL	202,000	37,000	20,000	22,000

*Includes additional housing aquisitions from previous page.

TABLE IV-28

MODIFIED ALL LAND PLAN
DETAILED OPERATING AND MAINTENANCE COSTS

YORK URBAN AREA

1. Secondary Treatment Facilities

	1972-1985	1986-2000
Utilization of secondary treatment plants at York, Springettsbury and Dover (see Table IV - 8, Basic All Water Plan)		
Subtotal, Secondary Treatment O&M	1,315,000	1,850,000
Less: O&M Cost of Aerated Lagoon Secondary Treatment (see Table IV-22, Basic All Land Plan)	605,000	814,000
Incremental O&M Cost of Modified Plan	710,000	1,036,000

2. All other O&M costs the same as in Basic All Land Plan.

UPPER BASIN COMMUNITIES

All O&M costs the same as in Basic All Land Plan

Summary - All Land Treatment Plan

A comparison of the Basic and Modified All Land Plans (Table IV-20 , and IV-25) reveals that the Basic Plan is significantly less costly (average annual cost of $8,044,000versus $9,682,000 for the Modified Plan). This can be attributed to the reduced housing acquisition requirements and the lower cost of operating one single pre-treatment facility at the land site compared to the higher cost of maintaining three separate treatment facilities in the York urban area. Other cost savings inherent in the Basic All Land Plan relate to the lower capital and operating costs of an aerated lagoon complex as compared to an activated sludge treatment plant and to the economies inherent in the management of sludge (separation and disposal) at the land site.

Discussion - Relocation of Housing

A major component of site acquisition for the larger sites is the cost of acquiring residential housing on and adjacent to the site and the relocation of the residents. In the housing-short York area the salvage of these structures, through relocation, is highly feasible; most are of good quality and worth over $20,000.

To maximize the effective recoverable value of these residences and to internalize it to the project, it is suggested that a formal program for the relocation and resale of acquired residences be considered as part of the project.

The regional authority or a contractor to the authority could establish one or more villages for either special or general residential use. Site parcels, streets, water supply and sewerage could be provided. The acquired structures would then be relocated to these village sites and sold to the public or rented for general or special use. The potential economic benefits of such a program (Table IV-29) could be a net savings of over 30 per cent in the acqusition cost of these homes. The potential impact of a housing relocation program on project costs is shown by Table IV-30. Savings of between $2 million and $4 million can be achieved.

TABLE IV- 29

COST SAVINGS FROM RELOCATION OF
ACQUIRED IRRIGATION SITE RESIDENCES

Acquisition cost of site residences	$25,000
Moving cost for structure relocation	2,500
Village site development costs	
Roads, sewer and water	2,500
Land acquisition	500
Structure foundation	5,000
Project Administration	1,000
	$36,500
Resale of structure	$20,000
Net cost of residence acquisition to project	$16,500
Equivalent salvage value	34%

TABLE IV-30

IMPLICATIONS OF HOUSING RELOCATION

	Maximum Take	Minimum Take
Number of Residential Units		
York area site	275	185
Upper basin sites	96	45
TOTAL	371	230
Acquisition and Relocation Costs		
Acquisition - $25,000/unit	9,275,000	5,750,000
Resident relocation $3,500/ family	1,313,000	805,000
Sub-Total	10,588,000	6,555,000
Contingencies	2,118,000	1,311,000
TOTAL	12,706,000	7,866,000
Salvage of housing through structure relocation (taken as 30% of acquisition costs based on Table IV-29)	3,812,000	2,360,000

DECEMBER PLAN

The December Plan for wastewater management in the Codorus Creek Basin as recommended by the Citizens Advisory Committee, consists of providing Type D advanced treatment for the York Urban Area (including the York, Springettsbury, Dover, New Salem and Red Lion service areas) at a central regional facility located adjacent to the existing York secondary treatment plant. The advanced treatment facility would provide ammonia and total nitrogen removal, chemical treatment for phosphorus removal, filtration for tertiary BOD and suspended solids removal, chlorination and post-aeration for dissolved oxygen enhancement.

Wastewater from the upstream communities (Hanover, Penn Township, Glen Rock-Shrewsbury area, Spring Grove, Jacobus, Loganville, Seven Valleys, Jefferson, and Winterstown) would be land treated after secondary treatment utilizing the existing and presently programmed local treatment plants. Figure IV-4 presents the general plan.

Selection of this plan by the Advisory Committee was based on joint consideration of cost, performance capability, institutional factors and ease of implementation.

Project Costs

The cost summary for the Study Area with the implementation of the December Plan is presented in Table IV-32. The total cost requirements of this plan would entail capital investments of $53,646,000 during the 1972-1985 period and $24,520,000 during the 1986-2000 period. The average annual cost is estimated at $8,567,000 for the 1972-2000 planning period. The construction costs for the York Urban Area are itemized in Table IV-7 and those for the Upper Basin Communities are itemized in Table IV-27.

Facilities Requirements

The December Plan in effect incorporates the York area facilities of the Basic All Water Plan with the upstream communities facilities of the Modified All Land Plan. The December Plan is sub-divided into the York area and upstream community portions. The facilities requirements are summarized by Table IV-31.

TABLE IV-31

FACILITIES REQUIREMENTS FOR THE DECEMBER PLAN

Service Area/ Treatment Plants	Present Capacity (MGD)	Secondary Additional Capacity Needs (MGD)		AWT/Land Irrigation Additional Capacity Needs (MGD)	
		1972-1985	1986-2000	1972-1985	1986-2000
YORK URBAN AREA					
- York	18	7.0	11.0	35.0	16.0
- Springettsbury	8	5.0	No additions	-	-
- Dover Township	1.75	No additions	1.0	-	-
- Dover Borough	0.25	Abandon -	To Dover Twp		
- Red Lion	0.7	Abandon -	To Springettsbury		
HANOVER URBAN AREA					
- Hanover	2.5	1.5	0.9	4.6	1.5
- Penn Township	1.75	No additions	0.5		
SPRING GROVE URBAN AREA	0.25	No additions	0.05	0.3	No additions
SHREWSBURY-NEW FREEDOM-RAILROAD & GLEN ROCK URBAN AREA					
- Glen Rock	0.3	No additions	0.2	1.45	0.95
- Railroad-New Freedom	1.35	No additions	0.55		
JACOBUS-LOGANVILLE URBAN AREA	-	0.41	No additions	0.41	No additions
SEVEN VALLEYS URBAN AREA	-	0.07	No additions	0.07	No additions
JEFFERSON URBAN AREA	-	0.04	No additions	0.04	No additions
WINTERSTOWN URBAN AREA	-	0.03	No additions	0.03	No additions

FIGURE IV-4

CODORUS CREEK WASTEWATER MANAGEMENT STUDY

DECEMBER PLAN

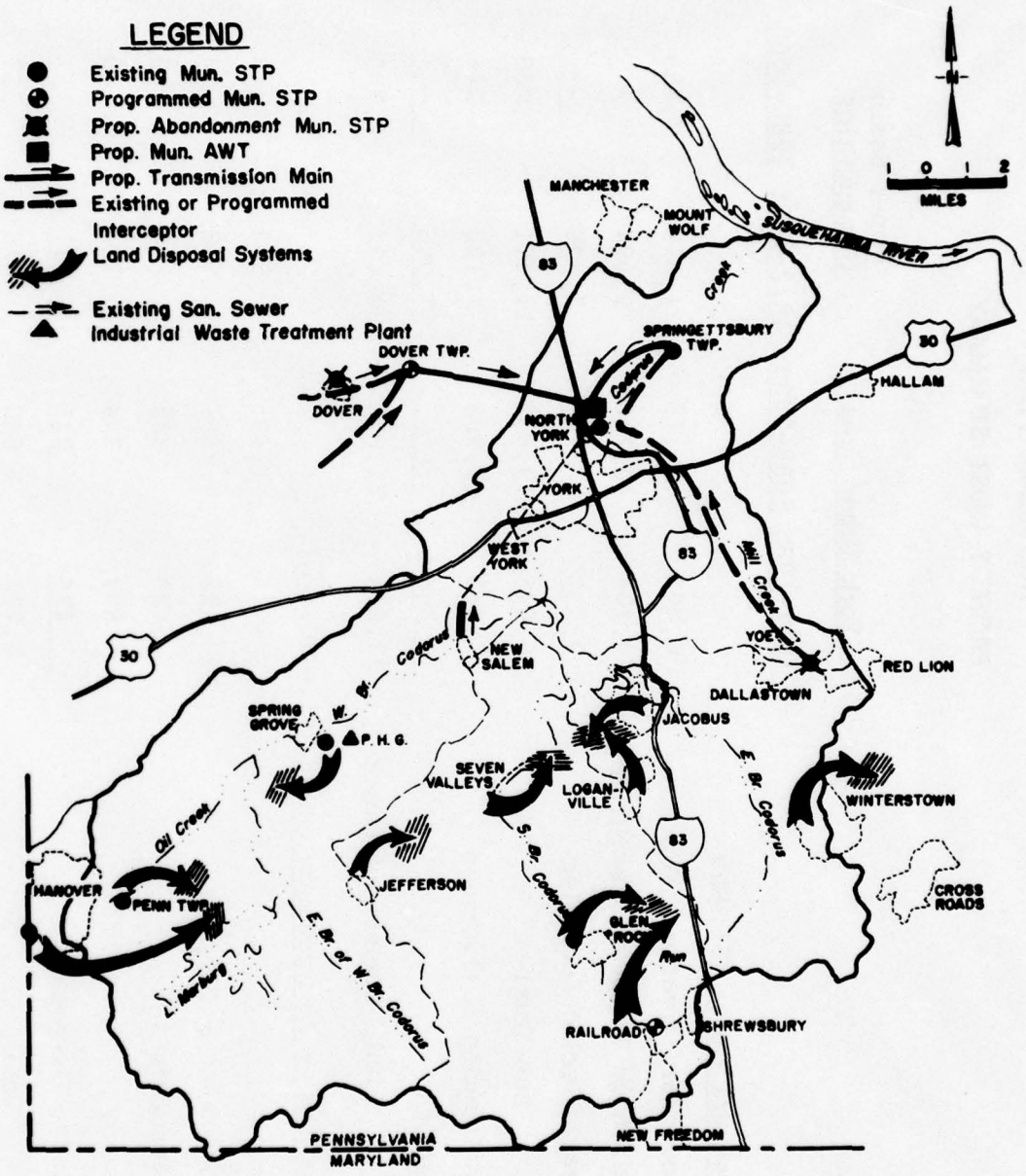


TABLE IV-32

DECEMBER PLAN

PROJECT COST SUMMARY

	York Urban Area		Upper Basin Communities		PLAN TOTAL	
	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Investment Costs ($1,000)						
Secondary Treatment Facilities	6,084	9,116	1,319	2,459	7,403	11,575
Advanced Treatment Facilities	20,104	10,716	8,084	-	28,188	10,716
Transmission Facilities	3,457	-	2,548	-	6,005	-
Sub-Total	29,645	19,832	11,951	2,459	41,595	22,291
Engineering & Overhead[1]	2,965	1,983	1,195	246	4,160	2,229
Lands	804	-	7,086	-	7,890	-
Total, Investment Costs	33,414	21,815	20,232	2,705	53,646	24,520
Operations & Maintenance Costs ($1,000/year)						
Labor	915	1,195	363	415	1,278	1,610
Equipment & Supplies	412	581	68	94	480	675
Chemicals	470	685	3	3	473	688
Energy	502	744	121	169	623	913
Sludge Disposal	476	725	121	171	597	896
Total, O & M	2,775	3,930	676	852	3,451	4,782

TABLE IV-32
(continued)

Other Costs ($1,000)	York Urban Area	Upper Basin Communities	PLAN TOTAL
Initial Stage Replacement Costs			
10 Year	4,332	646	4,978
25 Year	5,933	1,487	7,420
Second Stage Replacement Costs			
10 Year	2,599	123	2,722
25 Year	4,422	615	5,037
Salvage Value			
Facilities	2,653	369	3,022
Lands	804	3,190	3,994
Total Salvage Value	3,457	3,559	7,016
Average Annual Costs ($1,000/year)			
Average Annual Capital Cost	2,698	1,354	4,052
Average Annual O & M Cost	3,218	744	3,962
Average Annual Replacement Cost	501	76	577
Average Annual Salvage Value	12	12	24
Total, Average Annual Cost	6,405	2,162	8,567

[1] Engineering & overhead includes 10% of facilities cost.

NOTE: All investment costs above include 20% contingencies.

York Urban Area

Secondary treatment for all waste flows from the York, Springettsbury, Red Lion and Dover service areas would be provided at the York, Dover Township and Springettsbury facilities. The advanced water process treatment plant would be located adjacent to the York plant. The Red Lion treatment plant would be abandoned to permit the use of the Mill Creek interceptor for the transport of all wastes originating in the Red Lion-York development corridor. The York area regional AWT plant would be located adjacent to the York secondary treatment plant. This site is an efficient location for combined access from all three secondary plants. It also facilitates the provision of a pipeline to return the high quality effluent to a location above York for augmentation of low flow in Codorus Creek through the City of York. Augmentation would likely be a requirement of a program to revitalize the Creek in conjunction with the proposed downtown area renewal program.

Upstream Communities

Land irrigation to achieve high level advanced waste treatment can accomplish the highest level of dependable performance for the communities in the upper basin with only moderate land requirements. For the ten communities in this group, the total year 2000 estimated flow is 9.35 MGD. This would require 1,800 acres of irrigation area at the design basis rate of 2" per week for 8 months annual operation.

Geological, soils and engineering feasibility studies of site opportunities have identified the Schist and Phyllite terrainal areas as being the only environmental units generally suitable for land irrigation of wastewater in the Codorus Basin. These two units are easily accessible to all of the upstream communities.

For the communities of Hanover, Penn Township, Spring Grove, Glen Rock and Railroad-New Freedom, secondary biological treatment would continue to be provided at the present treatment plants. After treatment the wastes would be pumped to the irrigation site storage pond and then irrigated.

The land treatment system for the communities of Loganville, Jacobus, Jefferson and Seven Valleys would have incorporated an aerated lagoon or package type treatment plant to provide secondary treatment before discharge to the storage pond.

OTHER ELEMENTS OF THE WASTEWATER PLAN

In addition to the selection of the optimum method for treatment of wastewater flows other principal elements of the total wastewater management plan include:

- Wastewater treatment plant solids treatment and final disposal
- Management of industrial waste direct discharges
- Long-range framework plan for wastes treatment

Sludge Management Plan

The present general Codorus Basin practice of applying municipal treatment plant sludges to agricultural lands is recommended to be retained in each of the plans. However, an improved method of regulating the program is required. Seasonal periods of permissible application, dosage levels and application practices need to be more carefully controlled.

For the urban area secondary treatment plants, a program of truck haulage of digested sludge to application areas is proposed. Winter storage for up to 120 days would be provided at the treatment plants. For the treatment plants located at or near the land sites, unirrigated portions of the land treatment sites would be used for sludge application.

The estimated planning period quantities of sludge produced by the municipal treatment plants and related land requirements are given in Table IV-33.

TABLE IV-33

PROJECTED WASTEWATER SLUDGE PRODUCTION-
MUNICIPAL WASTES

Service Areas	Dry Solids Production (Tons/day) 1972	1985	2000
York Urban Area	15.8	23.0	33.8
Hanover-Spring Grove Urban Area	2.2	3.2	4.2
Railroad-New Freedom and Glen Rock Urban Area	0.5	1.0	1.6

LAND REQUIREMENTS FOR SLUDGE APPLICATIONS

ACREAGE REQUIREMENTS			
Annual Application of Sludge on Same Land at 25 Dry Tons/Ac.		One Time Application of Sludge at 250 Dry Tons/Ac.	
by 1985	by 2000	by 1985	by 2000
400	580	462	1,197

Industrial Wastes Management Plan

Two independent industrial wastes management situations must be dealt with separately in the program to manage water quality in the Codorus Basin. The first of these is the treatment requirements of the P. H. Glatfelter Company and the other is the general problem posed by the various direct industrial discharges located principally in the York and Hanover areas.

P. H. Glatfelter Paper Mill Recommended Plan

To satisfy the Commonwealth of Pennsylvania effluent restrictions and stream quality objectives the P. H. Glatfelter Company (PHGCo) must improve the quality of its effluent in the following areas.

BOD_5 - reduced to 7 mg/l or less from the present 10 mg/l level.

Color - reduce the present stream concentration levels of 300-400 units to less than 50 units. To accomplish this, effluent concentrations must be less than 100 units.

Thermal - reduce heat loading so that maximum stream temperatures below the plant do not exceed 87°F.

Dissolved oxygen - provide reaeration to maintain D.O. above 6 mg/l.

The possible treatment technologies that are available to PHGCo in order to accomplish the existing Commonwealth of Pennsylvania's stream and effluent standards are as follows:

Method A. Chemical clarification with lime followed, in order, by: biological treatment, selective adsorption with activated carbon for COD and color removal, polishing filtration, reaeration combined with evaporative cooling for temperature control, and chlorination. The technical feasibility of the process sequence (illustrated in Exhibit III-10) has been demonstrated and documented in a PHGCo report

entitled "P. H. Glatfelter Company - Advanced Waste Treatment Research - Color, BOD, D.O. and Temperature-Compendium and Status" - July 31, 1969.

Method B. Chemical clarification with lime followed, in order, by: biological treatment, land application (for the simultaneous removal of COD, color, suspended solid, nitrogen and phosphorus together with disinfection and temperature reduction through evaporative cooling) and reaeration. The technical feasibility of this process sequence, (illustrated in Exhibit III-11), has been demonstrated and documented in Technical Bulletins Numbers 150 and 164 of The National Council for Stream Improvement of the Pulp, Paper and Paperboard Industries and in "Recent Progress In Land Disposal of Mill Effluents", by R. O. Blosser and A. L. Caron, TAPPI 48, 43A-46A (1965).

The low nutrient content of the Glatfelter secondary effluent and the problem of land assembly makes the land treatment choice a less feasible choice than advanced treatment unless the Glatfelter wastes are combined with municipal effluent to enhance the nutrient value and facilitate site acquisition by being part of a municipal treatment program. Therefore, Method A would likely be the appropriate choice in conjunct9on with selection of the All Water Plan whereas with selection of the All Land Treatment Plan with and without reuse, Method B may be the optimum choice.

Disposal of Paper Mill Sludges - A major waste management problem presently facing the Glatfelter Paper Company is the ultimate disposal of the large quantities of sludges produced by the primary and secondary treatment processes. At present, approximately 50 dry tons per day of solids are collected and lagooned on site. Unused storage capacity exists in the existing sludge lagoons for only a few more years accumulation of material.

The company is presently evaluating alternatives for satisfying its sludge disposal need for the long-range future. A continuation of the present practice of on-site lagooning appears to be infeasible so that some management program for the development of a new ultimate disposal practice will likely be required.

The company is presently evaluating programs and processes that will recover and reuse a substantial amount of the paper fiber and other process materials that make-up most of the waste solids. One major area of reuse would be the reprocessing of the waste lime which would result from a recalcination process developed in conjunction with the lime clarification step discussed for the advanced treatment technology alternative Method A. This process would also result in the incineration of the primary organic solids collected in the sedimentation process.

The amount of sludge to be disposed of per unit of production will, therefore, be reduced substantially with the inclusion of advanced waste treatment and the associated economically justified solids recovery and reprocessing operations. The net amount of solids production requiring ultimate disposal will likely be only 20 to 40 per cent of the present unit rate of production.

For the purposes of estimating and costing out a program for waste solids disposal for the paper mill it was assumed that the net amount of solids to be disposed of over the long-range future would amount to a unit production level of 30 per cent of the present rate. On a wastewater flow basis this amounts to 0.9 tons of dry solids per million gallons treated.

Alternative methods of final disposal would include application to sandy soil areas as a soil builder, reclamation of strip-mine areas and landfilling at select environmentally safe sites. Potential sludge spreading sites are available within 100 to 200 miles of Spring Grove. Assuming the utilization of rail or truck transport for hauling from temporary storage lagoons an estimated cost of $8.00 per wet ton was used for evaluating final dispoal costs. The quantities of sludge to be disposed of are as follows:

	1972-1985	1986-2000
P. H. Glatfelter avg. wastewater flow - MGD	20	26
Annual quantity of dry solids-Tons (@0.9 Tons/MGD)	6,600	8,500
Annual quantity of wet solids-to be hauled - Tons (@15% solids conc.)	44,000	57,000

Glatfelter Costs - For the P. H. Glatfelter Company, treatment facilities investments and annual operating and replacement costs required by the conventional Method A are presented in Tables IV-35, IV-36 and IV-37. The average annual cost is $3,619,000. Land irrigation of Glatfelter wastes is explored in combination with municipal wastes in the presentation of the industrial reuse plans.

Other Direct Industrial Waste Dischargers

Problems associated with the various direct industrial discharges have largely been in the areas of periodic toxic metals spills and high concentrations of specific chemicals such as phosphorus. Many problem sources have been controlled but the surveillance management problem posed by these sources is severe.

Even with improved treatment these sources will not be able to achieve with direct discharge the treatment performance achieved by the municipal treatment system in the alternative advanced treatment plans. It is proposed, therefore, that industrial discharges be collected in the sanitary system after adequate pre-treatment to remove toxic and other materials not acceptable or amenable to treatment by the public facilities.

Industry has a role to play in the maintenance of the water quality desired for Codorus Creek. For the majority of the area industries that generate a process water effluent, the desired water quality in Codorus Creek and it's tributaries will promote recycle of industrial water to meet industrial water needs. Industries for which recycle will be advantageous will be those having excessive amounts of heavy metals in their treated process waters. Recycle of their industrial effluent coupled with enrichment, recovery and beneficial utilization of the associated heavy metals will prove to be of economic benefit when coupled with the maintenance of good quality water in the Codorus Creek waters.

A net discharge of industrial wastewater will be made to the regional wastewater management system where essentially complete water reclamation can be accomplished at an economy of scale achievable only by the regional system. Industrial discharges to the regional system must be regulated by appropriate sewer acceptance criteria and be of such quality so as to be consistent with the functioning of the regional management system.

A list of the present direct industrial discharge sources is given in Table IV-34 . This table also indicates the service area system each should be connected to, present flow conditions, and required pre-treatment before introduction into the municipal collection system. Certain existing direct discharge industries (Certain Teed Products, York Stone and Supply, and the York Water Co. Filtration Plant) are not included in this list. The first two are believed to discharge only cooling water and the latter will provide its own treatment facility.

TABLE IV- 34

TREATMENT PLAN - PRESENT DIRECT INDUSTRIAL DISCHARGERS

Industry	Service Area	Type of Waste Problem	Estimated Flow (MGD)	Required Pre-Treatment
York Urban Area				
General Time Corp.	Springettsbury	Metals	.01	Chemical Precipitation & metal recovery
Am. Machine & Foundry	"	"	.2	"
Cole Steel Equipment Co.	"	"	.03	"
York Shipley, Inc.	"	"	.02	"
Finchbaugh Products	"	"	.06	"
REDCO	"	"	.01	"
Sub-Total			.33	
Borg-Warner, York Division	York	Metals	.15	"
Cole Steel Equipment Co.	"	"	.04	"
The McKay Company	"	"	.04	"
New York Wire Company	"	"	.02	"
Bowen-McLaughlin	"	"	.02	"
American Chain & Cable Co.	"	"	.15	"
ACCO	"	"	.20	"
Sub-Total			.62	
Ness Company	York	Organic	.01	Gross Solids Removal
Dolomite Brick Company	"	Solids	.01	"
Medusa Cement	"	Solids	.40	"
The Pfaltzgraff Company	"	Solids	.02	"
Sub-Total			.44	

TABLE IV- 34 (Cont'd)

Industry	Service Area	Type of Waste Problem	Estimated Flow (MGD)	Required Pre-Treatment
Hanover-Penn Twp. Area				
Hanover Wire Cloth Div.	Penn Twp.	Metals	.10	Chemical Precipitation & metal recovery
Keystone Seneca Wire Cloth	"	"	.02	"
Sub-Total			.12	
Glen Rock, Shrewsbury, Railroad and New Freedom Area				
Aircraft Marine	Glen Rock	Metals	.03	Chemical Precipitation & metal recovery
Superior Wire	New Freedom	"	.01	"
Hungerford Packing	"	Organic	.02	Gross Solids Removal
Boyd's Laundromat	"	Organic/Nutrient	.01	None
Charles G. Summers	"	Organic	.04	Gross Solids Removal
Sub-Total			.11	

TABLE IV-35

P. H. GLATFELTER COMPANY - COST SUMMARY

	TREATMENT COSTS	
Investment Costs ($1,000)	1972-1985	1986-2000
Raw Water Treatment Facilities	2,520	960
Secondary Treatment Facilities	2,400	-
Advanced Treatment Facilities	8,568	-
Sub-Total	13,488	960
Engineering & Overhead[1]	1,349	96
Lands	-	-
Total, Investment Costs	14,837	1,056
Operations & Maintenance Costs ($1,000/yr)		
Labor	780	920
Equipment & Supplies	280	360
Chemicals	370	470
Energy	470	600
Sludge Disposal	350	455
Total, O & M Costs	2,250	2,805
Other Costs ($1,000)		
Initial Stage Replacement Costs		
10-Year	1,960	
25-Year	2,944	
Second Stage Replacement Costs		
10-Year	48	
25-Year	240	
Salvage Value		
Facilities	240	
Lands	-	
Total Salvage Value	240	
Average Annual Costs ($1,000/yr)		
Average Annual Capital Cost	969	
Average Annual O & M Cost	2,463	
Average Annual Replacement Cost	188	
Average Annual Salvage Value	1	
Total, Average Annual Cost	3,619	

[1] Engineering & Overhead includes 10% of facilities cost

NOTE: All Investment Costs above include 20% contingencies.

TABLE IV-36

P. H. GLATFELTER COMPANY WATER AND WASTEWATER TREATMENT FACILITIES REQUIREMENTS

Wastewater Facilities

Date	IMPROVEMENT	
1973	Construction of 20 MGD carbon adsorption advanced waste treatment plant - Carbon filters - Filter building - Carbon regeneration equipment - Carbon feed and storage equipment	$ 5,000,000
1973	Post-aeration facilities for 20 MGD flow	180,000
	Chlorination facilities for 20 MGD flow	160,000
1980	Expansion of present 20 MGD secondary treatment facility to 28 MGD for year 2000 design - Primary treatment - Aerated lagoon activated sludge secondary treatment	2,000,000
1980	Expansion of carbon adsorption advanced treatment system to 28 MGD capacity	1,800,000
	Subtotal	$ 9,140,000
	Contingencies (20%)	1,828,000
	Wastewater Subtotal	$10,968,000
	Engineering & Overhead (10%)	1,097,000
	WASTEWATER TOTAL	$12,065,000

TABLE IV-36 (Cont.)

Water Supply Facilities

Date	IMPROVEMENT	
1973	Replacement of present 8 MGD older water treatment plant with 12 MGD new facility	
	- Chemical mix basin flocculation and sedimentation facility - Alum feed and storage equipment - Lime feed and storage equipment - Filter building	$ 2,100,000
1986	Four (4) MGD expansion of water treatment plant	800,000
	Subtotal	2,900,000
	Contingencies (20%)	580,000
	Water Supply Subtotal	$ 3,480,000
	Engineering & Overhead (10%)	348,000
	WATER SUPPLY TOTAL	$ 3,828,000

TABLE IV-37

P. H. GLATFELTER COMPANY

OPERATING COSTS FOR WASTEWATER
AND WATER SUPPLY FACILITIES
($ per year)

Wastewater Treatment

	1972-1985	1986-2000
Primary & Secondary Treatment		
Labor	$ 300,000	$ 350,000
Equipment & Supplies	100,000	130,000
Energy	100,000	130,000
Chemicals	100,000	130,000
SUB-TOTAL	$ 600,000	$ 740,000
Advanced Treatment (Carbon Filtration, Carbon Regeneration, Post-Aeration & Chlorination)		
Labor	$ 380,000	$ 450,000
Equipment & Supplies	130,000	160,000
Energy	270,000	340,000
Chemicals	200,000	250,000
SUB-TOTAL	$ 980,000	$1,200,000
WASTE TREATMENT TOTAL	$1,580,000	$1,940,000

Water Treatment Plant

Labor	$ 100,000	$ 120,000
Equipment & Supplies	50,000	70,000
Energy	100,000	130,000
Chemicals	70,000	90,000
WATER TREATMENT TOTAL	$ 320,000	$ 410,000

TABLE IV-37 (Cont.)

Sludge Disposal

	1972-1985	1986-2000
Haulage and land application @$8.00 per wet ton	$ 350,000	$ 455,000
TOTAL O&M COSTS	$2,250,000	$2,805,000

Year 2020 Framework Plan

The alternative plans proposed provide for the construction of transmission and treatment facilities required to meet the year 2000 projected flow conditions. To meet the year 2020 flow treatment requirements, will require additional investments in pumping station and treatment plant expansions. Transmission pipelines will be adequate to the year 2020.

Projected year 2020 flows are listed below through the year 2020:

Area	2000	2020
York Urban Area	50.8	73.3
Hanover-Penn Twp Area	6.1	8.9
Spring Grove	0.3	0.8
Glen Rock-Railroad and New Freedom Area	2.4	5.0

These estimates are subject to the impacts of future changes in industrial and domestic water conservation practices due to the effects of increased treatment costs and limited availability of in-basin water supplies. Actual flows in the year 2020 will likely be less than the projections shown.

For the York area water based plans, a small amount of additional land area would be required for secondary and advanced treatment plants. Expansion of treatment capacity at each of the three secondary treatment plants and at the advanced treatment plant would be necessary.

For the upstream communities land treatment plan, additional irrigation site areas, storage ponds and secondary treatment capacity would be necessary. Pumping capacity to the irrigation site area would also require expansion but transmission pipelines would be adequate. Additional necessary irrigation site areas would readily be

available for all but the Hanover-Penn Township site. Expansion of this site will require development of a new satellite project area.

The land treatment site for the York urban area would only be adequate until the year 2000 with materialization of the flows projected. This site could not readily be expanded beyond that date without the realization of other program elements such as industrial reuse, use of the storage ponds for evaporative cooling and expanded use conservation practices.

INDUSTRIAL REUSE PLAN ALTERNATIVES

Analysis of wastewater management alternatives for the Codorus Basin in relation to overall water resource management needs has lead to the identification of water reuse as a major long-range program need. Limited availability of in-basin supplies and the problem of stream flow reductions from diversion of withdrawals, creates the need to explore reuse on a major scale.

A number of large water using industries in the York urban area are likely to be able to use the tertiary treated effluent from the advanced treatment plant directly for cooling and process uses. The quality of the tertiary effluent will be as good as that of treated surface water in most aspects. Higher dissolved solids for the treated effluent represents the only major quality difference.

The P. H. Glatfelter paper mill as the major point source user of basin water supply (presently 17 MGD) presents a prime reuse potential. An extensive review and feasibility analysis effort to ascertain the viability of wastewater effluent reuse at the mill has lead to the conclusion that secondary effluent from the York area treatment plants could be treated to a satisfactory process-water quality with the raw water treatment plant facilities presently in place at the mill.

At the paper mill the secondary treated wastes would receive additional treatment at the present raw water treatment plant. Treatment processes would include chemical flocculation and settling, sand filtration and chlorination.

Reuse could be accomplished with only a modest increase in raw water treatment costs, largely incurred as increased chemical demands and sludge disposal costs. Minor modification in chemical feed systems may also be required. The nature and cost of such modifications could only be established through an extensive program of laboratory and plant scale performance systems. However, costs of chemical feed systems represent only a few percent of the cost of hydraulic structures and process units in a water treatment plant.

Two basic design alternatives exist for the linkage of reuse at the Glatfelter paper mill with the alternative municipal treatment plans presented in this study. One of these entails construction of a sepa-

rate pipeline to the paper mill from the York treatment plant or from the land treatment site with the final discharge from the paper mill being returned to the West Branch of Codorus Creek after receiving appropriate advanced water process treatment. The second would entail a transmission line from the York land treatment site to the paper mill and a return pipeline to the land treatment site for final treatment of the paper mill wastes by the land after receiving secondary biological treatment at the present P. H. Glatfelter facility.

Separate reuse facilities cost evaluations are presented in this study for integration with three basic design alternatives (Options).

Option A - Reuse with plan to meet current standards

Option B - Reuse with Basic All Water Plan

Option C - Reuse with Basic All Land Plan

Reuse with the December Plan is effectively equivalent to Option B.

Option A - Reuse with Plan to Meet Current Standards

This plan entails the construction of a transmission pipeline from the City of York treatment plant to the P. H. Glatfelter paper mill. Secondary treatment would be provided at the York plant for the wastes delivered to the paper mill pipeline. Chemical treatment, filtration and reaeration facilities will also be installed to treat the entire York plant flow. This capability is provided to treat the entire flow during periods when delivery of secondary effluent to the paper mill is not desired. The design aspects of the other Study Area plants would not be affected by the reuse program. Figure IV-5 depicts the plan.

Project Costs

Capital investment costs for this alternative are listed in Table IV-41, and annual operation and maintenance costs in Table IV-42 . The total average annual cost (Table IV-33) is $8,663,000.

FIGURE IV-5

CODORUS CREEK WASTEWATER MANAGEMENT STUDY

REUSE OPTION A

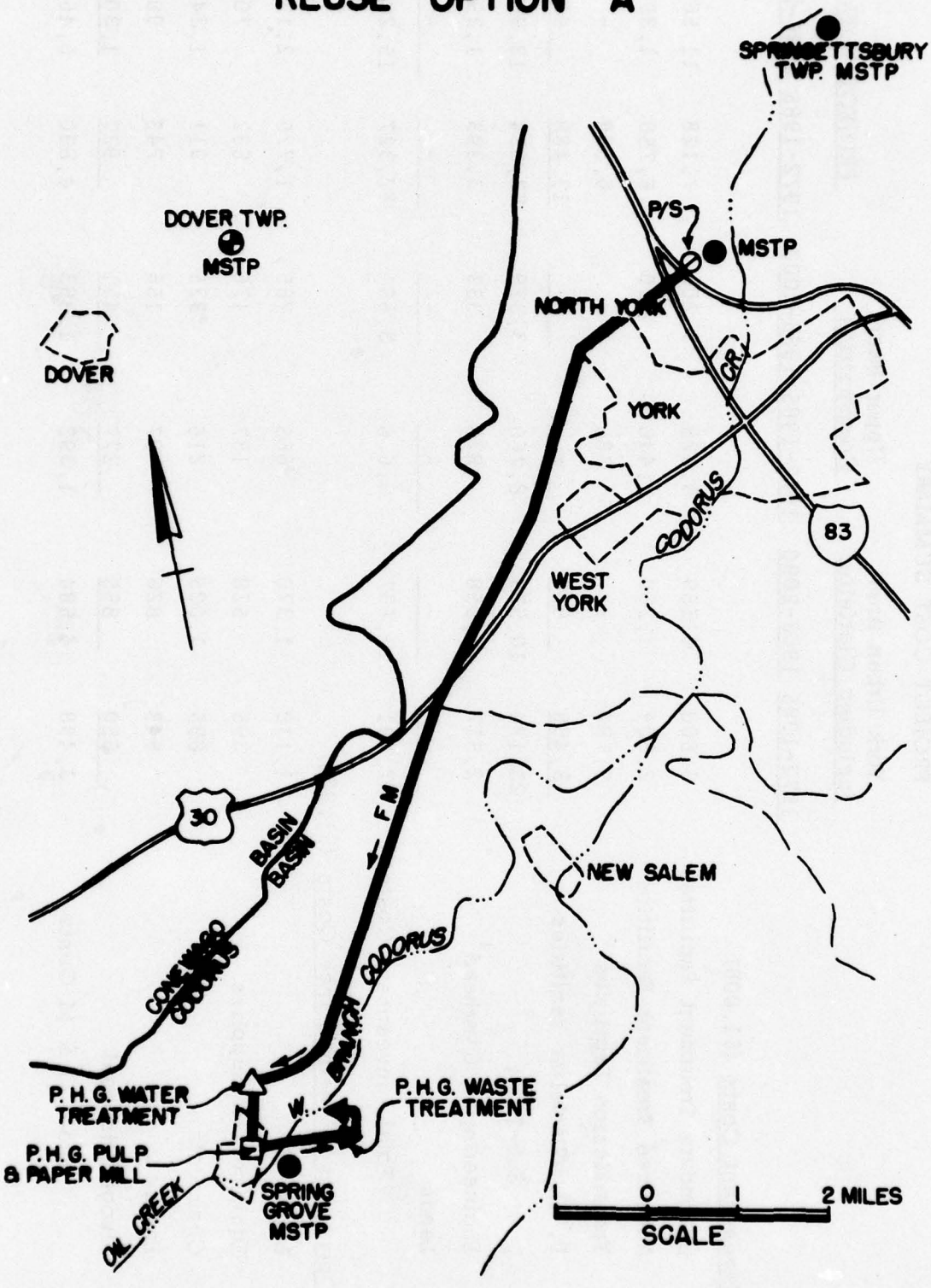


TABLE IV-38

REUSE ALTERNATIVE OPTION A

PROJECT COST SUMMARY

	York Urban Area Including Glatfelter		Upper Basin Communities		PROJECT TOTAL	
	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Investment Costs ($1,000)						
Secondary Treatment Facilities	3,600	8,359	3,528	3,208	7,128	11,567
Advanced Treatment Facilities	2,304	1,260	4,446	120	6,750	1,380
Transmission Facilities	5,782	-	786	-	6,568	-
P. H. Glatfelter Facilities	13,488	960	-	-	13,488	960
Sub-Total	25,174	10,579	8,760	3,328	33,934	13,907
Engineering & Overhead[1]	2,517	1,058	876	333	3,393	1,391
Lands	-	-	-	-	-	-
Total, Investment Costs	27,691	11,637	9,636	3,661	37,327	15,298
Operations & Maintenance Costs ($1,000)						
Labor	1,110	1,370	665	765	1,775	2,135
Equipment & Supplies	395	528	137	176	532	704
Chemicals	695	1,005	216	335	911	1,340
Energy	648	826	97	156	745	982
Sludge Disposal	650	855	277	451	927	1,306
Total, O & M Costs	3,498	4,584	1,392	1,883	4,890	6,467

TABLE IV-38 (continued)

Other Costs ($1,000)	York Urban Area Including Glatfelter	Upper Basin Communities	PROJECT TOTAL
Initial Stage Replacement Costs			
10 Year	2,601	1,065	3,666
25 Year	4,319	1,829	6,148
Second Stage Replacement Costs			
10 Year	718	185	903
25 Year	2,582	816	3,398
Salvage Value			
Facilities	1,645	496	2,141
Lands	-	-	-
Total Salvage Value	1,645	496	2,141
Average Annual Costs ($1,000/year)			
Average Annual Capital Cost	2,065	708	2,773
Average Annual O & M Cost	3,915	1,581	5,496
Average Annual Replacement Cost	288	112	400
Average Annual Salvage Value	6	-	6
Total, Average Annual Cost	6,262	2,401	8,663

[1]Engineering & overhead includes 10% of facilities cost.

NOTE: All investment costs above include 20% contingencies.

These costs include the estimated incremental operating cost for water treatment at the paper mill as well as investments by the paper mill in water treatment and waste treatment facilities. These latter costs are detailed in the section of the report dealing with industrial treatment needs.

Option B - Reuse with Basic All Water Plan

Design aspects of this plan configuration include the construction of a pipeline to convey the secondary effluent from the York treatment plant to the raw water treatment plant at the paper mill. To take care of the special problem of temporary upsets and periodic effluent quality problems at the York treatment plant that would not permit reuse, provision is made to hold five (5) days of average reuse flow in a detention basin before introduction into the advanced treatment plant. Figure IV-6 depicts the overall layout scheme for this option for the York urban area. Facilities for the upper basin communities would be as shown in the Basic All Water Plan.

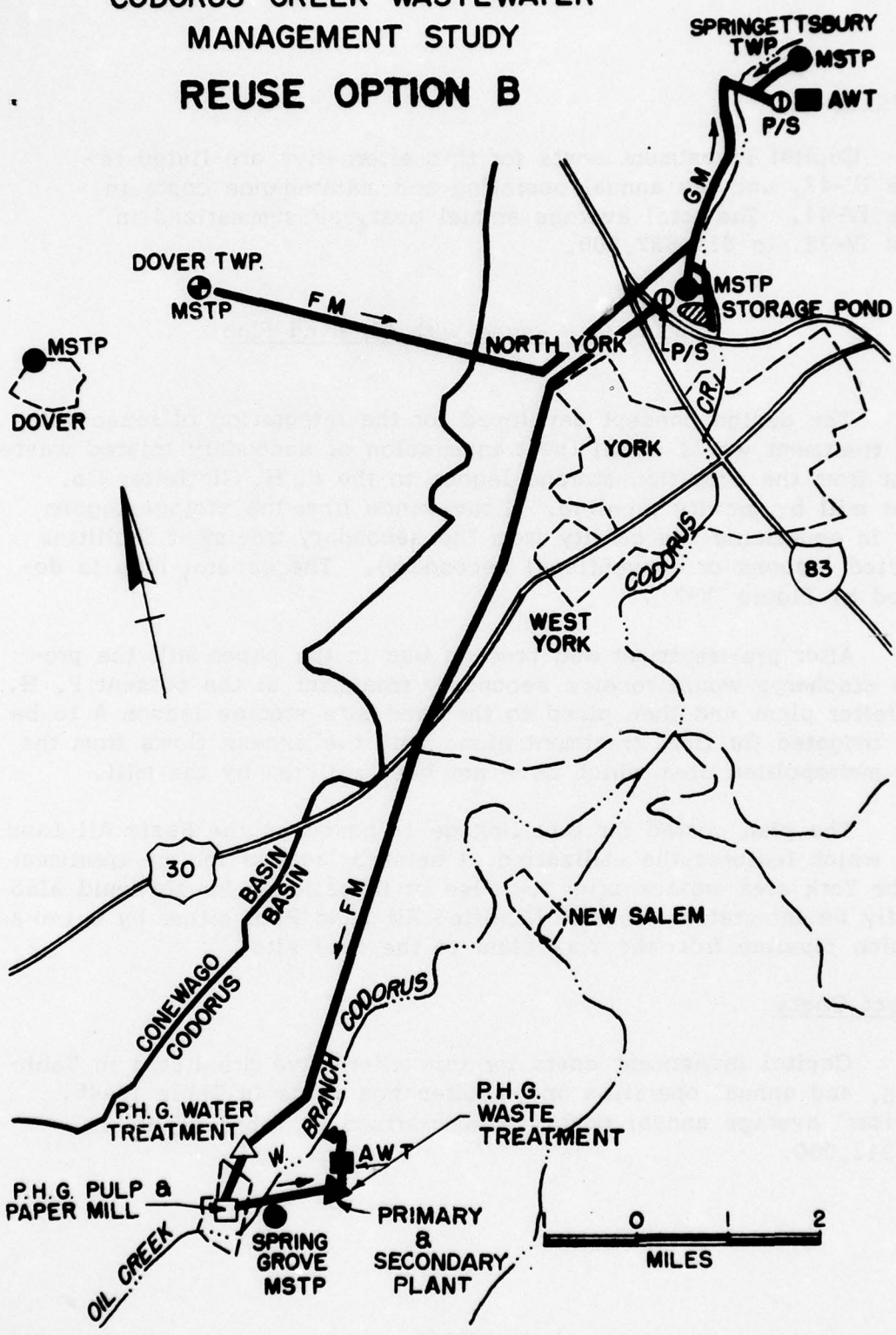
The remaining York area effluent would be directed to an advanced treatment plant constructed at the present Springettsbury STP location. The projected amounts of waste treated at the AWT plant and the amount reused is as follows:

	Year		
	1972 MGD	1985 MGD	2000 MGD
Municipal Flows	22	35	51
Glatfelter Usage (reuse)	17	23	28
Excess Municipal Flows	5	12	23

FIGURE IV-6

CODORUS CREEK WASTEWATER MANAGEMENT STUDY

REUSE OPTION B



Project Costs

Capital investment costs for this alternative are listed in Table IV-43, and the annual operating and maintenance costs in Table IV-44. The total average annual cost, as summarized in Table IV-39, is $11,887,000.

Option C - Reuse with All Land Plan

The design concept developed for the integration of reuse with land treatment would entail the transmission of secondary treated wastewater from the irrigation storage lagoon to the P. H. Glatfelter Co. paper mill by gravity pipeline. Conveyance from the storage lagoon aids in equalizing the quality from the secondary treatment facilities (aerated lagoons or conventional secondary). The general plan is depicted by Figure IV-7 .

After pre-treatment and process use in the paper mill the process discharge would receive secondary treatment at the present P. H. Glatfelter plant and then piped to the land site storage lagoon A to be land irrigated for final treatment along with the excess flows from the York metropolitan area which have not been utilized by the mill.

The plan costed for this linkage is based on the Basic All Land Plan which features the utilization of aerated lagoons for pre-treatment of the York area wastes prior to reuse or irrigation. Reuse could also readily be integrated with the Modified All Land Plan either by a transmission pipeline from the York plant to the land site.

Project Costs

Capital investment costs for this alternative are listed in Table IV-45, and annual operation and maintenance costs in Table IV-46. The total average annual cost, as summarized in Table IV-40, is $10,312,000.

FIGURE IV-7

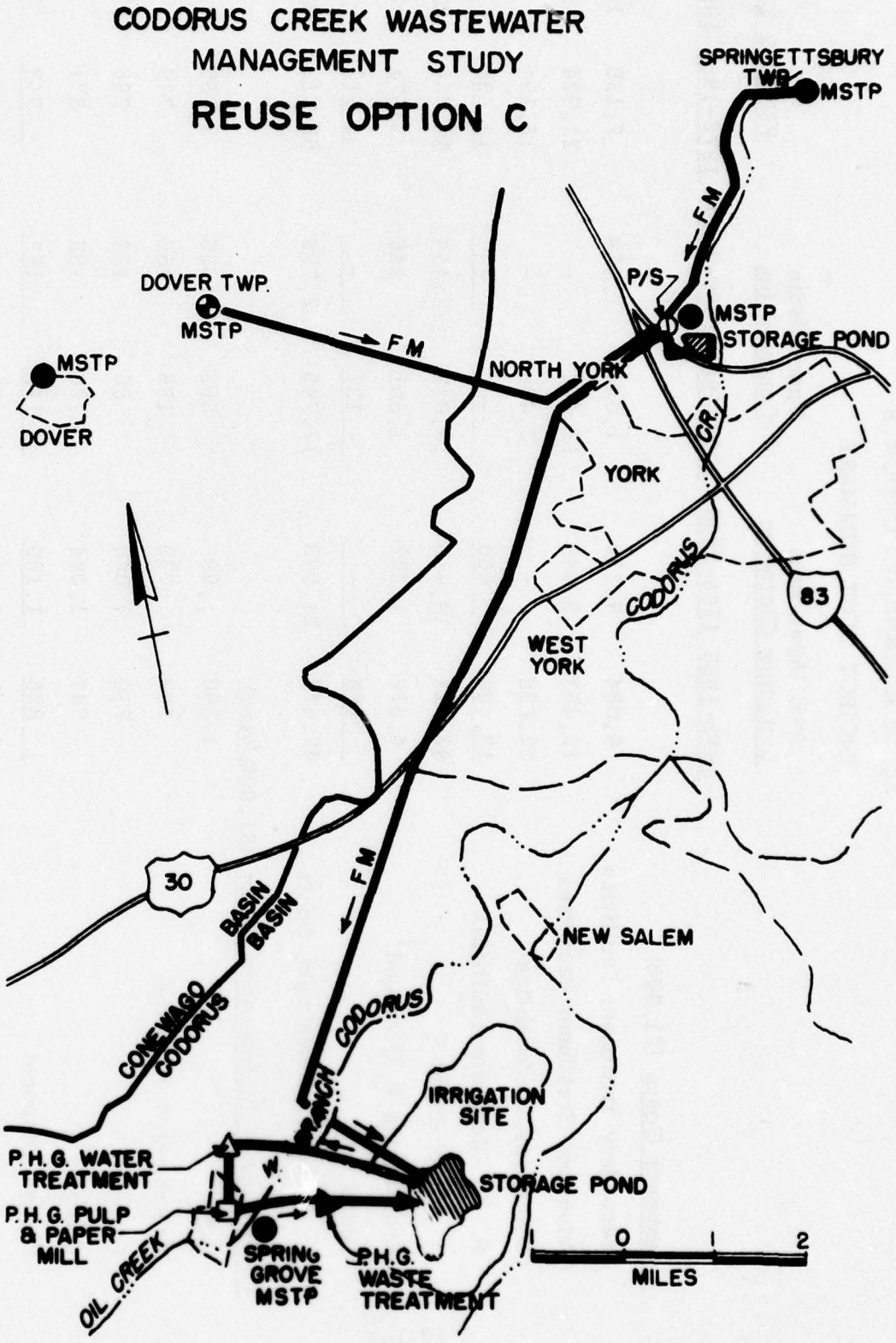

CODORUS CREEK WASTEWATER
MANAGEMENT STUDY
REUSE OPTION C
SPRINGETTSBURY TWP.
MSTP
F M
P/S 7
MSTP
STORAGE POND
DOVER TWP.
MSTP
F M
NORTH YORK
MSTP
DOVER
GR.
YORK
CODORUS
83
WEST YORK
30
BASIN
BASIN
F M
NEW SALEM
CONEWAGO
CODORUS
BRANCH
CODORUS
IRRIGATION SITE
P.H.G. WATER TREATMENT
STORAGE POND
P.H.G. PULP & PAPER MILL
SPRING GROVE MSTP
P.H.G. WASTE TREATMENT
OIL CREEK
0
1
2
MILES

TABLE IV-39

REUSE ALTERNATIVE OPTION B

PROJECT COST SUMMARY

	York Urban Area Including Glatfelter		Upper Basin Communities		PROJECT TOTAL	
	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Investment Costs ($1,000)						
Secondary Treatment Facilities	6,084	9,116	1,044	2,459	7,128	11,575
Advanced Treatment Facilities	10,452	9,840	11,472	-	21,924	9,840
Transmission Facilities	12,698	-	3,496	-	16,194	-
P. H. Glatfelter Facilities	13,488	960	-	-	13,488	960
Sub-Total	42,722	19,916	16,012	2,459	58,734	22,375
Engineering & Overhead[1]	4,272	1,992	1,601	246	5,873	2,238
Lands	480	-	132	-	612	-
Total, Investment Costs	47,474	21,908	17,745	2,705	65,219	24,613
Operations & Maintenance Costs ($1,000/year)						
Labor	1,590	1,980	565	625	2,155	2,605
Equipment & Supplies	563	789	156	186	719	975
Chemicals	710	1,040	86	120	796	1,160
Energy	743	1,084	128	188	871	1,272
Sludge Disposal	826	1,180	117	167	943	1,347
Total, O & M Costs	4,432	6,073	1,052	1,286	5,484	7,359

TABLE IV-39 (continued)

Other Costs ($1,000)	York Urban Area Including Glatfelter	Upper Basin Communities	PROJECT TOTAL
Initial Stage Replacement Costs			
10 Year	6,292	2,346	8,638
25 Year	8,877	2,716	11,593
Second Stage Replacement Costs			
10 Year	2,647	123	2,770
25 Year	4,662	1,984	6,646
Salvage Value			
Facilities	2,893	369	3,262
Lands	480	132	612
Total Salvage Value	3,373	501	3,874
Average Annual Costs ($1,000/year)			
Average Annual Capital Cost	3,592	1,198	4,790
Average Annual O & M Cost	5,062	1,142	6,204
Average Annual Replacement Cost	689	218	907
Average Annual Salvage Value	12	2	14
Total, Average Annual Cost	9,331	2,556	11,887

[1] Engineering & overhead includes 10% of facilities cost.

NOTE: All investment costs above include 20% contingencies.

TABLE IV-40

REUSE ALTERNATIVE OPTION C

PROJECT COST SUMMARY

	York Urban Area Including Glatfelter		Upper Basin Communities		PROJECT TOTAL	
Investment Costs ($1,000)	1972-1985	1986-2000	1972-1985	1986-2000	1972-1985	1986-2000
Basic All Land Facilities	37,306	5,479	11,852	2,459	49,158	7,938
P. H. Glatfelter Facilities	4,720	960	-	-	4,720	960
Additional Transmission Facilities	1,524	-	-	-	1,524	-
Sub-Total	43,550	6,439	11,852	2,459	55,402	8,898
Engineering & Overhead[1]	4,355	644	1,185	246	5,540	890
Lands	19,686	-	5,341	-	25,027	-
Total, Investment Costs	67,591	7,083	18,378	2,705	85,969	9,788
Operations & Maintenance Costs ($1,000/yr)						
Labor	1,130	1,391	363	415	1,493	1,806
Equipment & Supplies	273	358	68	94	341	452
Chemicals	405	519	3	3	408	522
Energy	826	1,097	121	169	947	1,266
Sludge Disposal	575	770	121	171	696	941
Total, O & M Costs	3,209	4,135	676	852	3,885	4,987

TABLE IV-40
(continued)

Other Costs ($1,000)	York Urban Area Including Glatfelter	Upper Basin Communities	PROJECT TOTAL
Initial Stage Replacement Costs			
10-Year	2,613	646	3,259
25-Year	5,433	1,487	6,920
Second Stage Replacement Costs			
10-Year	342	123	465
25-Year	1,440	615	2,055
Salvage Value			
Facilities	800	369	1,169
Lands	9,708	3,190	12,898
Total Salvage Value	10,508	3,559	14,067
Average Annual Costs ($1,000/yr)			
Average Annual Capital Cost	4,476	1,238	5,714
Average Annual O & M Cost	3,564	744	4,309
Average Annual Replacement Cost	262	76	338
Average Annual Salvage Value	36	12	48
Total, Average Annual Cost	8,266	2,046	10,312

[1] Engineering & Overhead includes 10% of facilities cost

NOTE: All Investment Costs above include 20% contingencies.

TABLE IV-41
REUSE ALTERNATIVE OPTION A
INTEGRATED WITH PLAN TO MEET CURRENT STANDARDS
FACILITIES COST ESTIMATE

1972-1985 Period		
York-Glatfelter treated waste pipeline		
35 MGD Pumping Station		
TDH = 350'	910,000	
58,000 LF of 42" FM	3,650,000	
		4,560,000
Sub-Total		4,689,000
Contingencies		938,000
ITEM TOTAL		5,627,000
Other municipal facilities as detailed in Plan to Meet Current Standards		14,819,000
P. H. Glatfelter water and wastewater treatment facilities as detailed in Industrial Waste Treatment Section		13,488,000
1972-1985 Construction Total		33,934,000
1986-2000 Period		
P. H. Glatfelter Secondary Facility Expansion		960,000
Municipal facilities as detailed in Plan to Meet Current Standards		12,947,000
1986-2000 Construction Total		13,907,000

TABLE IV-42
REUSE ALTERNATIVE OPTION A
INTEGRATION WITH PLAN TO MEET CURRENT STANDARDS
DETAILED OPERATING AND MAINTENANCE COSTS

	1972-1985	1986-2000
All Municipal Treatment Plants Except York (See Table IV-3)		
Sub-Total	1,392,000	1,883,000
York Treatment Plant		
Labor	300,000	420,000
Equipment & Supplies	100,000	150,000
Chemicals	100,000	250,000
Energy	120,000	160,000
Sludge Disposal	300,000	400,000
Sub-Total	920,000	1,380,000
Transmission from York to Glatfelter		
Labor	30,000	30,000
Energy	58,000	66,000
Equipment & Supplies	15,000	18,000
Sub-Total	103,000	114,000
P. H. Glatfelter Company Water Treatmeant Facilities		
Labor	100,000	120,000
Energy	100,000	130,000
Equipment & Supplies	50,000	70,000
Chemicals	295,000	375,000
Sub-Total	545,000	695,000
Wastewater Treatment Facilities (For detailed cost breakdown refer to Table IV-37)		
Secondary Treatment	600,000	740,000
Advanced Treatment	980,000	1,200,000
Sub-Total	1,580,000	1,940,000
Sludge Disposal	350,000	455,000
TOTAL PROJECT O & M COSTS	4,890,000	6,467,000

TABLE IV- 43

REUSE ALTERNATIVE OPTION B
SYSTEM INTERGRATION WITH BASIC ALL WATER PLAN
FACILITIES COST ESTIMATE

1972-1985 Period

Date	Project Item		Cost
	1. Secondary Treatment Plants		
	York Area Secondary Treatment Facilities (see Table IV-7)		6,084,000
	2. Conveyance System		
	York - Springettsbury treated waste pipeline		
	21,700 LF of 42" GR		1,860,000
	Dover - York treated waste pipeline		
	Pumping Station	70,000	
	27,500 LF of 18" FM	688,000	
			758,000
	New Salem - York Interceptor		
	Pumping Station	30,000	
	9,400 LF of 6" FM	82,000	
	1,200 LF of 8" GR	17,000	
			129,000
	Springettsbury STP - Springettsbury AWT		
	Pumping Station 40 MGD, TDH=40'	100,000	
	1,000 LF of 36" FM	55,000	
			155,000
	York - Glatfelter treated waste pipeline		
	Pumping Station - 35 MGD TDH=350'	910,000	
	58,000 LF of 42'FM	3,650,000	
			4,560,000

TABLE IV-43 (Cont'd)

1972-1985 Period

Date	Project Item		Cost
	One hundred (100) million gallon storage basin adjacent to York STP for detention of upsets and controlled release to Springettsbury AWT		
	Earthen Basin 30' deep x 10 ac.	2,400,000	
	Aeration equipment	400,000	
	Pumping Station - 10 MGD	100,000	
	Inlet & outlet structures	100,000	
	Land site - 12 acres	120,000	
			3,120,000
		Sub-Total	10,582,000
		Contingencies	2,116,000
		ITEM TOTAL	$12,698,000

3. Springettsbury Advanced Treatment Facility

1973 Twelve (12) MGD Type D advanced waste treatment plant at Springettsbury for 1985 design year.

Basis of Design: Average Daily Flow = 12 MGD
Peak Design Flow = 21 MGD

Nitrification Facilities

- Aeration basins	650,000	
- Sedimentation basins	750,000	
- Sludge retention pump station	100,000	
Item Total		1,500,000

Denitrification Facilities

- Anaerobic denitrification basins	650,000	
- Sedimentation basins	750,000	
- Sludge return pump station	100,000	
Item Total		1,500,000

TABLE IV-43 (Cont'd)

1972-1985 Period

Date	Project Item		Cost
	Chemical Treatment Facilities		
1973 (Cont'd)	- Rapid mix basin	30,000	
	- Flocculation units	150,000	
	- Sedimentation basins	600,000	
	- Recarbonation basin & equipment	400,000	
	- Lime feed & storage equipment	150,000	
	- Methanol feed & storage equip.	70,000	
	- Lime sludge dewatering and re-calcination equipment	1,100,000	
	- Chemical building	300,000	
			2,800,000
	Sludge Management Facilities		
	- Sludge thickener	20,000	
	- Sludge storage tank	15,000	
	- Centrifuge	45,000	
			80,000
	Filter Building & Facilities		1,200,000
	Reaeration Facilities		
	- Aeration basin with mechanical aerators		180,000
	Chlorination Facilities		
	- Chlorination contact tank	100,000	
	- Chlorination feed & storage equipment	40,000	
			140,000
	Yard Piping		700,000
	Electrical & Instrumentation		350,000

TABLE IV-43 (Cont'd)

1972-1985 Period

Date	Project Item		Cost
1972 (Cont'd)	Control & Laboratory Building		200,000
	Site Development		
	- Roadwork & Paving	40,000	
	- Lanscaping	20,000	
			60,000
	Land Acquisition		
	- 40 acres @10,000		400,000
		Facility Total	9,110,000
		Contingencies	1,822,000
		ITEM TOTAL	$10,932,000
	P. H. Glatfelter Water and Wastewater Treatment Facilities		13,488,000
1972-1985	York Urban Area Construction		
		Sub-Total	$43,202,000
	Other Urban Area facilities as detailed in Basic All Water Treatment Plan		
	- Hanover-Penn Twp - Spring Grove Area		9,553,000
	- Shrewsbury-New Freedom-Railroad Area		4,676,000
	- Upper Basin Small Communities		1,915,000
		Sub-Total	16,144,000
	1972-1985 CONSTRUCTION TOTAL		59,346,000

TABLE IV-43 (Cont'd)

1986-2000 Period

1. Secondary Treatment

	Expansion of Secondary Treatment at York and Dover (see Table IV-6)	9,116,000

2. Advanced Treatment Facility

1986	Eleven (11) MGD expansion of Springettsbury AWT Plant	8,200,000
	Basis of Design: Average Daily Flow = 11 MGD Peak Design Flow = 19 MGD	
	Contingencies	1,640,000
	ITEM TOTAL	$ 9,840,000
	1986-2000 PERIOD YORK URBAN AREA CONSTRUCTION SUB-TOTAL	$18,956,000
1986-2000	P. H. Glatfelter Secondary Facility Expansion	960,000
	Other Urban Area Facilities as detailed in Basic All Water Plan	
	- Hanover-Penn Township-Spring Grove	1,560,000
	- Glen Rock-Shrewsbury-New Freedom-Railroad	899,000
	Sub-Total	$ 2,459,000
	1986-2000 CONSTRUCTION TOTAL	$22,375,000

TABLE IV-44

REUSE ALTERNATIVE OPTION B
INTEGRATION WITH ALL WATER PLAN
DETAILED OPERATING AND MAINTENANCE COSTS

York Urban Area	Annual Average Operating & Maintenance Cost of Facilities 1972-1985	1986-2000
York Area Secondary Treatment Facilities[1]		
- Labor	$ 570,000	$ 750,000
- Energy	114,000	163,000
- Equipment & Supplies	155,000	212,000
- Chemicals	-	-
- Sludge Disposal	476,000	725,000
Subtotal	1,315,000	1,850,000
Local Transmission to Springettsbury AWT		
- Labor	30,000	30,000
- Energy	11,000	30,000
- Equipment & Supplies	3,000	9,000
Subtotal	44,000	69,000
Springettsbury AWT Plant		
- Labor	180,000	250,000
- Energy	90,000	225,000
- Equipment & Supplies	110,000	190,000
- Chemicals	115,000	285,000
Subtotal	495,000	950,000
Transmission from York - Glatfelter		
- Labor	30,000	30,000
- Energy	58,000	66,000
- Equipment & Supplies	15,000	18,000
Subtotal	103,000	114,000
TOTAL YORK URBAN AREA O & M COSTS	$1,957,000	$2,983,000

[1]For detailed cost breakdown, refer to Table IV-8.

TABLE IV-44 (Cont'd)

	Annual Average Operating & Maintenance Cost of Facilities	
	1972-1985	1986-2000
P.H. Glatfelter Wastewater and Water Treatment Facilities (For details see Tables IV- and IV-36)		
Water Treatment	$ 545,000	$ 695,000
Wastewater Treatment	1,580,000	1,940,000
Sludge Disposal	350,000	455,000
Sub-Total	$2,475,000	$3,090,000
Upper Basin Communities (From Table IV-5)		
Hanover-Penn Township-Spring Grove	$ 704,000	$ 841,000
Glen Rock-Shrewsbury-New Freedom-Railroad	330,000	424,000
Jacobus-Loganville-Seven Valleys-Jefferson-Winterstown	18,000	21,000
Sub-Total	$1,052,000	$1,286,000
PLAN TOTAL O & M	$5,484,000	$7,359,000

TABLE IV-45

REUSE ALTERNATIVE OPTION C
INTEGRATION WITH BASIC ALL LAND PLAN
FACILITIES COST ESTIMATE

1972-1985 Period		
1973 Transmission line from land treatment site storage lagoons to Glatfelter Co. 8,000 LF of 30" gravity sewer	350,000	350,000
Return pipeline from paper mill secondary treatment plant to land site storage lagoon		
Pumping Station - 28 MGD	440,000	
Pipeline - 8,000 LF of 48" FM @ $60.00/ft.	480,000	
		920,000
Sub-Total		1,270,000
Contingencies		254,000
Item Total		1,524,000
Facilities as detailed in Basic All Land Treatment Plan		74,185,000
P. H. Glatfelter Water & Wastewater Treatment Facilities		
Water Treatment Facilities		2,520,000
Expansion of Secondary Treatment Plant		2,200,000
Glatfelter Total		4,720,000
1972-1985 Construction Total		80,429,000
1986-2000 Period		
Facilities as detailed in Basic All Land Treatment Plan		7,938,000
Expansion of P. H. Glatfelter water treatment plant		960,000
1986-2000 Construction Total		$ 8,898,000

TABLE IV-46

REUSE ALTERNATIVE OPTION C
INTEGRATION WITH BASIC ALL LAND PLAN
DETAILED OPERATING AND MAINTENANCE COSTS

	1972-1985	1986-2000
Basic All Land Treatment Facilities Plan	2,233,000	2,920,000
Transmission to P. H. Glatfelter		
Labor	15,000	15,000
Equipment & Supplies	2,000	2,000
Sub-Total	17,000	17,000
Return Transmission from Paper Mill to Land Site		
Labor	40,000	40,000
Energy	75,000	90,000
Equipment & Supplies	25,000	30,000
Sub-Total	140,000	160,000
P. H. Glatfelter Facilities		
Primary & Secondary Treatment Plant	600,000	740,000
Water Treatment Plant	545,000	695,000
Sludge Disposal	350,000	455,000
PROJECT TOTAL	3,885,000	4,987,000

STORMWATER MANAGEMENT

Stormwater runoff from urban and rural areas comprises the major remaining pollutional source in the Codorus Basin after implementation of a high level advanced sanitary and industrial wastes treatment program. The pollutional or quality characteristics of stormwater are depicted in Table IV-47 which shows typical soluble phosphorus, BOD and suspended solids concentrations in the average runoff of long duration storms well past the initial storm flush period.

In Table IV-47 there is little to distinguish between suburban and urban stormwaters in terms of pollutional impact on the receiving watercourse. Since the first storm flush from each of these same sources produces similar pollutional impacts, there does not appear to be any justification for less stormwater management in the rural or suburban areas than that required in an urban area. Complete stormwater management is called for if the investment in the advanced treatment capacity and stream water quality is not to be jeopardized.

Present Stormwater System

Of the approximately 300 sq. miles project study area contained in Codorus Basin and adjacent areas, 12.6 sq. miles are developed in urban use and served by complete storm drainage systems (separate and combined). An additional 43 sq. miles is classified as suburban and served largely by natural drainage. Table IV-48 summarizes present and estimated year 2000 drainage management and land use relationships. By the year 2000 urban and suburban land uses will comprise 21 per cent of the study area.

In the urban areas storm drainage systems are divided up into a number of subsystems which discharge to local drainageways. These systems typically serve from 50 to 500 acres. A program is currently underway to separate the remaining combined sewer portion of the City of York.

TABLE IV-47

WATER QUALITY CHARACTERISTICS
OF STORMWATER RUNOFF

Nature of Area	Soluble Phosphorus mg/l	BOD mg/l	Suspended Solids mg/l
Urban-Served by combined sewers[1]	1.0	10	130
Urban-Served by separate sewers[2]	0.25	20	500
Rural-Served partially by storm sewers[3]	1.0	10	555

[1]De Filippi, J. A. & C. S. Shih, "Characteristics of Separated Storm and Combined Sewer Flows", JWPCF, 43, p. 2033 (1971).

[2]De Filippi, J. A. & C. S. Shih, "Pollutional Effects of Stormwater & Overflows from Combined Sewer Systems," PHS, HEW, p. 18 (1964).

[3]Weidner, R. B., A. G. Christianson, S. R. Weibel and G. G. Robeck, "Rural Runoff as a Factor in Stream Pollution," JWPCF, 41, p. 377 (1969).

TABLE IV-48

DRAINAGE MANAGEMENT AND LAND USE RELATIONSHIPS

Area	Area Served by Drainage System - Sq. Mile 1970	2000
York Urban Area		
Combined Sewer	0.25	0
Storm Sewer	9.35	20.0
Overland Runoff	32.8	22.4
Subtotal	42.4	42.4
Hanover-Penn Twp. Area		
Combined Sewer		
Storm Sewer	1.5	3.0
Overland Runoff	4.5	4.9
Subtotal	6.0	7.9
Spring Grove		
Combined Sewer	0.1	
Storm Sewer	0.1	0.4
Overland Runoff	0.4	0.4
Subtotal	0.6	0.8
Other Urban Communities		
Overland Runoff	11.0	as developed
Rural Areas	250.0	238.0
TOTAL	310.0	289.1

On the basis of the stormwater quality information presented in Table IV-47 and the land use-stormwater system characteristics for the 1970 level of development, Table IV-49 compares the total quantity of specific pollutants in lbs. per year discharged by the different pollution source areas (sanitary and industrial wastewater, urban, suburban and rural drainage). The remaining quality impact significance of stormwater both urban and rural is quite evident.

Recommended Plan

The recommended stormwater management plan for the Codorus Basin encompasses all three system source areas of quality impacts:

- urban storm drainage
- suburban overland runoff
- rural and agricultural runoff

Management of stormwater in the rural area is accomplished by techniques other than those used for urban and suburban stormwater and is described in a later section.

The proposed stormwater treatment plan for both suburban and urban areas entails the collection, transport, regulation, storage and treatment of stormwater in the wastewater treatment plants constructed for the sanitary and industrial wastes. For urban areas with complete storm drainage systems each of the present points of discharge will be tied into a stormwater interceptor system for conveyance and storage prior to introduction into the area treatment plant as capacity permits. For the suburban areas, off-stream detention basins will be provided at convenient locations to divert storm flows for subsequent transmission to the area treatment plant via the sanitary or stormwater interceptor systems.

Design Basis

Much of the design basis information used for the selection of recommended design criteria aspects of the recommended stormwater plant for the Codorus Basin is based on recent studies of the relationships between urban and suburban runoff, detention storage, evacuation rates to treatment plants and reduction in total pollutant discharge.

TABLE IV- 49

POLLUTANT DISCHARGES

Source Area	Annual Flow (million gallons)	Pollutant Concentrations mg/l: Soluble Phosphorus	BOD	Suspended Solids	Annual Pollutant Quantities - lb/yr: Soluble Phosphorus	BOD	Suspended Solids
Type D December Plan Treatment of Municipal & Industrial Wastes	15,320	0.2	4	3	25,600	512,000	884,000
Urban Storm Drains (separate & combined sewers)	3,930[1]	.25	10	130	8,200	328,000	4,260,000
Suburban Areas (overland flow)	7,600[2]	.25	20	500	15,800	1,270,000	31,700,000[4]
Rural Areas	42,600[3]	1.0	10	555	356,000	3,560,000	197,000,000[4]
Total					405,600	5,670,000	233,344,000

Notes:

[1] - 20" runoff x 11.3 sq.mi. x 17.4 MG per year/Inches - Sq. Mi.

[2] - 10" overland runoff x 43.8 sq.mi. x 17.4 MG per year/Inches - Sq.Mi.

[3] - 10" overland runoff x 245 sq.mi. x 17.4 MG per year/Inches - Sq.Mi.

[4] - Much of this is settleable material which is deposited in streams and lakes as sediment.

These studies include work of The City of Chicago and The Metropolitan Sanitary District of Greater Chicago[1], and the Corps of Engineers C-SELM studies[2]. A comparison of precipitation data for Chicago, York, Harrisburg and Baltimore is presented in Table IV-50.

Design of practical stormwater collection and storage systems must deal with the inherent storage by shallow ponding on streets and grassy areas, as well as in the local collection systems. From the studies conducted by the various agencies mentioned above, it was discovered that for an urbanized area with a collection and delivery capacity at 0.5 cfs per acre and a storage capacity of 0.208 acre-feet per acre, a sufficient amount of pollutants could be captured and removed by treatment so that water quality standards for the waterways might be met to a degree consistent with that provided for with the dry weather flow treatment. Furthermore, with a conveyance capacity of 0.5 cfs per acre, the ponding on streets and other areas becomes tolerable in depth and duration for even the most severe historical storms.

It is assumed in this study that local governments would adopt the criterion of 0.5 cfs per acre for sizing all the storm sewers. The collected flows would then be diverted to a delivery system which would convey the flows to one of the storage sites where the stormwater would be first stored and then gradually released for treatment.

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1 - The most recently published report is entitled "Evaluation Report of Alternative Systems - Development of a Flood and Pollution Control Plan for the Chicagoland Area", dated January 1972.

2 - C-SELM Wastewater Management Survey Study - Phase I, U.S. Army Corps of Engineers Chicago District, February 1972.

TABLE IV-50

PRECIPITATION DATA

	Chicago	Harris-burg	York	Balti-more
Average Annual Rainfall	31"	40"	41"	44"
Rainfall Frequency-Volume Comparisons (Inches)				
6-Hour Storm				
2-year return	2.0	1.8	2.0	2.2
5-year return	2.7	2.6	2.8	3.0
10-year return	3.1	3.0	3.3	3.6
25-year return	3.7	3.6	3.9	4.2
24-Hour Storm				
2-year	2.6	2.7	2.9	3.1
5-year	3.4	3.6	4.0	4.3
10-year	3.8	4.2	4.5	4.8
25-year	4.3	4.8	5.4	6.0

These storage sites would be located at strategic places close to the waterway and treatment plants, and also at the central points of the drainage area to be served.

Stormwater would be discharged to the York area treatment plants at a rate such that the total plant rate of flow would not exceed the design maximum which is approximately 1.7 x the annual average dry weather flow. The hydraulic capacity of process units sized on the basis of maximum flow would therefore not have to be increased from that provided for sanitary and industrial wastes.

However, the treatment of urban runoff from the 9.6 sq. mile storm sewer service area will add an annual volume of average flow to be treated of approximately 3340 million gallons. This will increase the average treatment plant flows by 26 per cent (9.15MGD). Capacity expansion of sludge treatment, chemical storage, and lime recalcination systems by this magnitude will be required. The components of annual operating costs related to flow (power, chemicals and sludge disposal) will also be increased by approximately 26 per cent.

Description of Plan

Stormwater management plans have been prepared for the York, Spring Grove, and Hanover-Penn Township Urban Areas. The other areas within the Codorus Basin do not presently have stormwater sewer systems; and, as they do construct such systems, a plan similar to those presented here should be developed for each area.

Collection and Storage Facilities

The York urban area from the point of view of stormwater management has two distinct sub-areas. The first is the presently developed inner core characterized by high density, high percentage of impervious area, partially combined sanitary and storm sewers,

and limited opportunities to control or change development patterns to accommodate stormwater runoff. As discussed in previous sections of this report the design parameters of the inner core system are:

Storage = 2.5 inches over the tributary drainage area
Conveyance = 0.5 cfs per acre

A system of conveyance sewers and tunnels and storage pits and quarries have been designed for these flows and are shown on Exhibit IV-33 . This system has been designed in conjunction with the suburban system; and, strictly speaking cannot be constructed or costed separately. However, the cost estimate presented on Table IV-51 is based on proportioning the storage costs according to the 2.5 inches and proporting the conveyance costs according to the area served.

The outlying York urban area offers greater opportunities for stormwater management. The total runoff will be less because of a greater percentage of previous area. Also, opportunities exist to construct local detention basins which permit regulation of stormwater to the conveyance system which are considerably cheaper than deep quarry or pit storage. The design parameters for the outlying areas are:

Storage = 1.5 inches over the tributary drainage area
Conveyance = 0.5 cfs per acre

As with the inner core area, a cost estimate for the outlying system has been prepared based on proportioning total system costs and is presented in Table IV-51 . The conveyance system for the outlying York urban area is shown on Exhibit IV-33.

Table IV-51 was derived from the cost estimate detailed in Table IV-52.

TABLE IV-51

STORMWATER MANAGEMENT SYSTEM COSTS
COLLECTION AND STORAGE FACILITIES
YORK URBAN AREA

Inner Core

Area = 9.6 square miles
Storage Required at 2.5 inches = 1,280 acre-feet

Item	System Cost	Proportionate Cost for Inner Core
Local Surface Storage	$ 3,198,000	$ --
Quarry & Pit Storage	11,850,000	4,870,000
Tunnels	9,200,000	2,080,000
Sewers	17,935,000	4,060,000
Pumping Station	382,000	86,000
Subtotal		$11,096,000
Contingencies (20%)		2,219,000
TOTAL		$13,315,000

Outlying Areas

Area = 32.8 square miles
Storage Required at 1.5 inches = 2,630 acre-feet

Item	System Cost	Proportionate Cost for Inner Core
Local Surface Storage	$ 3,198,000	$ 3,198,000
Quarry & Pit Storage	11,850,000	6,980,000
Tunnel	9,200,000	7,120,000
Sewers	17,935,000	13,875,000
Pumping Station	382,000	296,000
Subtotal		$31,469,000
Contingencies (20%)		6,294,000
TOTAL		$37,763,000

TABLE IV-52

STORMWATER MANAGEMENT SYSTEM COSTS
COLLECTION AND STORAGE FACILITIES
YORK URBAN AREA
COST ESTIMATE

Capital Costs:

Local Surface Storage

Creek No. 1, Watershed No. 1			
3650 Ac x 1.5/12 =	456 Ac-ft x $2500	$1,140,000	
Creek No. 4, Watershed No. 1			
3050 Ac x .125 =	382 Ac-ft x $2500 =	955,000	
Creek No. 6, Watershed No. 1			
2160 Ac x .125 =	270 Ac-ft x $2500 =	675,000	
Creek No. 7, Watershed No. 1			
1359 Ac x .125 =	170 Ac-ft x $2500 =	425,000	
	1,278 Ac-ft		$3,195,000

Quarry and Pit Storage Including Solids Handling

East Quarry	600 Ac-ft x $4000 =	2,400,000	
West Quarry	1,592 Ac-ft x $4000 =	6,370,000	
New Pit	440 Ac-ft x $7000 =	3,080,000	
			$11,850,000

Conveyance

Tunnel 12' Dia x 23,000' @$400.00/ft	$ 9,200,000
Sewers	17,935,000
Pumping Station @ York STP Q = 25 mgd	382,000
	27,517,000
Subtotal	$42,562,000
Contingencies (20%)	8,512,000
Total	$51,074,000

TABLE IV-52 (Continued)

Operation and Maintenance Costs	
Labor	15,000
Equipment and Materials	2,000
Pit and Pond Maintenance	10,000
Power (3340 MG/yr @ 120' TDH)	14,000
Total	$ 41,000

Spring Grove Urban Area -- Stormwater drainage in Spring Grove is presently accomplished by 51 acres of storm drains and 41 acres of combined sewers. Because of the density of development in the urban area, design parameters for stormwater control are:

Storage = 2.5 inches over the tributary drainage area
Conveyance = 0.5 cfs per acre

A system of conveyance sewers and a storage pond have been designed for these flows. Dry weather flow and all wet weather flow up to the maximum design capacity of the sewage treatment plant will be pumped directly into the plant for treatment. All excess flow will be pumped into the storage pond for retention and then released to the treatment plant as treatment capacity is available. Exhibit IV-34 shows the area to be served and a cost estimate for this system is presented in Table IV-53.

Hanover-Penn Township Urban Area -- The Hanover-Penn Township Urban Area is presently serviced by storm sewers which drain 877 acres of built-up area and two separate sanitary sewer systems, one to the east and one to the west of the urban area. Design parameter for stormwater control from this urban area are:

Storage = 2.5 inches over the tributary drainage area
Conveyance = 0.5 cfs per acre

In order to minimize pumping costs and transmission line sizes, storage ponds have been located in close proximity to the outlets of the storm drainage areas served. Ponds to the west of the divide through Hanover, will be discharged to the Hanover sewage treatment plant as treatment capacity becomes available and the pond to the east of the divide will be discharged to the Penn Township sewage treatment plant.

Exhibit IV-35 shows the areas to be served and a cost estimate for this system is presented in Table IV-54.

TABLE IV-53

STORMWATER MANAGEMENT SYSTEM COSTS

COLLECTION AND STORAGE FACILITIES

SPRING GROVE URBAN AREA

COST ESTIMATE

Area = 0.2 square miles
Storage required at 2.5 inches = 20 acre feet

Capital Costs:

Item		
Local Surface Storage		
2.5 ac. - 8' deep (4' exc.) = 15,500 cy @ $1.50		$26,000
Transmission Main		
2700 lf - 42" Gr. @ $66		178,000
Pump Station		
0.3 MGD - 23' TDH - 200 HP		100,000
	Subtotal	$304,000
	Contingencies (20%)	60,000
	TOTAL	$364,000

Operation and Maintenance Costs:

Labor	$ 1,000
Equipment and Materials	100
Pond Maintenance	500
Power	200
TOTAL	$ 1,800

TABLE IV-54

STORMWATER MANAGEMENT SYSTEM COSTS

COLLECTION AND STORAGE FACILITIES

HANOVER-PENN TOWNSHIP URBAN AREA

COST ESTIMATE

Area = 1.5 square miles
Storage Required at 2.5 inches = 175 acre feet

Capital Costs:

Item	System Cost	
Local Surface Storage		
6 ac. - 11' deep = 100,000 cy @ 1.50	$150,000	
2 ac. - 10' deep = 30,000 cy @ 1.50	45,000	
4 ac. - 11' deep = 70,000 cy @ 1.50	105,000	
5 ac. - 11' deep = 90,000 cy @ 1.50	135,000	
		$ 435,000
Transmission Mains		
6000 lf - 15" Gr. @ $21	$126,000	
7000 lf - 15" Gr. @ $21	147,000	
3600 lf - 6" FM. @ $9	32,000	
9000 lf - 12" FM. @ $17	153,000	
		$ 458,000
Pump Stations		
2.4 MGD - 11' TDH - 7-1/2HP	$ 60,000	
0.8 MGD - 128' TDH - 25HP	70,000	
1.7 MGD - 26' TDH - 15HP	65,000	
2.8 MGD - 140' TDH - 100HP	90,000	
		$ 285,000
Subtotal		$1,178,000
Contingencies (20%)		236,000
TOTAL		$1,414,000

TABLE IV-54 (continued)

Operation and Maintenance Costs:

Labor	$3,000
Equipment and Materials	500
Pond Maintenance	2,000
Power	3,000
TOTAL	$8,500

Stormwater Treatment Costs

As stormwater would be released to the area sewage treatment plants at rates low enough to insure that design maximum loadings on treatment units would not be exceeded, design sizes for the treatment plants will not be increased. Chemical storage and sludge handling facilities, however, are designed on the basis of average flow, therefore, these units must be increased in size in order to handle the additional chemical requirements and increased sludge volumes generated by the stormwater. Additional chemical feeding costs will also be incurred. Tables IV-55 through IV-57 summarize the additional treatment facilities and operating and maintenance costs at the treatment plants necessary to treat the stored stormwater.

TABLE IV-55

STORMWATER TREATMENT COSTS

YORK URBAN AREA

Design Flows

Advanced Water Treatment Plant Design Capacity -	35 MGD
Maximum Design Capacity -	60 MGD
Stormwater Flow -	3340 MG/Year

Additional Treatment Facilities Costs

Chemical Treatment Building and Facilities $3,050,000 x 0.25		$ 770,000
Filter Building and Facilities $1,600,000 x 0.10		160,000
Sludge Management + System $125,000 x 0.30		38,000
	Subtotal	$ 968,000
	Contingencies (20%)	192,000
	TOTAL	$1,160,000

Operation and Maintenance Costs

Power	$22.61 /MG
Labor	23.80 /MG
Materials	4.10 /MG
Chemicals	16.20 /MG
TOTAL	$66.71 /MG

3340 MG/Year x $66.71 = $222,000 /Year

TABLE IV-56

STORMWATER TREATMENT COSTS

SPRING GROVE

Design Flows

Sewage Treatment Plant Design Capacity -	0.3 MGD
Maximum Design Capacity	0.51 MGD
Stormwater Flow	59 MG/Year

Additional Irrigation Facility Costs

$493,000 x 0.5	$250,000
Contingencies (20%)	50,000
TOTAL	$300,000

Operation and Maintenance Costs

Labor	$2,300/year
Equipment and Material	800/year
Chemicals	100/year
Energy	2,100/year
Total	$5,300 /year

TABLE IV-57

STORMWATER TREATMENT COSTS

HANOVER-PENN TOWNSHIP

Design Flow	
Sewage Treatment Plant Design Capacity	6.1 MGD
Maximum Design Capacity	10.4 MGD
Stormwater Flow	531 MG/year
Additional Irrigation Facility Costs	
$7,984,000 x 0.25	$2,000,000
Contingencies (20%)	400,000
TOTAL	$2,400,000
Operation and Maintenance Costs	
Labor	$29,600 /year
Equipment and Material	10,000 /year
Chemicals	1,200 /year
Energy	27,200 /year
Total	$68,000 /year

Stormwater Management for the Undeveloped Rural Area

The largest single source of pollutants (soluble phosphorus, BOD, suspended solids) shown in Table IV-49 is the rural areas. The basic approach to this problem is an extension and intensification of existing soil conservation practices with the objective of keeping the soil, and therefore the pollutants, in place. Management practices that should be implemented include: limiting fertilizer applications to actual crop needs; contour farming and terracing; proper crop selection on steep slopes; and maintenance of grassed drainageways. Of particular importance regarding the dairying and horse raising farms in the basin is the disposal of animal manure. Programs of technical and economical assistance in all these problem areas are available from the U.S. Department of Agriculture and the Pennsylvania Extension Service.

CODORUS CREEK WASTEWATER STUDY

VOLUME IV ANNEX

BASIS OF DESIGN & COST ESTIMATES

CODORUS CREEK WASTEWATER STUDY
LAND DISPOSAL ALTERNATIVE
BASIS OF DESIGN & COST ESTIMATES

I. Flow Projections

Use year 2000 flows for design of all facilities
(See Phase II report, Exhibit II-14)

II. Main Transmission from Service Area to Irrigation Site

Design Flow = Maximum Daily Flow
- For treated effluent = 1.75 x Average Annual Flow
- For raw sewerage = 2.25 x " " "
  for large service areas
  = 4.0 x Average Annual Flow
  for very small service areas

Pipeline - 5.0 ft./sec > Max. Velocity > 2.0 ft./sec
Optimum design approximates friction loss of 0.3 ft/100ft.
Costs based on attached Table 1.

Pumping Station - Usually one P.S. at service area.
Costs based on "package stations". Individual estimates made for each site.

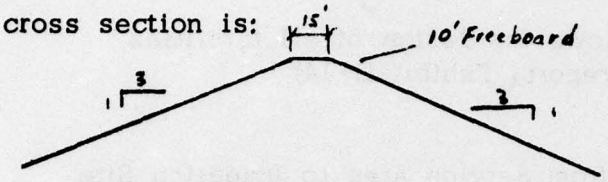
III. Storage Facilities

Storage Volume = 4 months of flow or 368 acre-feet per mgd
Storage is provided by damming a local drainage with a tributary area of about 100 acres. The maximum reservoir depth is up to 130 feet with maximum drawdown limited to 20 feet.

CODORUS CREEK WASTEWATER STUDY
LAND DISPOSAL ALTERNATIVE
BASIS OF DESIGN & COST ESTIMATES

III. Storage Facilities (Cont'd)

The dam cross section is:



Unit Cost = $1.25 per cubic yard and is meant to cover the fill material, foundation treatment, outlet facilities Riprap = $8.00 per c.y.; Reservoir clearing = $800 per Ac.

Surface Aerators will be provided to maintain aerobic conditions. 1 - 75 HP Aerator will be provided per 10 surface acres at a cost of $10,000 per aerator.

IV. Distribution Piping and Pumping

This is the piping and pumping from the storage facilities to the irrigation machines.

Design Flow = Maximum Flow during the 8 month irrigation season
= 1.5 x Average Annual Flow

Pipeline - For velocity and head loss see II. above
Costs based on attached Table 1.

Pumping Stations - Usually one P.S. at storage facility

Static Head = Max.El. to be irrigated - Min.Res.El.
Pressure Head = 30 psi or 70 feet (see V below)
Head Loss = 0.3 ft per 100 ft.

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THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY. APPENDIX A. TECH--ETC(U)
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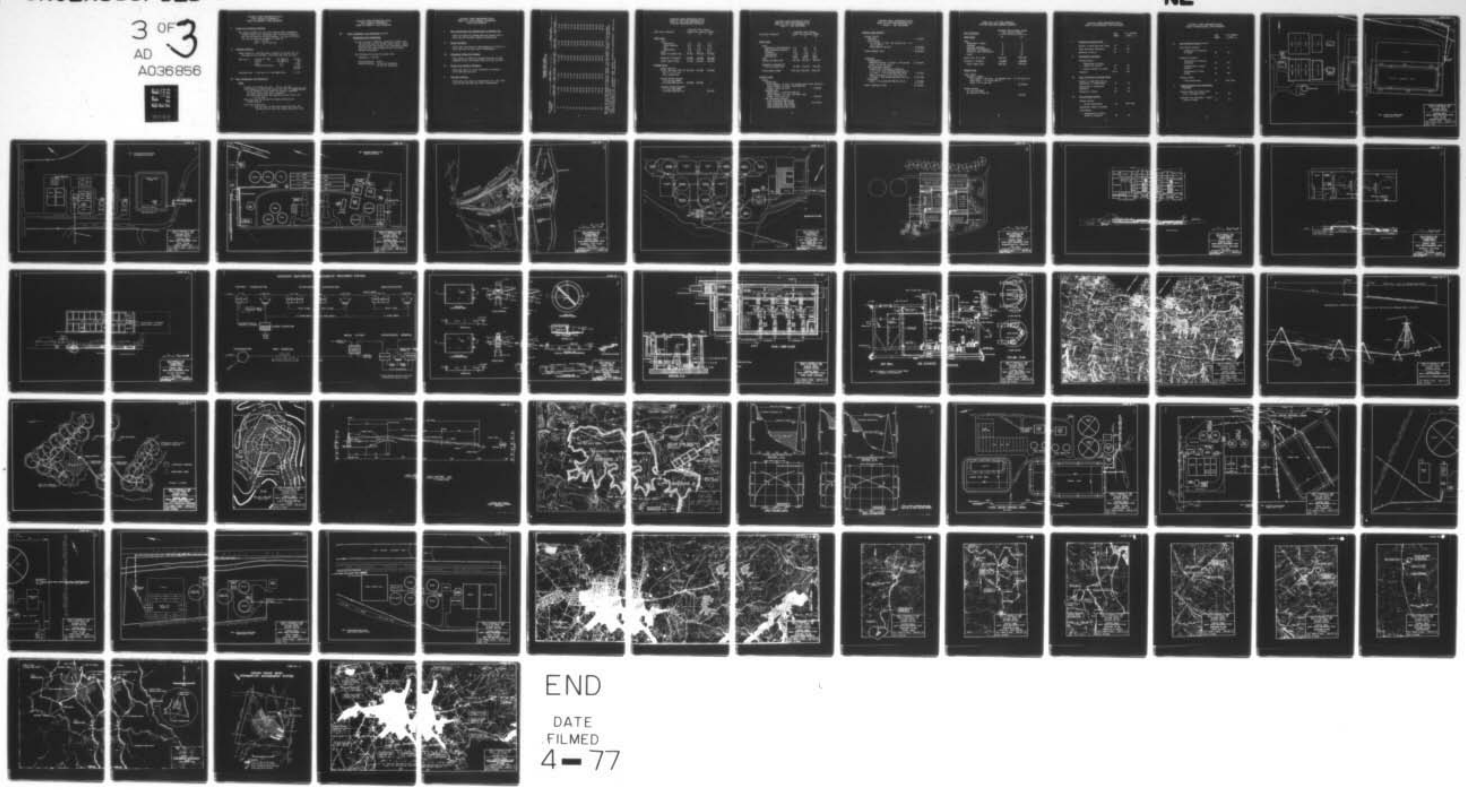

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V. Center Pivot Irrigation Machines

The optimum machine for use in the Codorus Basin considering machine capital cost, operating costs, and land coverage is the 650 foot radius or 30 acre machine. Its cost is $10,000. The cost of other size machines is based on:

Pivot - $3,000
Arm - $10.75 per foot

VI. Drainage Facilities

Wells spaced at 1,000 feet with a capacity of 120 gpm and 215 feet deep will be provided. Each well will drain 23 acres.

Well Cost -	Drilling 12" Well	215' @$12/ft	$2,580
	Casing	40" @$11/ft	440
	Pump	L.S.	2,500
	Electrical Connection	L.S.	1,000
			$6,520

Discharge Pipe - 1,000 feet of 6" diam.@$4.80/ft. $ 4,800

VII. Land, Residences, and Relocations

LAND

2"/week for 8 months per year 194 ac. per mgd
Some otherwise suitable land (slopes less than 15%) cannot be irrigated because of the geometry of land forms and irrigation equipment.
For small service areas this is minimal.
For large service areas this amounts to about 10% or 213 ac per mgd.
Other land must be provided for storage facilities and aerated lagoons.

Unit costs of land are:
$750 per acre for land with slopes less than 15%
250 per acre for land with slopes greater than 15%

VII. Land, Residences, and Relocations (Cont'd)

RESIDENCES AND FARMSTEADS

For the most part, sufficient, unoccupied suitable land can be found near the smaller service areas. Actual housing counts were made in the West Branch Valley from land use maps provided by the York County Planning Commission.

The following unit prices have been used:

Residences - $25,000

Moving Expenses - $500
Other Allowances - $2,500 for farmsteads
- $3,000 for residences.

CODORUS CREEK WASTEWATER STUDY
BASIS OF A LAND DISPOSAL ALTERNATIVE
O&M COST ESTIMATE

I. Main Transmission from Service Area to Irrigation Site

O&M cost based on average flow and average TDH at $0.02 per kwh (includes energy & maintenance)

II. Storage Facilities

O&M power cost based on 25%-operation of aerators at $0.01 per kwh (off peak and/or interruptable).

III. Distribution Piping and Pumping

O&M power cost based on average flow from 8 month irrigation season and average TDH at $0.015 per kwh.

IV. Center Pivot Irrigation Machines

O&M cost based on 1 man maintaining 8 machines at $15,000 per man-year.

V. Drainage Facilities

O&M power cost based on average flow and 225' TDH at $0.01 per kwh (off peak and/or interruptable).

PIPELINE UNIT COSTS
(Dollars per Linear Foot)

Pipe Diameter (Inches)	Force Main			Gravity Sewer	
	Urban Area[1]	Open Country[1]	Project Site[2]	Urban Area	Open Country
4	$ 7.00	$ 5.00	$ 3.20[3]	$ 8.00	$ 7.00
6	8.75	7.50	4.80[3]	12.00	10.50
8	11.00	10.00	8.00	16.00	14.00
10	14.00	12.50	10.00	20.00	17.50
12	17.50	15.00	12.00	24.00	21.00
14	18.50	17.50	14.00	28.00	24.50
16	22.00	20.00	16.00	32.00	28.00
20	28.00	25.00	20.00	40.00	35.00
24	34.00	30.00	24.00	48.00	42.00
30	44.00	37.50	30.00	60.00	52.50
36	55.00	44.00	36.00	72.00	63.00
42	66.00	52.50	42.00	84.00	73.50
48	77.50	60.00	48.00	96.00	84.00
54	92.50	67.50	54.00	108.00	94.50
60	107.50	75.00	60.00	120.00	105.00

[1]All pipe 24 inch and smaller is cast iron except, All pipe greater than 24 inch is concrete.
[2]All pipe 24 inch and smaller is asbestos cement except (3) which is plastic, All pipe greater then 24 inch is concrete.
[3]Costs include right of way, excavation, pipe, backfill, manholes and appurtenances. Costs do not include contingencies and engineering. 1972 price levels.

CODORUS CREEK WASTEWATER STUDY
BASIS OF O&M COST ESTIMATES FOR
CONTACT STABILIZATION FACILITIES

O&M Cost Component	Treatment Plant Average Design Flow Capacity (MGD) 1	10	40
Fixed Costs			
Labor			
-Supervision	0.5	1.0	2.0
-Plant Operation	2.0	6.0	15.0
-Lab	0.5	1.0	2.0
-Maintenance	1.0	4.0	15.0
Total	4.0	12.0	34.0
Annual Cost @$15,000	60,000	180,000	510,000
Equipment & Supplies	10,000	50,000	150,000
TOTAL FIXED COSTS	70,000	230,000	660,000
Variable Costs			
Power Costs for 50 HP, 600 HP & 2350 HP @1.5,1.1 & 1¢ per kwh, respectively	$13/MG	$11/MG	$10/MG
Aerobic Sludge Disposal -0.8 dry tons/MG@ 4% Solids @$3/wet ton	$60/MG	$60/MG	-
Anaerobic Sludge Disposal -0.8 dry tons/MG@ 6% Solids @$3/wet ton	-	-	$40/MG

CODORUS CREEK WASTEWATER STUDY
BASIS OF O&M COST ESTIMATES FOR
CLASS D - AWT FACILITIES

O&M Cost Component	Treatment Plant Average Design Flow Capacity (MGD) 1	10	40
Fixed Costs			
Labor			
-Nitrification-Denitrification	3.0	5.0	10
-98% Phosphorus Removal	3.0	4.5	10
-Filtration	0.5	1.0	2
-Post Aeration	0.25	0.25	0.5
-Chlorination	0.25	0.25	0.5
Total	7.0	11.0	23.0
Annual Cost @$15,000	105,000	165,000	345,000
Equipment & Supplies @ 1.5% of Capital Cost	40,000	100,000	290,000
TOTAL FIXED COSTS	$145,000	$265,000	$635,000
Variable Costs			
Energy			
-Nitrification			
-BOD loading = 70 mg/l, O_2 transfer rate=1.3 lbs O_2/HP-hr.			
-Return Sludge = 0.5 Avg. Flow @15'TDH			
-Power = $0.01 per kwh			3.90/MG
-Denitrification			
-Mixer req't. = 0.06 HP/1,000 ft^3			
-Return Sludge = 0.5 Avg. Flow @15' TDH			
-Power = $0.01 per kwh			0.60/MG
-98% Phosphorus Removal			
-Lime Coagulation @0.70/MG			
-Lime Dewatering @1.20/MG			22.70/MG
-Lime Recalcining @19.10/MG			
-Lime Recarbonation @1.70/MG			

CODORUS CREEK WASTEWATER STUDY
BASIS OF O&M COST ESTIMATES FOR
CLASS D - AWT FACILITIES

Variable Costs (Cont'd)

Energy (Cont'd)	
-Filtration	6.40/MG
-Post Aeration	
-O_2 loading = 6 mg/l, O_2 transfer rate = 1.4 lbs O_2/HP-hr	
-Power @$0.01 per kwh	0.40/MG
TOTAL ENERGY COST	34.00/MG
Chemicals	
-Denitrification	
-Methanol loading = 30 mg/l = 250 lbs/MG	25.00/MG
-Cost = $0.10 per pound	
-98% Phosphorus Removal	
-Polymer lime coagulation loading for 1.15 x Avg. Flow (includes backwash) at 0.2 mg/l = 1.95 pounds/MG @$1.92/lb	3.75/MG
-Make up lime for 1.15 x Avg. Flow at 100 mg/l = 960 pounds/MG @$27 per ton	13.00/MG
Chlorination	
-4mg/l = 35 pounds/MG @$0.05 per lb	1.75/MG
TOTAL CHEMICAL COST	43.50/MG

BASIS OF O & M COST ESTIMATE FOR THE YORK AREA AERATED LAGOONS

Cost Component	Treatment Plant Average Design Flow Capacity (MGD)	
	35	50
Fixed Costs		
Labor		
Supervisory & Admin.	2	2
Chemists	2	2
Operating Engineers	4	5
Mechanics & Electricians	3	4
Laborers & Site Maintenance	5	7
TOTAL	16	20
Annual Cost @ $15,000	$240,000	$300,000
Equipment & Supplies	45,000	60,000
TOTAL Fixed Costs	$285,000	$360,000

Variable Cost

Power Costs

Aerators & Mixers

BOD loading = 200 mg/l, O_2 transfer rate = 1.3 lbs O_2/HP hr.
Mixer Req't = 0.06 HP/1000 ft^3
Power = $0.01 per kwh

$8.80/MG

Sludge Disposal

0.8 dry tons/MG@
4% Solids @ $1/wet ton

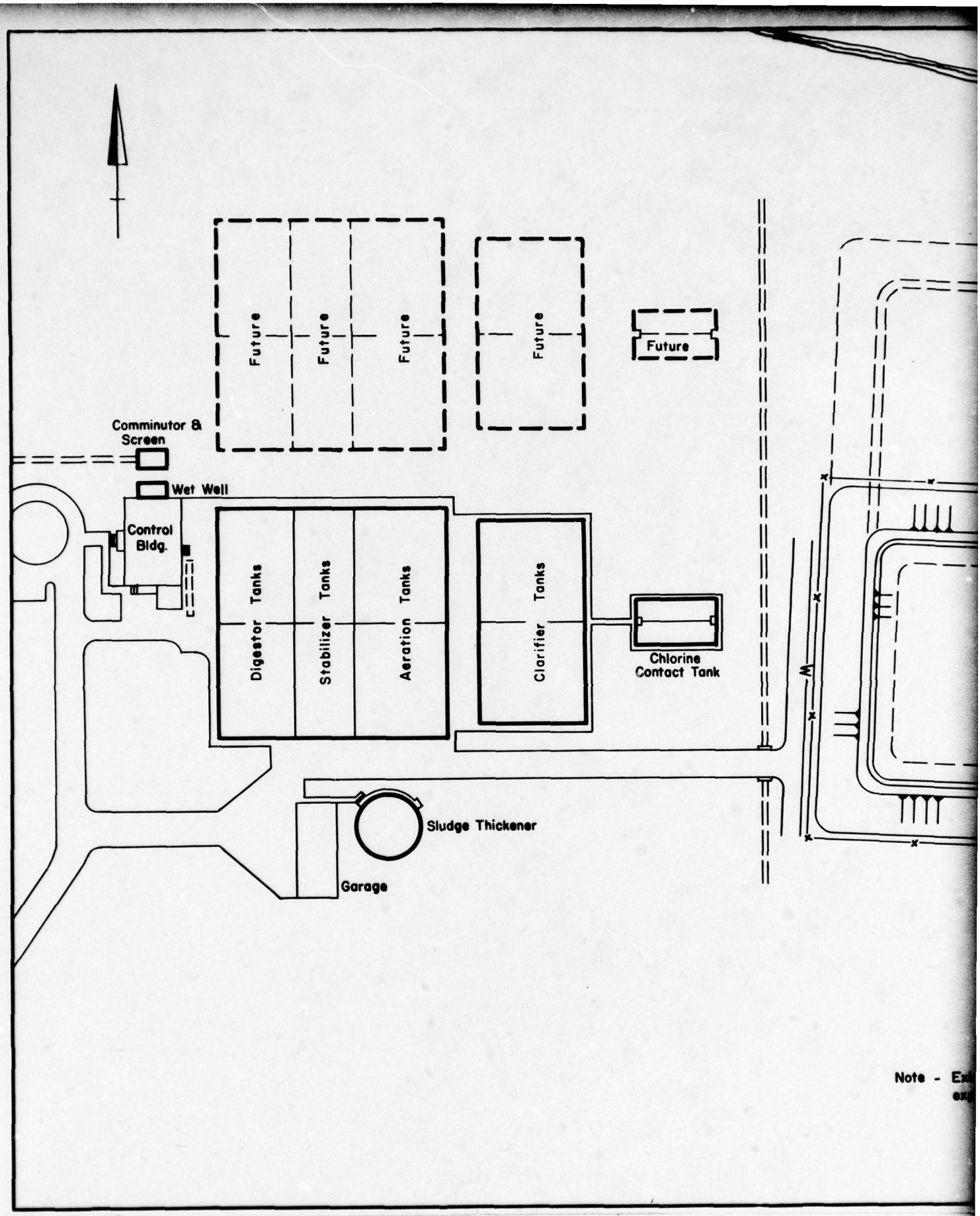
$20/MG

CODORUS CREEK WASTEWATER STUDY
BASIS OF REPLACEMENT COST ESTIMATES

		Life Years	% of Original Cost
I.	Secondary Treatment Plants		
	Aeration & other high wear items	10	5
	Other Mechanical Equipment	25	25
	Structures & Piping	50	70
II.	Transmission Facilities		
	Pumping Station		
	- Replacement of pumps, motors and controls	25	40
	- Station structure & piping	50	60
	Pipelines	50-75	100
III.	Type D-Advanced Treatment Plants		
	Aeration & other high wear eq. replacement or rehabilitation	10	20
	Replacement of Mechanical Equipment	25	20
	Structures & Piping	50	60
IV.	Land Treatment System		
	Storage Lagoons		
	- Aerator Replacement	10	item total
	Distribution Piping & Pumping		
	Pump Station		
	- Replacement of pumps, motors & electrical	25	50

CODORUS CREEK WASTEWATER STUDY
BASIS OF REPLACEMENT COST ESTIMATES

	Life Years	% of Original Cost
IV. Land Treatment System (Cont'd)		
Pump Station (cont'd)		
- Replacement of Structure & Piping	50	50
Irrigation Facilities		
- Replacement of Rotating Machines	25	100
- Rehabilitation of Fixed System	25	40
- Replacement of Fixed System	50	100
Drainage Wells		
- Pump Replacement	10	item total
V. Carbon Adsorption and Regeneration Facilities		
Chemical feed and control facilities, incinerator lining	10	20
Hydraulic flow equipment - valves, controls, pumps	25	20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Comminutor &
Screen
Wet Well
Control
Bldg.
Digestor Tanks
Stabilizer Tanks
Aeration Tanks
Clarifier Tanks
Chlorine
Contact Tank
Sludge Thickener
Garage

Note - Ex
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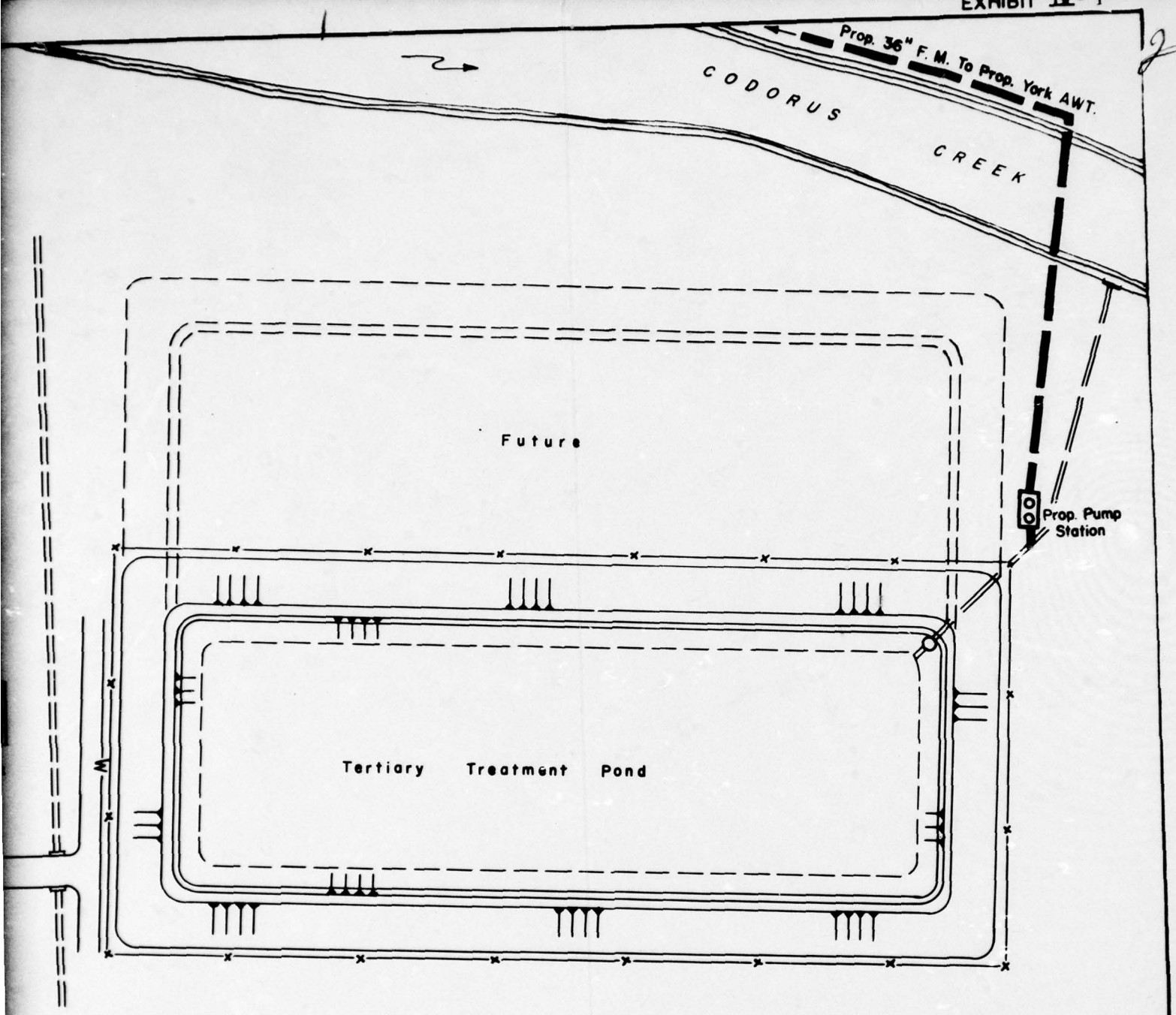
EXHIBIT IV-1



Note - Existing plant provides planned expansion show as "Future"

CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND

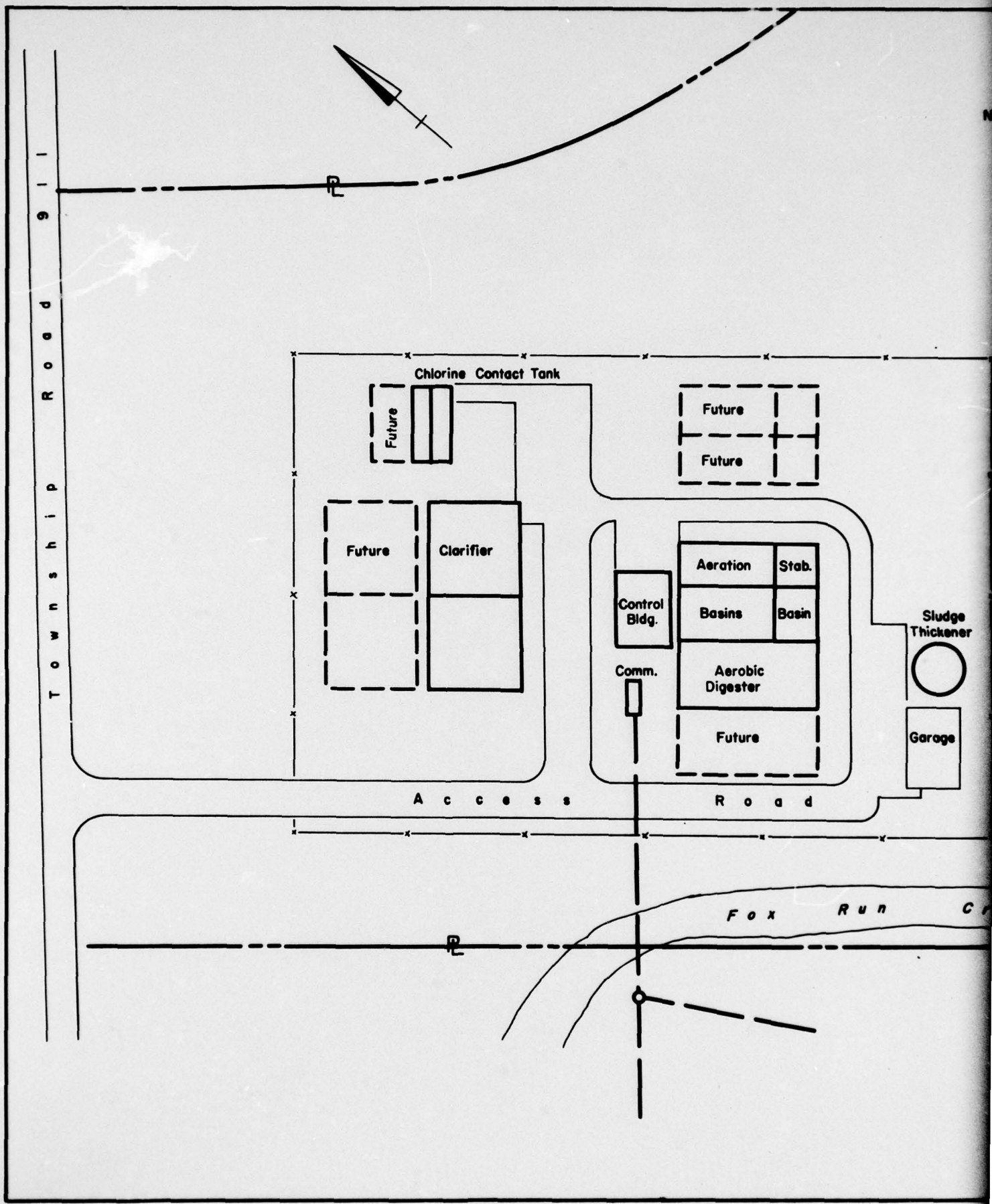
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

SITE PLAN

SPRINGETTSBURY TWP. STP.

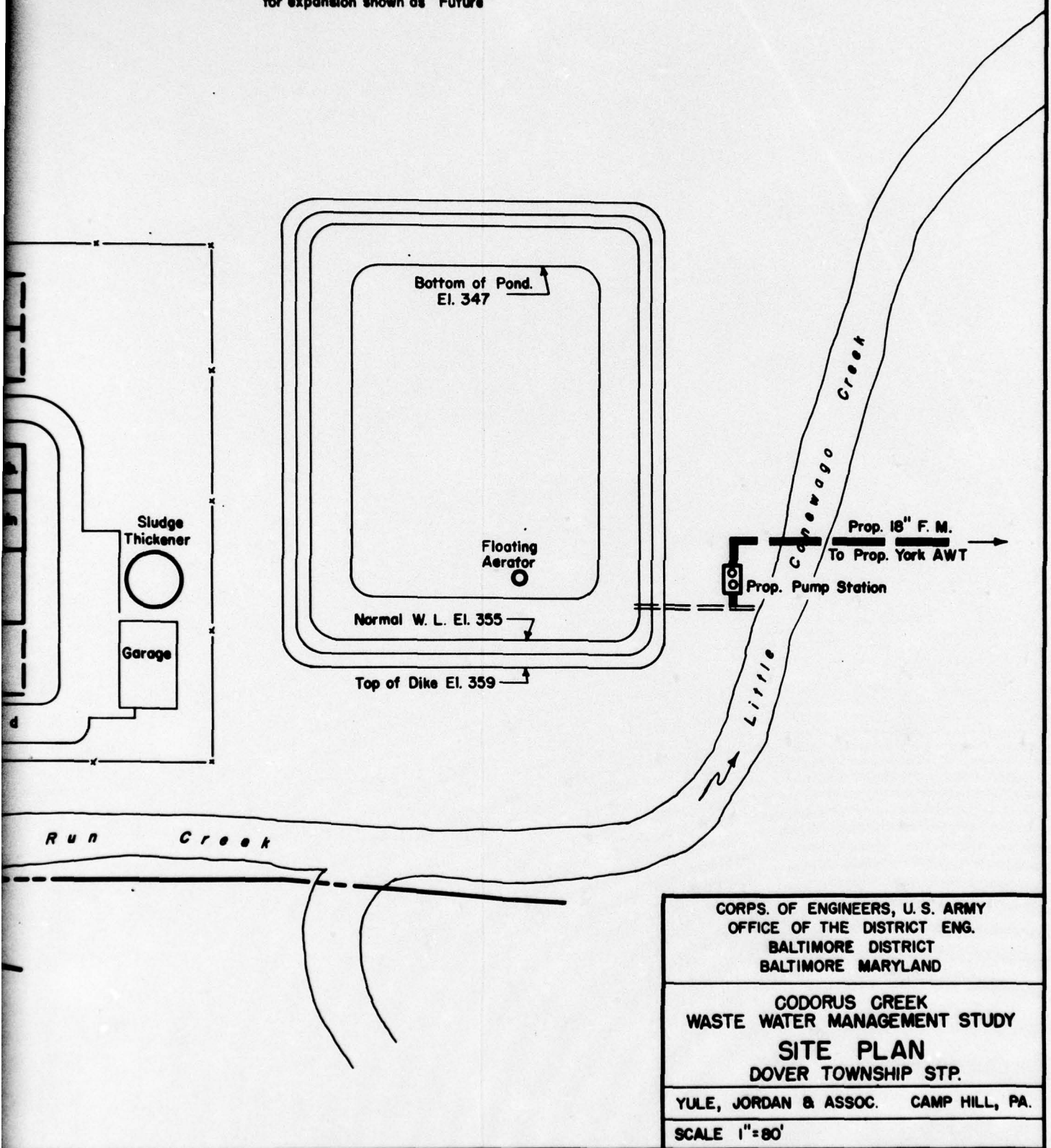
YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE 1"=100'


Township Road 911
Chlorine Contact Tank
Future
Future
Future
Future
Future
Clarifier
Aeration
Stab.
Basins
Basin
Control Bldg.
Comm.
Aerobic Digester
Future
Sludge Thickener
Garage
Access Road
Fox Run

2

Note - Programmed plant design provides for expansion shown as "Future"



CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND

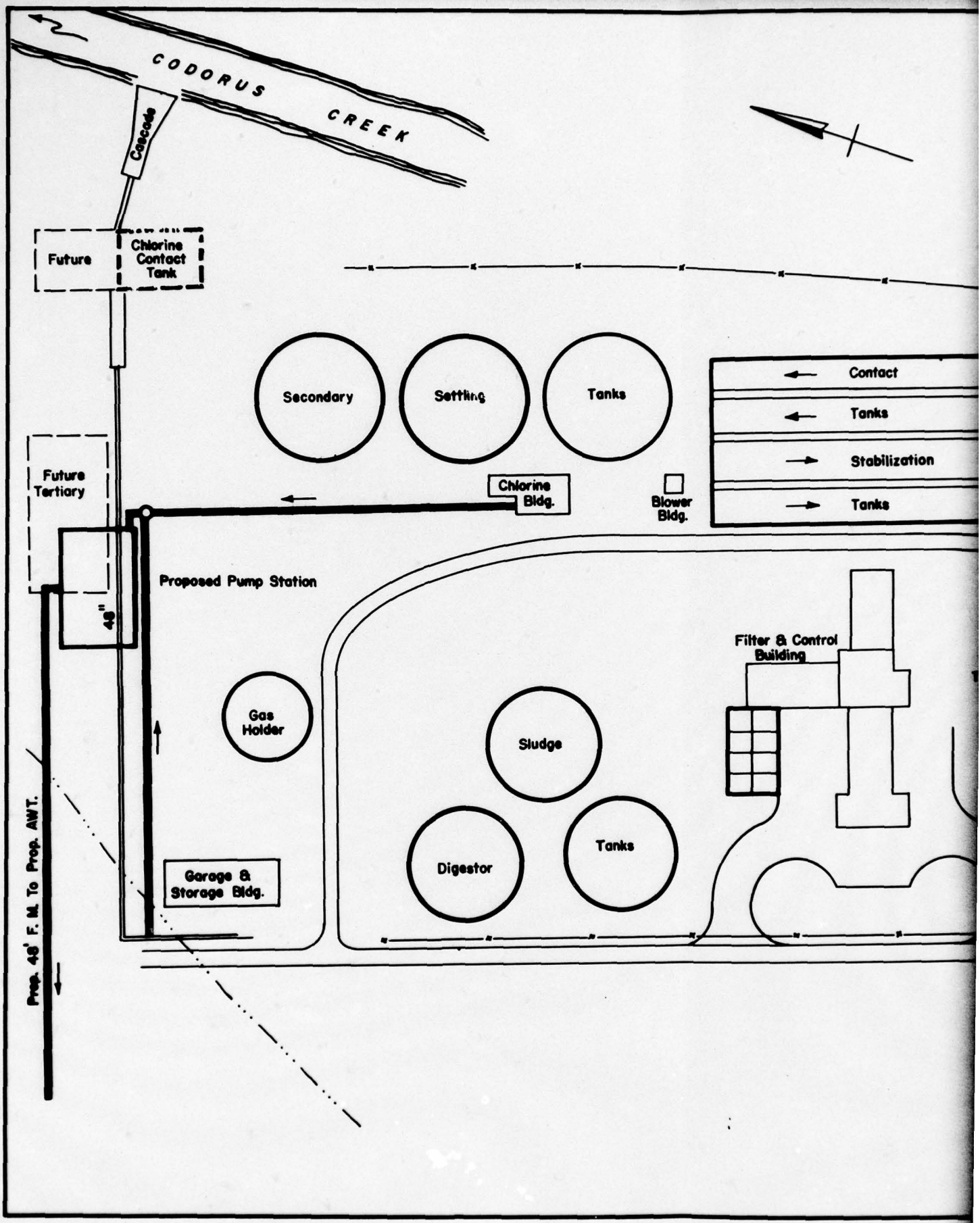
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

SITE PLAN

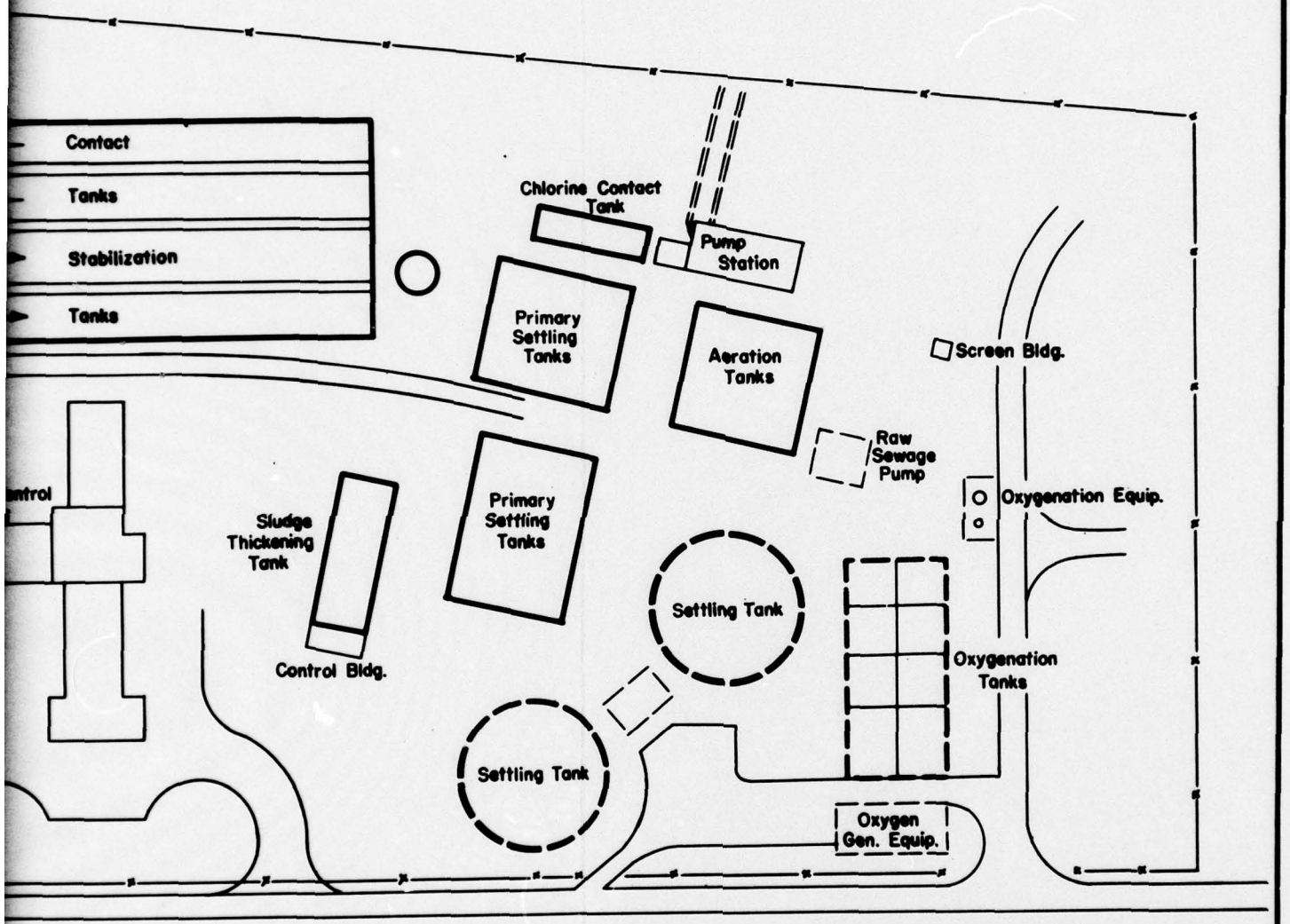
DOVER TOWNSHIP STP.

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE 1"=80'


CODORUS CREEK
Cascade
Future
Chlorine Contact Tank
Secondary
Settling
Tanks
Contact
Tanks
Stabilization
Tanks
Future Tertiary
Chlorine Bldg.
Blower Bldg.
Proposed Pump Station
48"
Filter & Control Building
Gas Holder
Sludge
Digestor
Tanks
Garage & Storage Bldg.
Prop. 48' F. M. To Prop. AWT.

Note - Programmed expansion of plant indicated by dashed lines.



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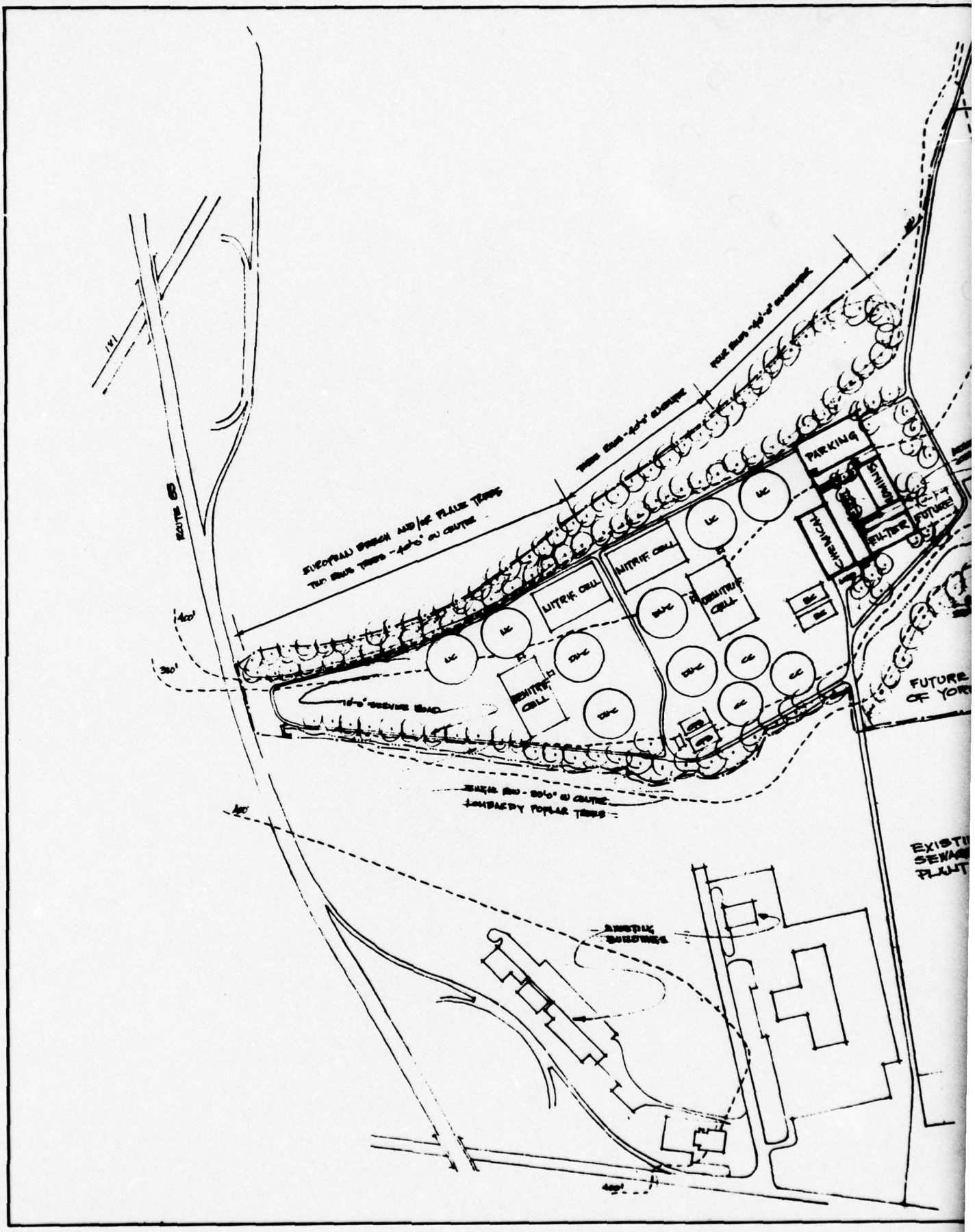
BALTIMORE DISTRICT
BALTIMORE MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

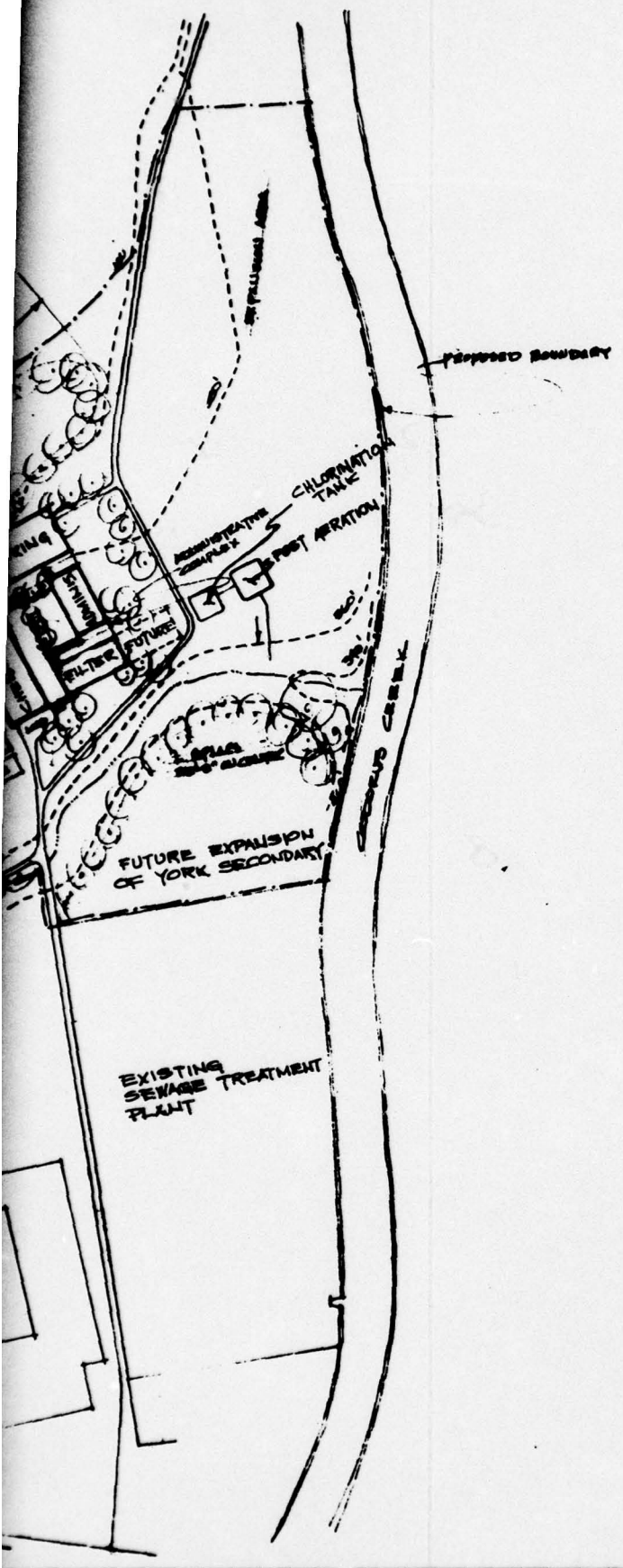
SITE PLAN
CITY OF YORK STP.

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE 1"=80'


PARKING
NITRIF. CELL
DENITRIF. CELL
FUTURE
FUTURE
ANAEROBIC BUILDINGS
EXISTI
SEWAG
PLANT

20



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BALTIMORE, MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

GENERAL SITE PLAN
YORK AREA
ADVANCED TREATMENT PLANT

YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE AS SHOWN

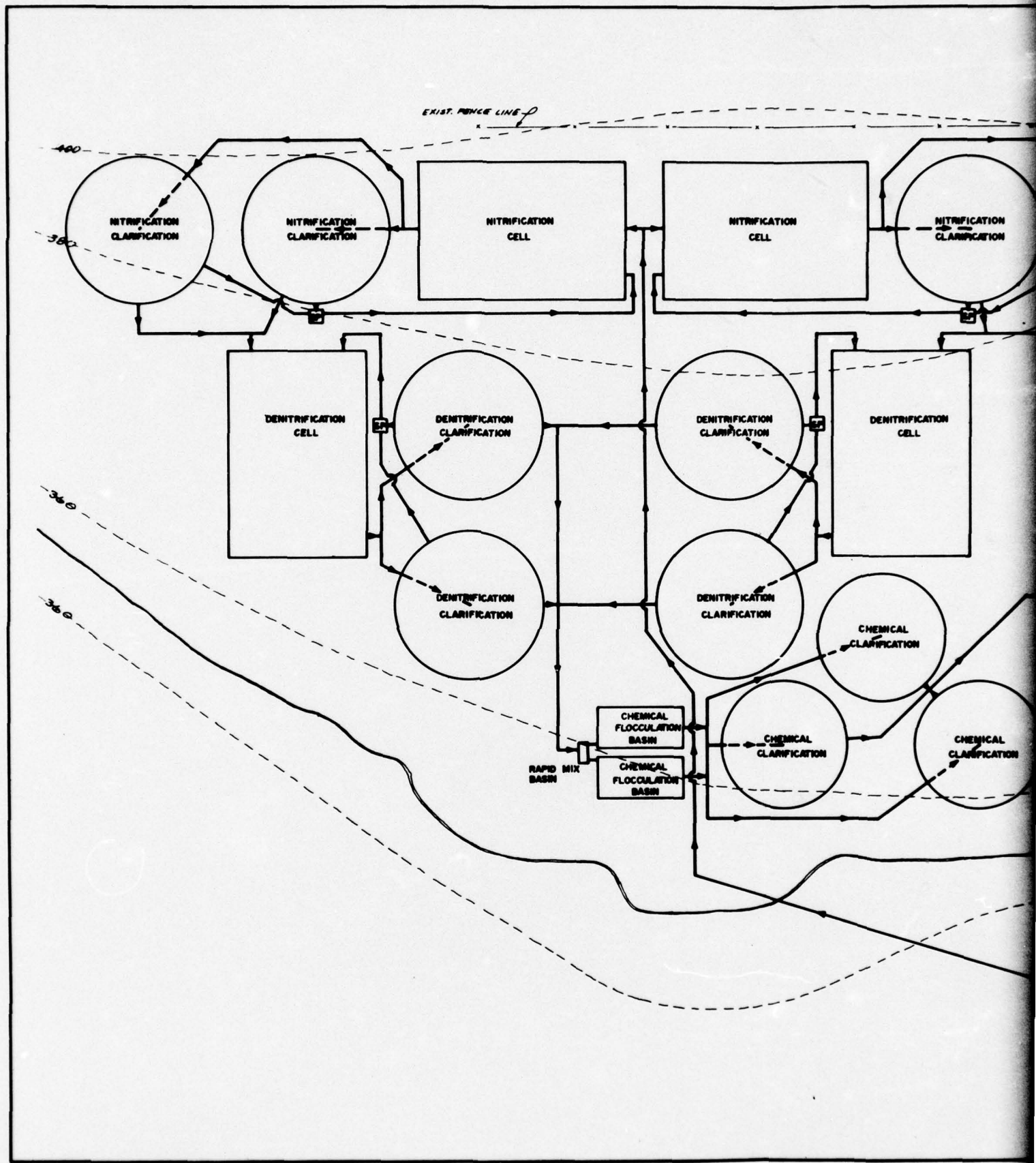
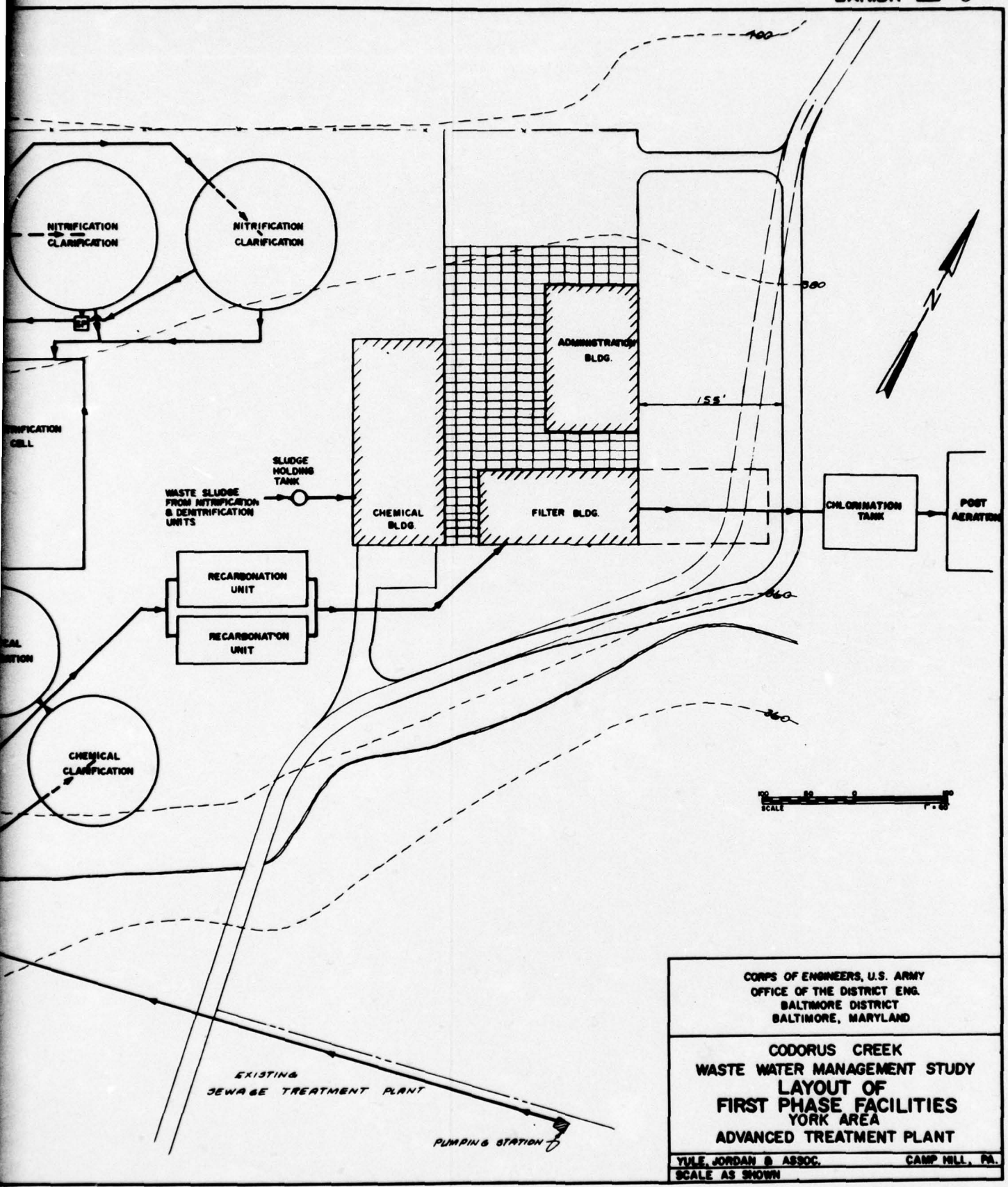

EXIST. FENCE LINE
400
380
360
360
NITRIFICATION CLARIFICATION
NITRIFICATION CLARIFICATION
NITRIFICATION CELL
NITRIFICATION CELL
NITRIFICATION CLARIFICATION
DENITRIFICATION CELL
DENITRIFICATION CLARIFICATION
DENITRIFICATION CLARIFICATION
DENITRIFICATION CELL
DENITRIFICATION CLARIFICATION
DENITRIFICATION CLARIFICATION
CHEMICAL CLARIFICATION
CHEMICAL FLOCCULATION BASIN
CHEMICAL CLARIFICATION
CHEMICAL CLARIFICATION
RAPID MIX BASIN
CHEMICAL FLOCCULATION BASIN

EXHIBIT IV-5 2



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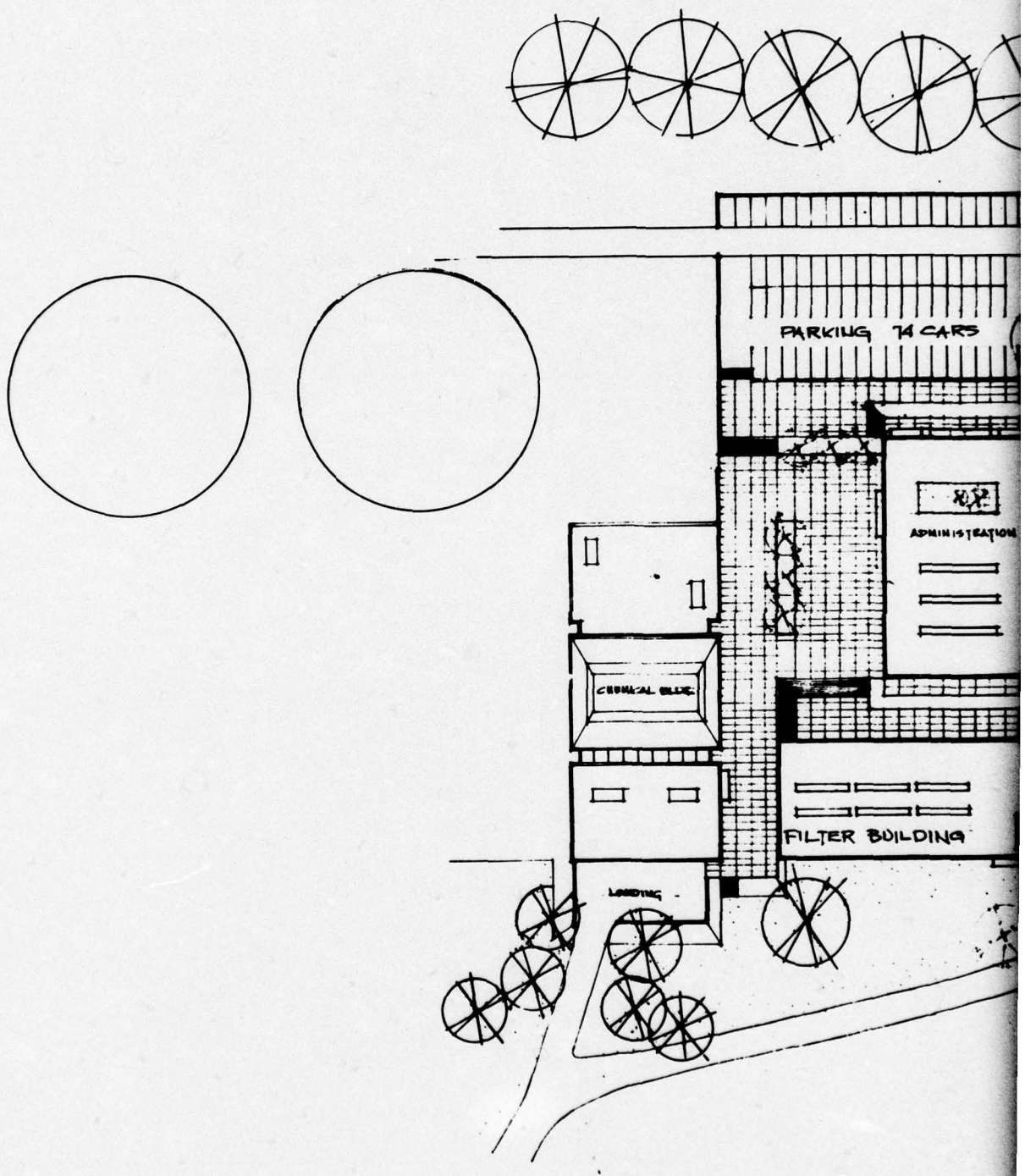
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

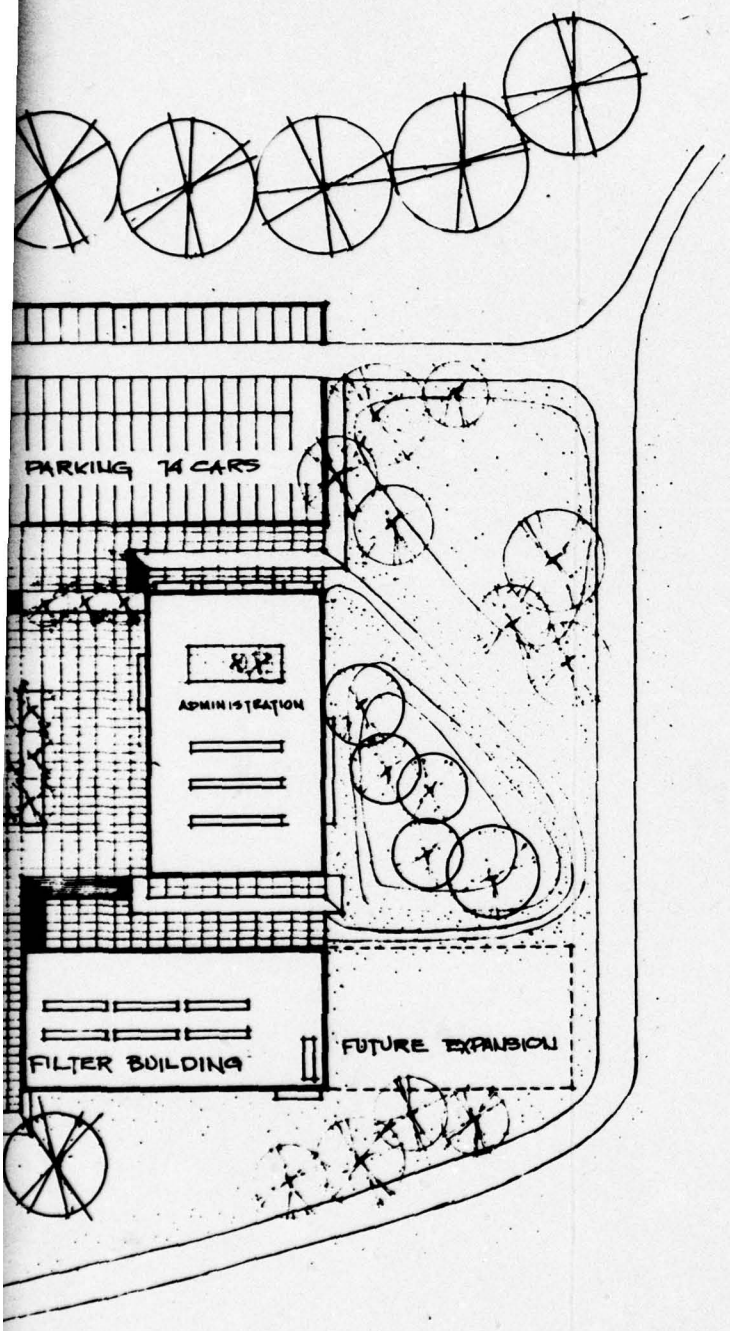
LAYOUT OF FIRST PHASE FACILITIES

YORK AREA
ADVANCED TREATMENT PLANT

YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE AS SHOWN


PARKING 14 CARS
ADMINISTRATION
CHEMICAL BLDG.
FILTER BUILDING
LOADING

2



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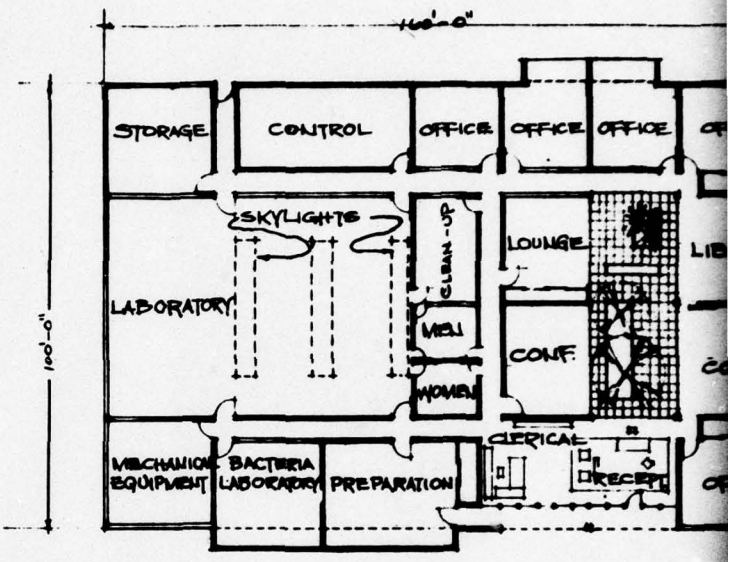
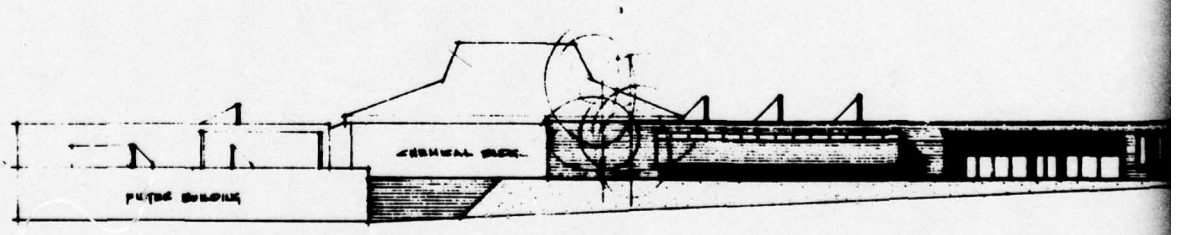
BALTIMORE, MARYLAND

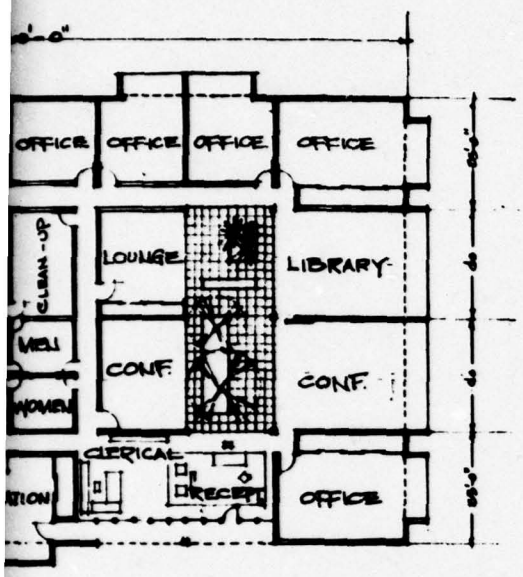
CODORUS CREEK.
WASTE WATER MANAGEMENT STUDY
ADMINISTRATIVE COMPLEX
YORK AREA
ADVANCED TREATMENT PLANT

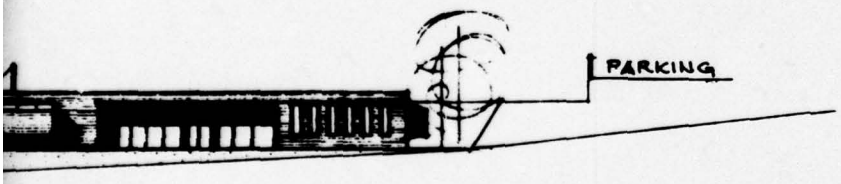
YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE AS SHOWN


STORAGE
CONTROL
OFFICE
OFFICE
OFFICE
SKYLIGHTS
CLEAN - UP
LOUNGE
LABORATORY
MEN
WOMEN
CONF.
CLERICAL
RECEPT.
MECHANICAL EQUIPMENT
BACTERIA LABORATORY
PREPARATION
100'-0"


1
1

2



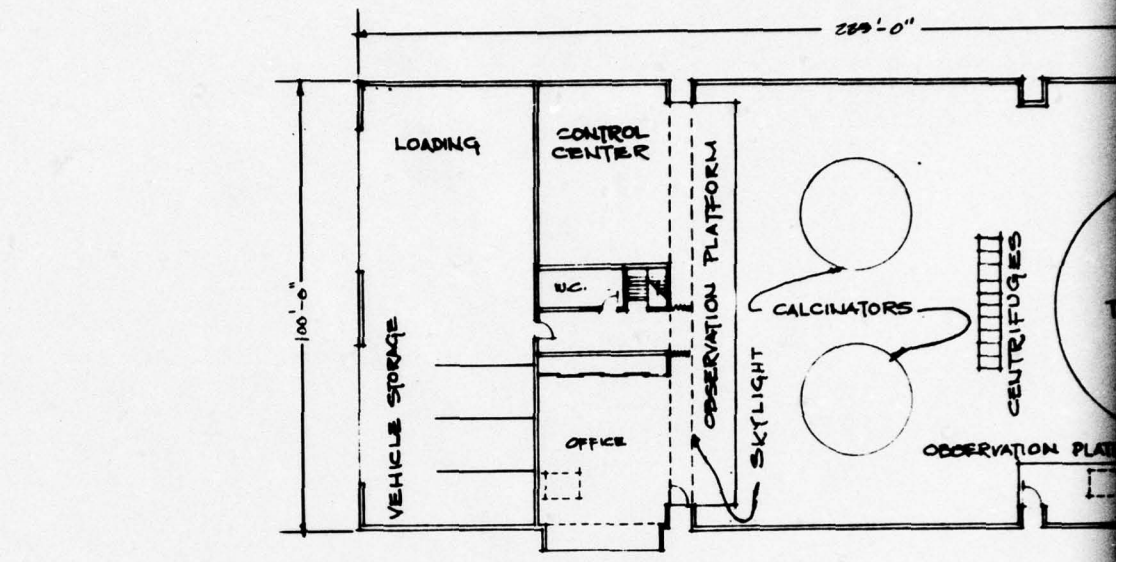


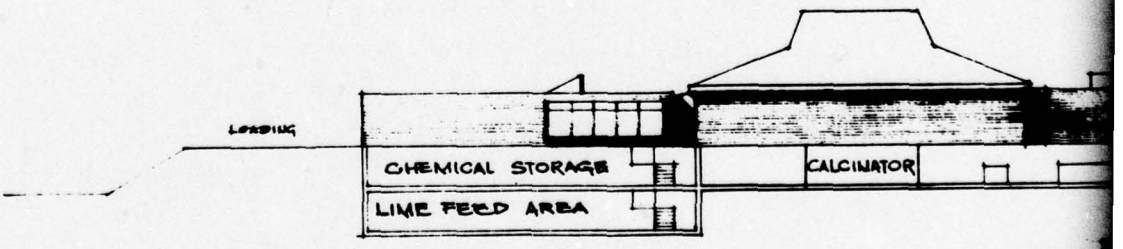
EAST ELEVATION

CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

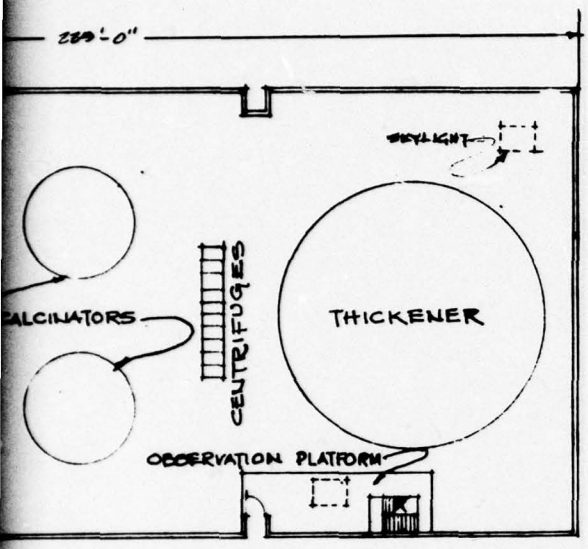
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
ADMINISTRATION BUILDING
YORK AREA
ADVANCED TREATMENT PLANT

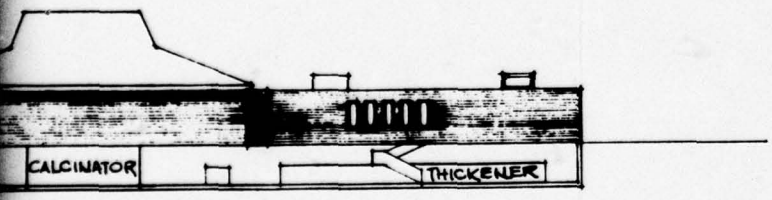
YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE AS SHOWN


289'-0"
100'-0"
LOADING
CONTROL CENTER
U.C.
OFFICE
VEHICLE STORAGE
OBSERVATION PLATFORM
SKYLIGHT
CALCINATORS
CENTRIFUGES
OBSERVATION PLAT


LOADING
CHEMICAL STORAGE
LIME FEED AREA
CALCINATOR

2





EAST ELEVATION

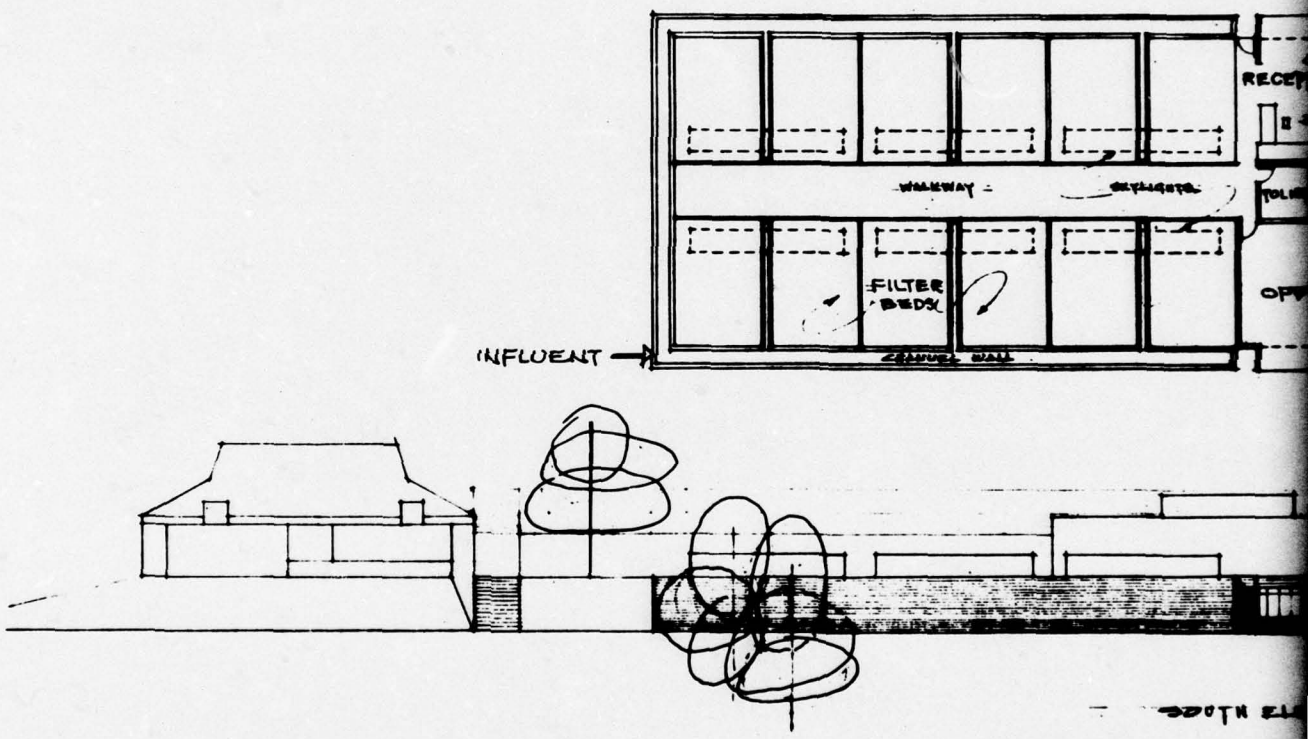
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CODORUS CREEK,
WASTE WATER MANAGEMENT STUDY

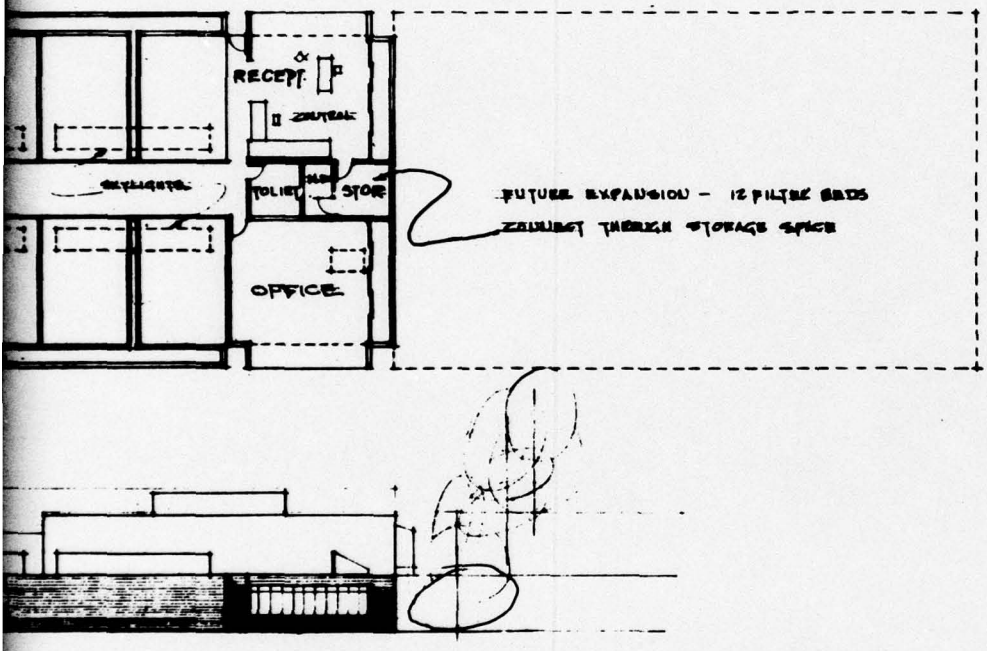
CHEMICAL BUILDING
YORK AREA
ADVANCED TREATMENT PLANT

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE AS SHOWN


INFLUENT
FILTER BEDS

2



SOUTH ELEVATION

CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CODORUS CREEK.
WASTE WATER MANAGEMENT STUDY

FILTER BUILDING
YORK AREA
ADVANCED TREATMENT PLANT

YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE AS SHOWN

ADVANCED WASTEWATER

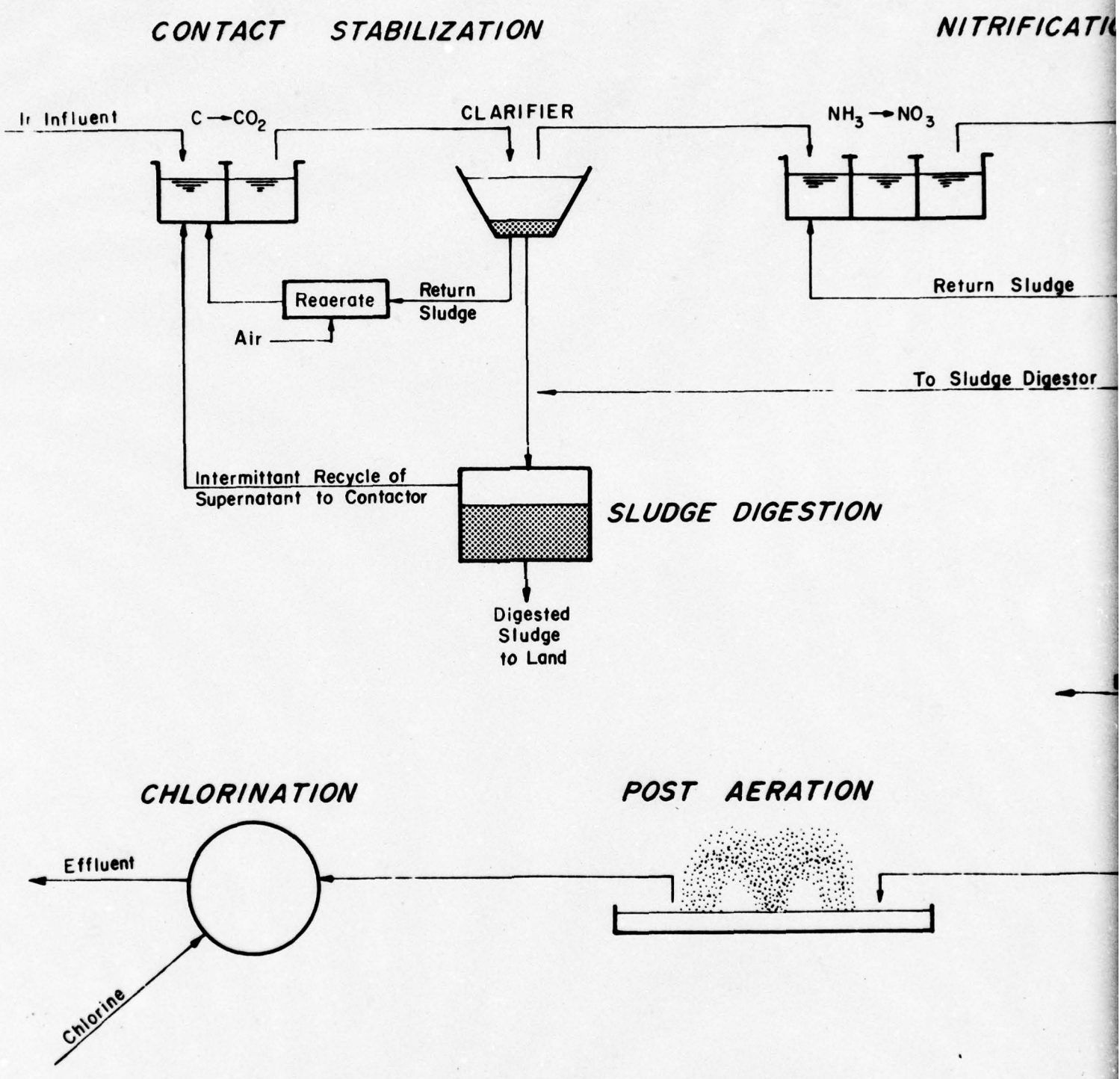
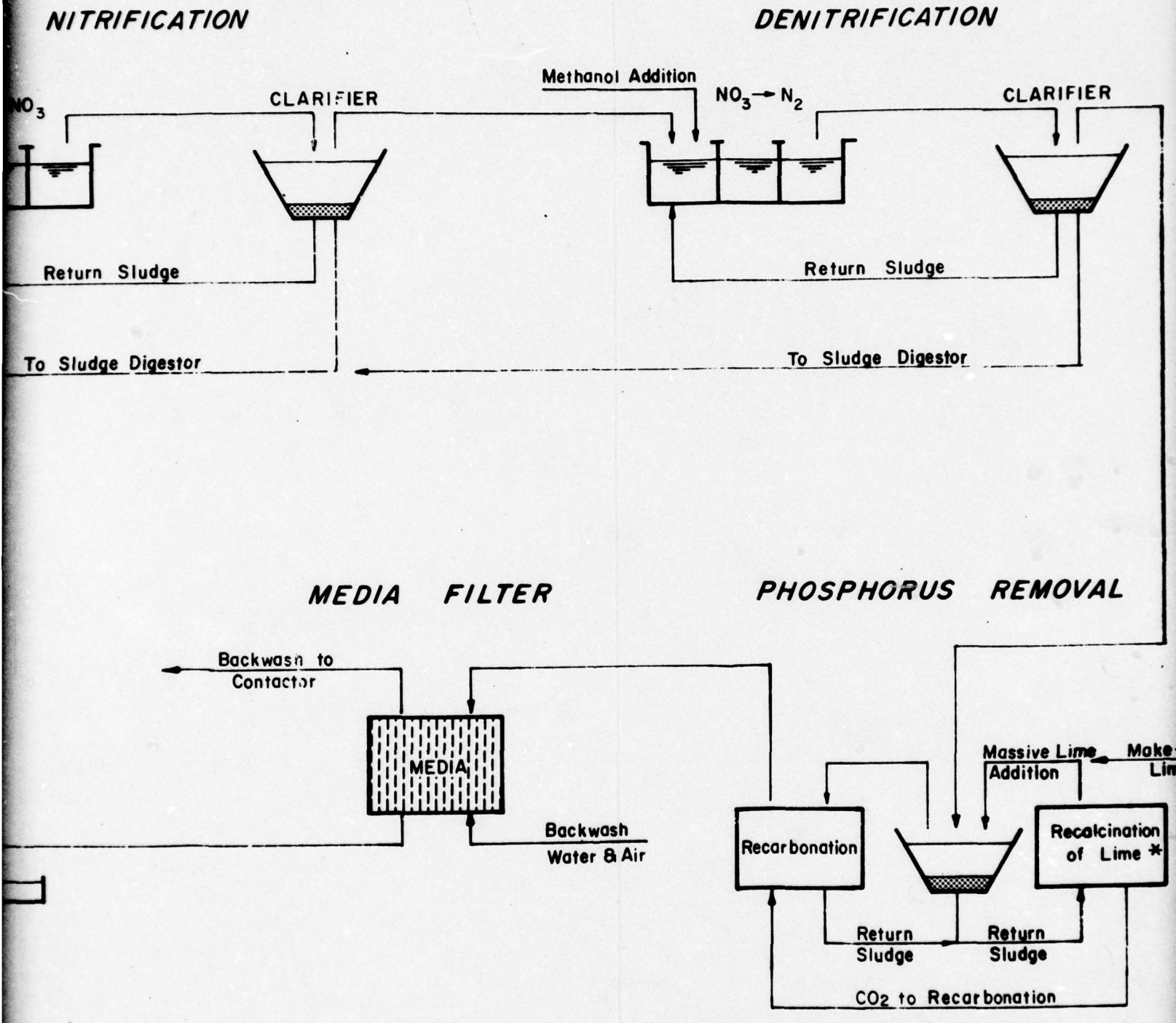
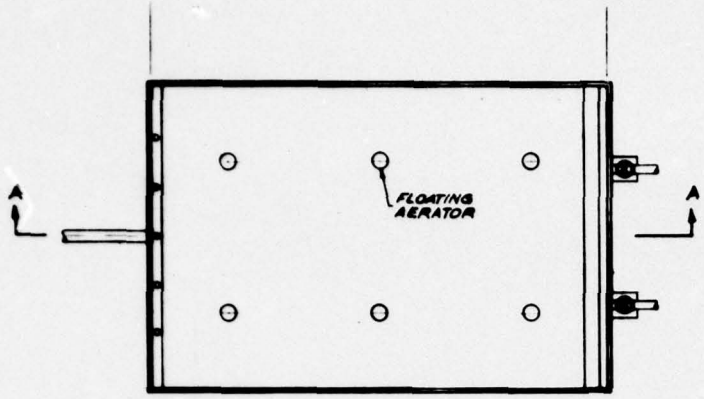


EXHIBIT IV-10

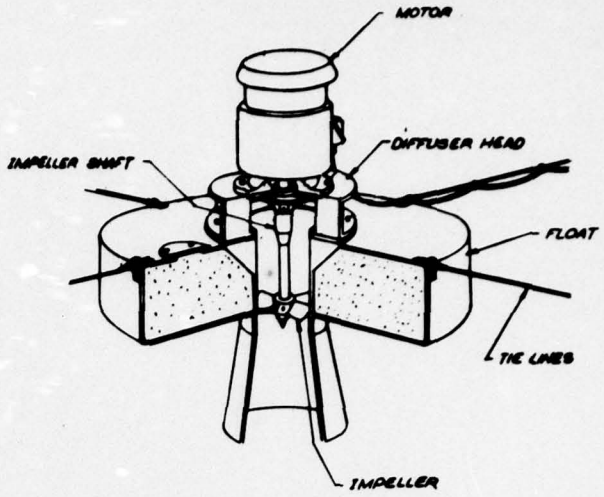
ASTEWATER TREATMENT SYSTEM



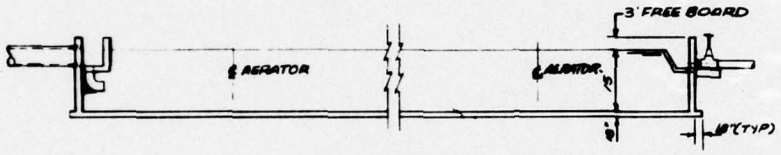
* Includes thickening, dewatering, fluidized-bed recalcination, lime make-up and reslaking



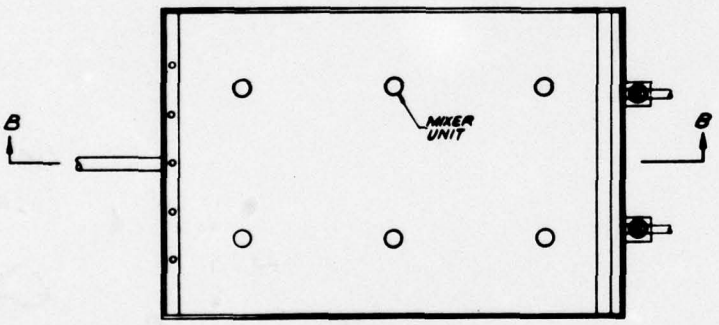
PLAN VIEW
NITRIFICATION BASIN



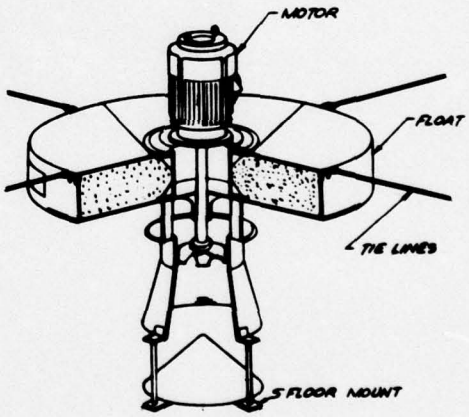
TYPICAL AERATOR



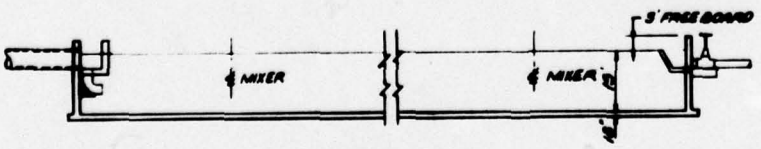
SECTION A-A



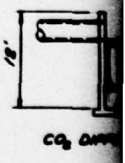
PLAN VIEW
DENITRIFICATION BASIN



TYPICAL MIXER



SECTION B-B

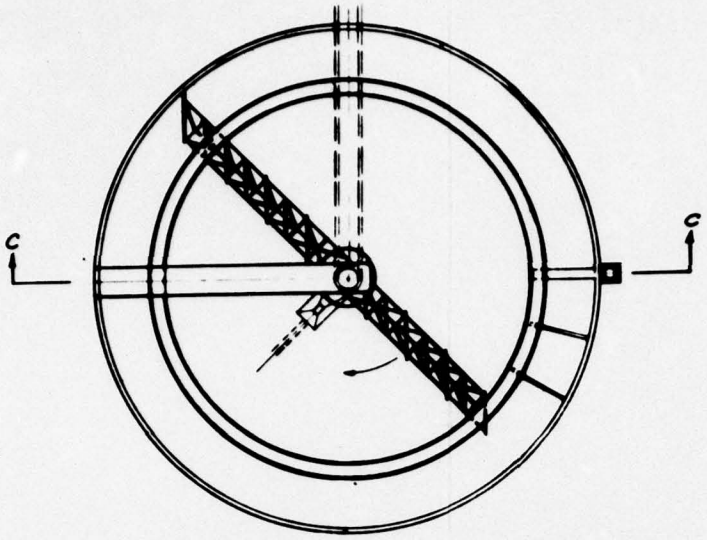


MOTOR

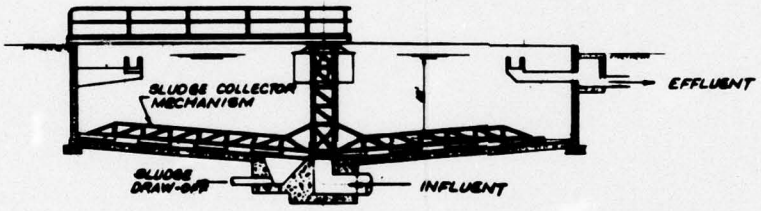
DIFFUSER HEAD

FLOAT

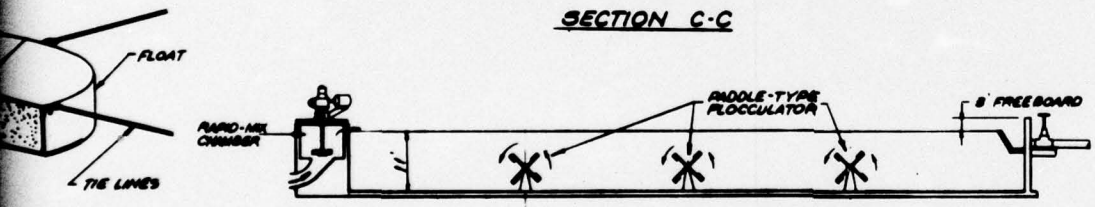
TIE LINES



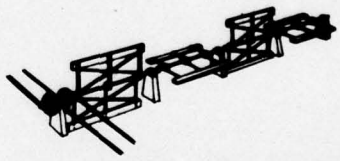
PLAN VIEW
SEDIMENTATION BASIN



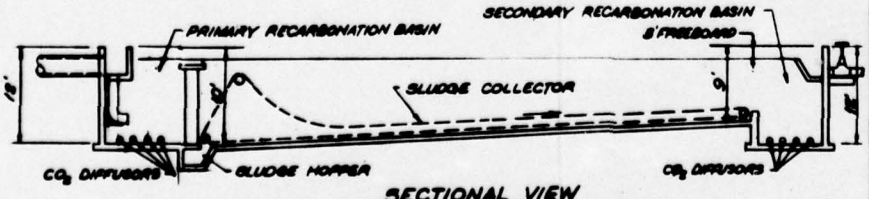
SECTION C-C



SECTIONAL VIEW
RAPID MIX - CHEMICAL FLOCCULATION BASIN



TYPICAL PADDLE-TYPE FLOCCULATOR



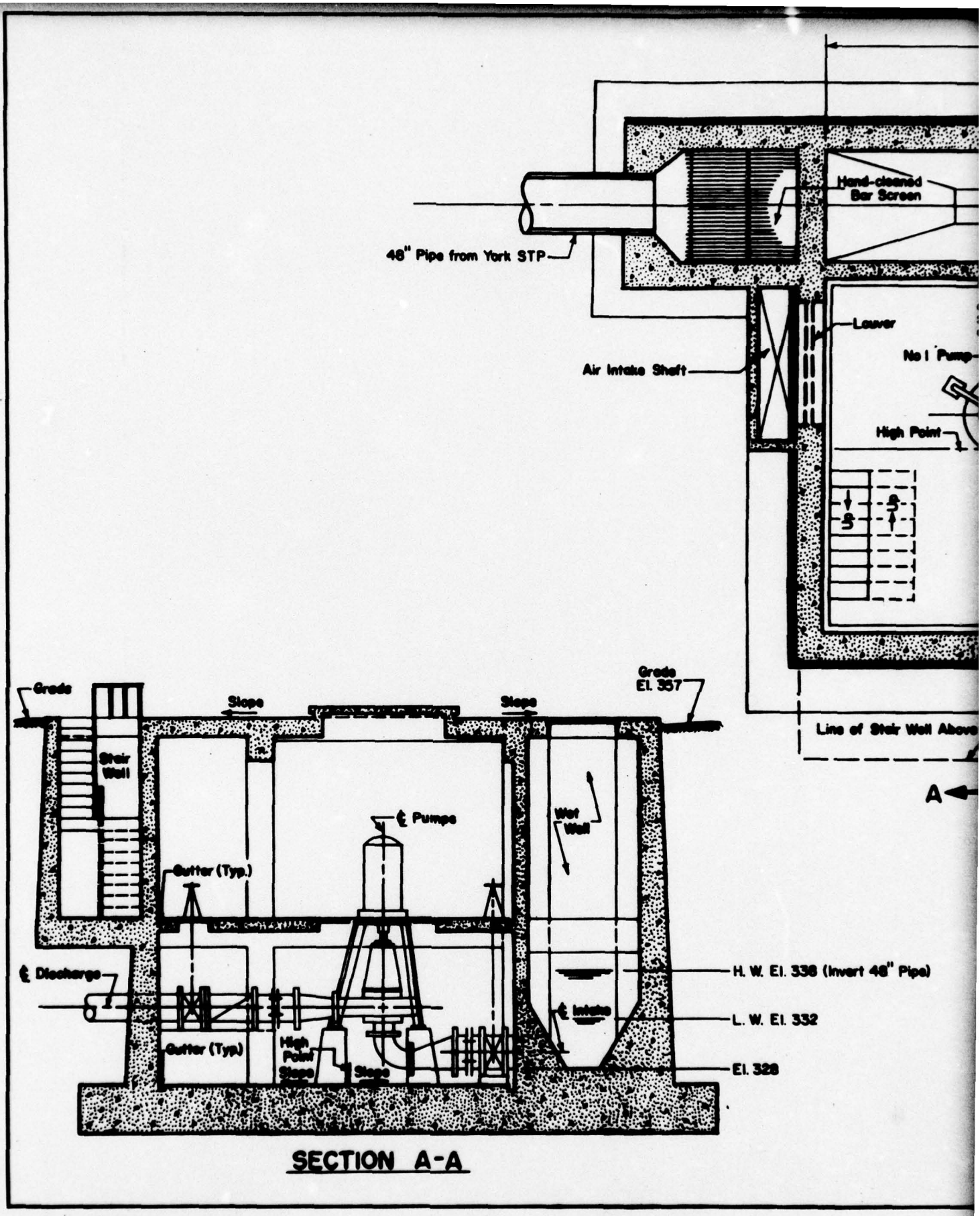
SECTIONAL VIEW
TWO-STAGE RECARBONATION UNIT

NOT TO SCALE

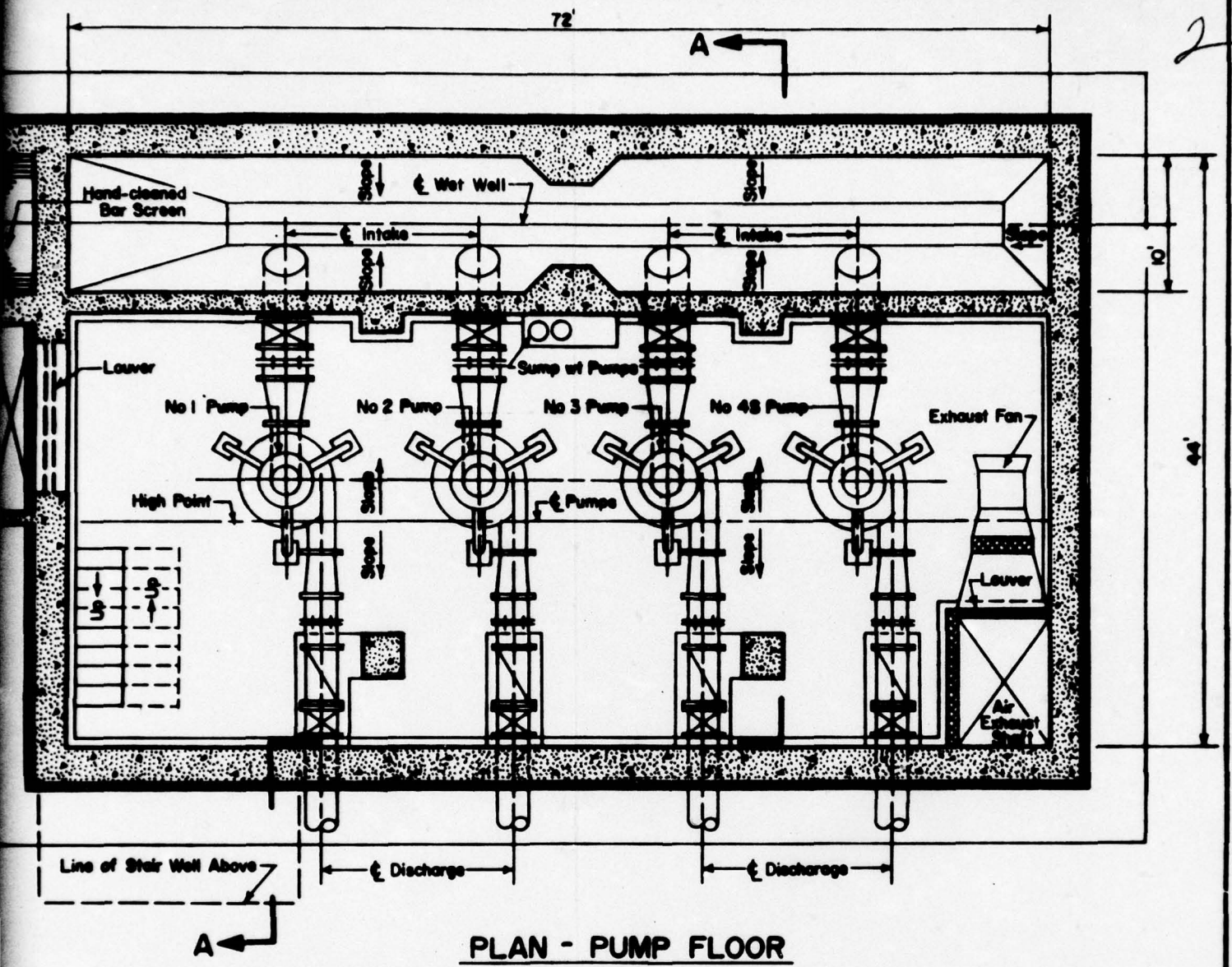
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
TYPICAL PROCESS EQUIPMENT DETAILS
YORK AREA
ADVANCED TREATMENT PLANT

YALE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE AS SHOWN


Hand-cleaned Bar Screen
48" Pipe from York STP
Louver
Air Intake Shaft
No 1 Pump
High Point
Line of Stair Well Above
A
Grade
Slope
Slope
Grade El. 357
Stair Well
℄ Pumps
Wet Well
Gutter (Typ.)
℄ Discharge
H. W. El. 338 (Invert 48" Pipe)
℄ Intake
L. W. El. 332
Gutter (Typ.)
High Point
Slope
Slope
El. 328

SECTION A-A

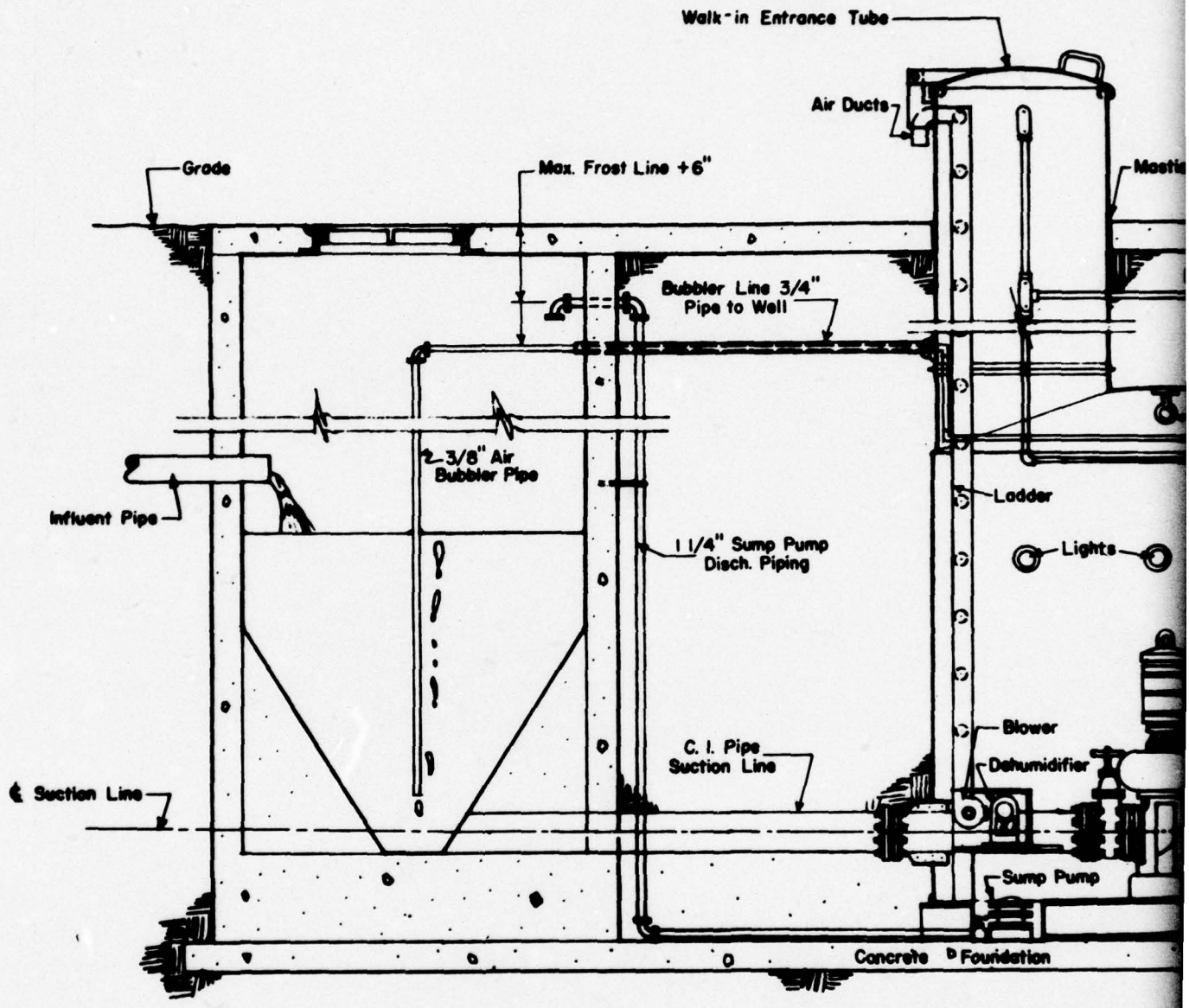


PLAN - PUMP FLOOR

El. 338 (Invert 48" Pipe)

El. 332

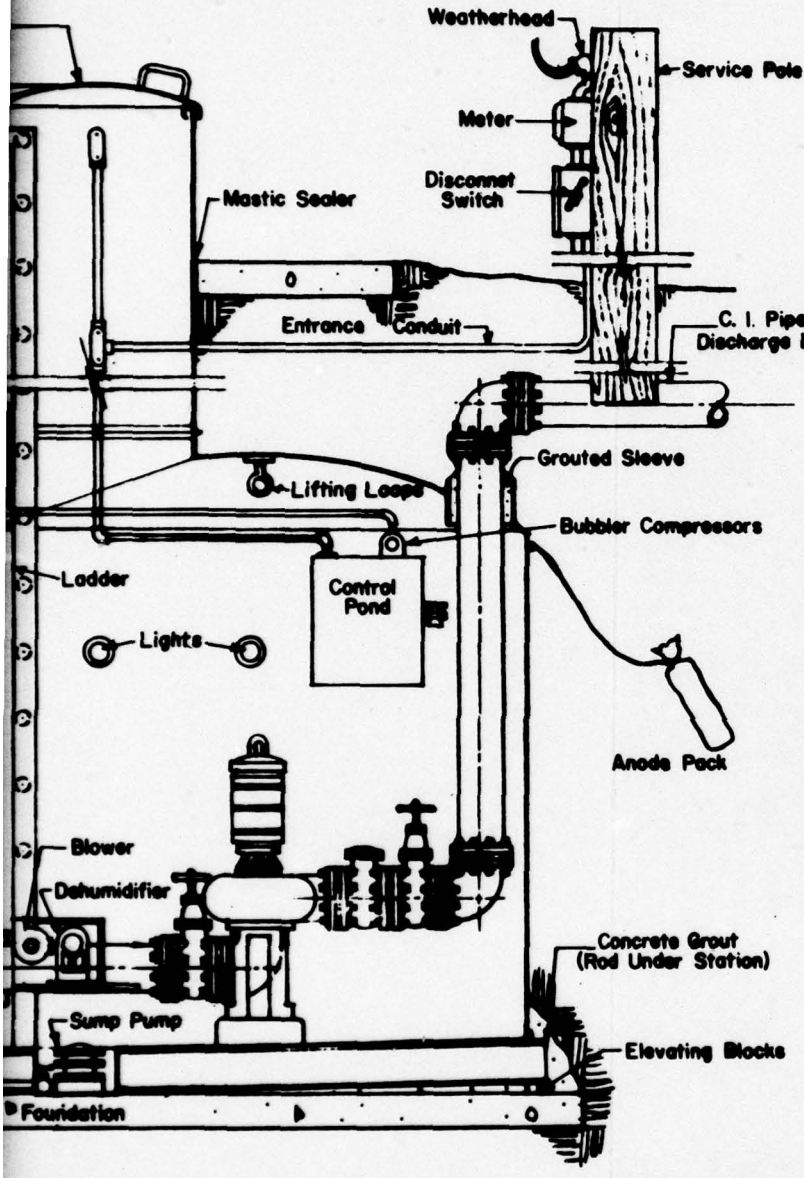
CORPS. OF ENGINEERS, U. S. ARMY OFFICE OF THE DISTRICT ENG. BALTIMORE DISTRICT BALTIMORE MARYLAND
CODORUS CREEK WASTE WATER MANAGEMENT STUDY YORK PUMP STATION
YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE - NOT TO SCALE



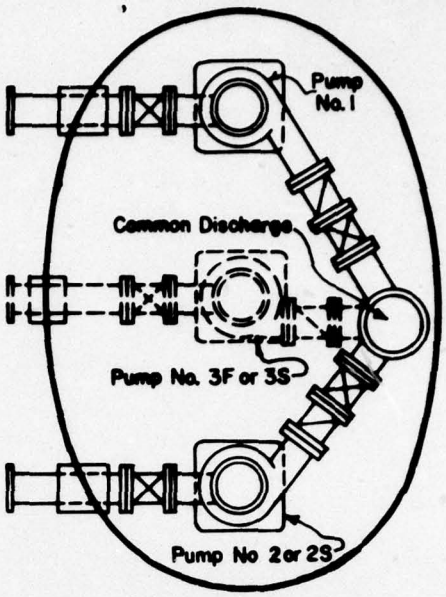
WET WELL

END ELEVATION

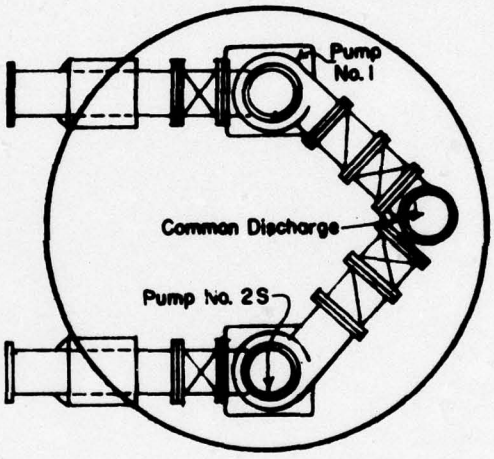
NOTE: See Schedule of Prefabricated Pumping Stations for dimensions and pump capacities.



ELEVATION



3 PUMP STATION



2 PUMP STATION

STATION PLAN

CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

PREFABRICATED PUMPING STATIONS

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE NOT TO SCALE

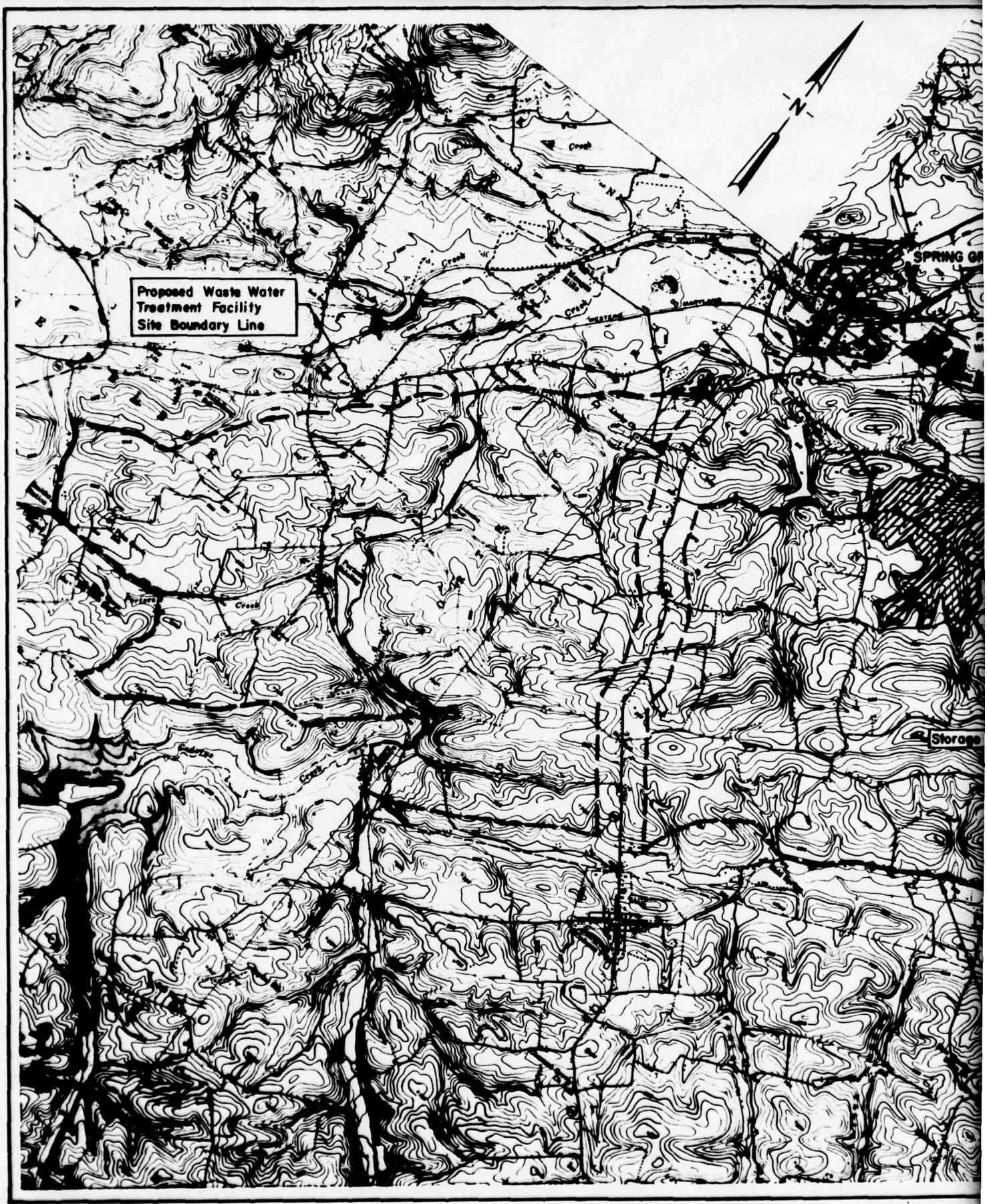
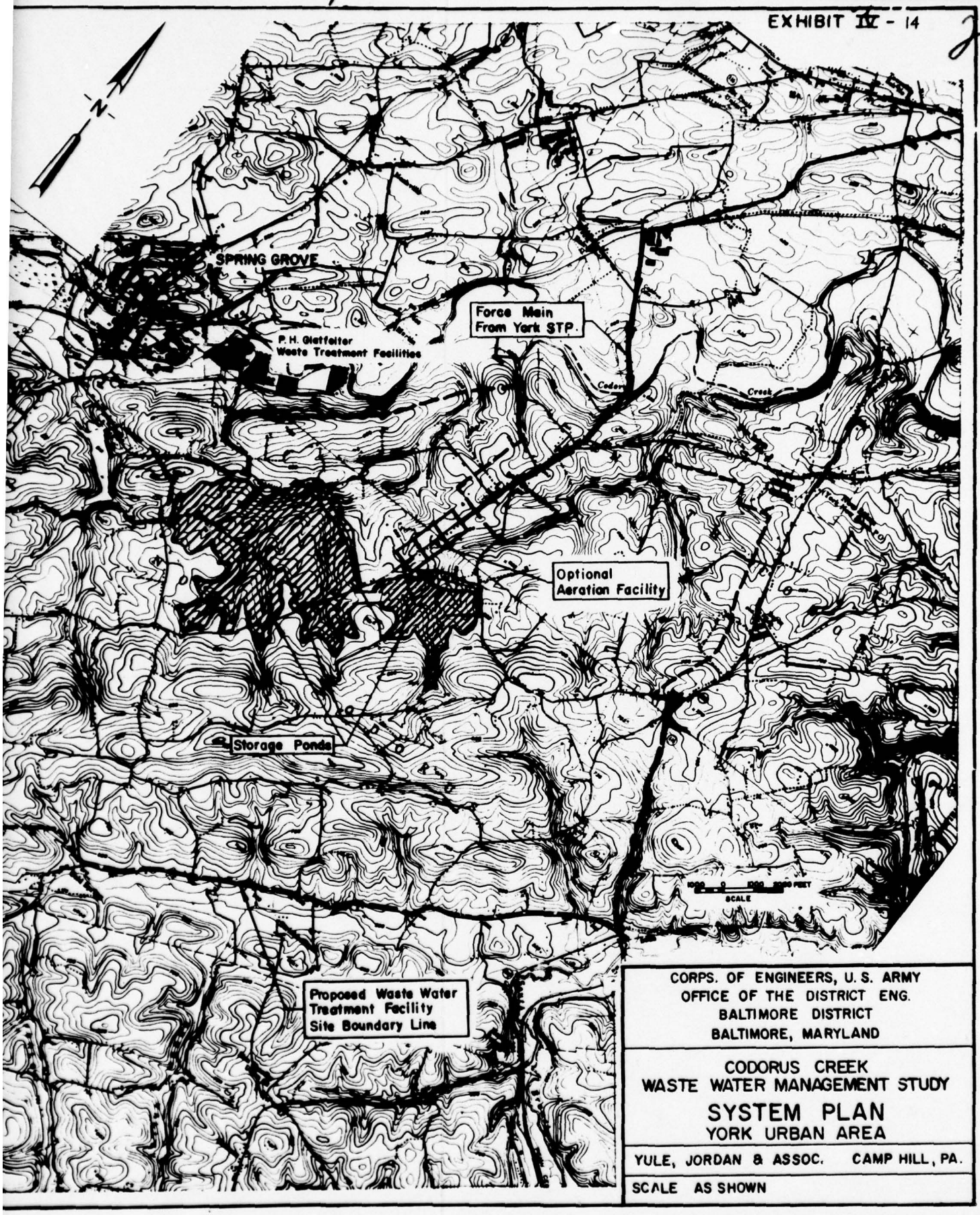

Proposed Waste Water
Treatment Facility
Site Boundary Line
N
SPRING G
Storage

EXHIBIT IV - 14



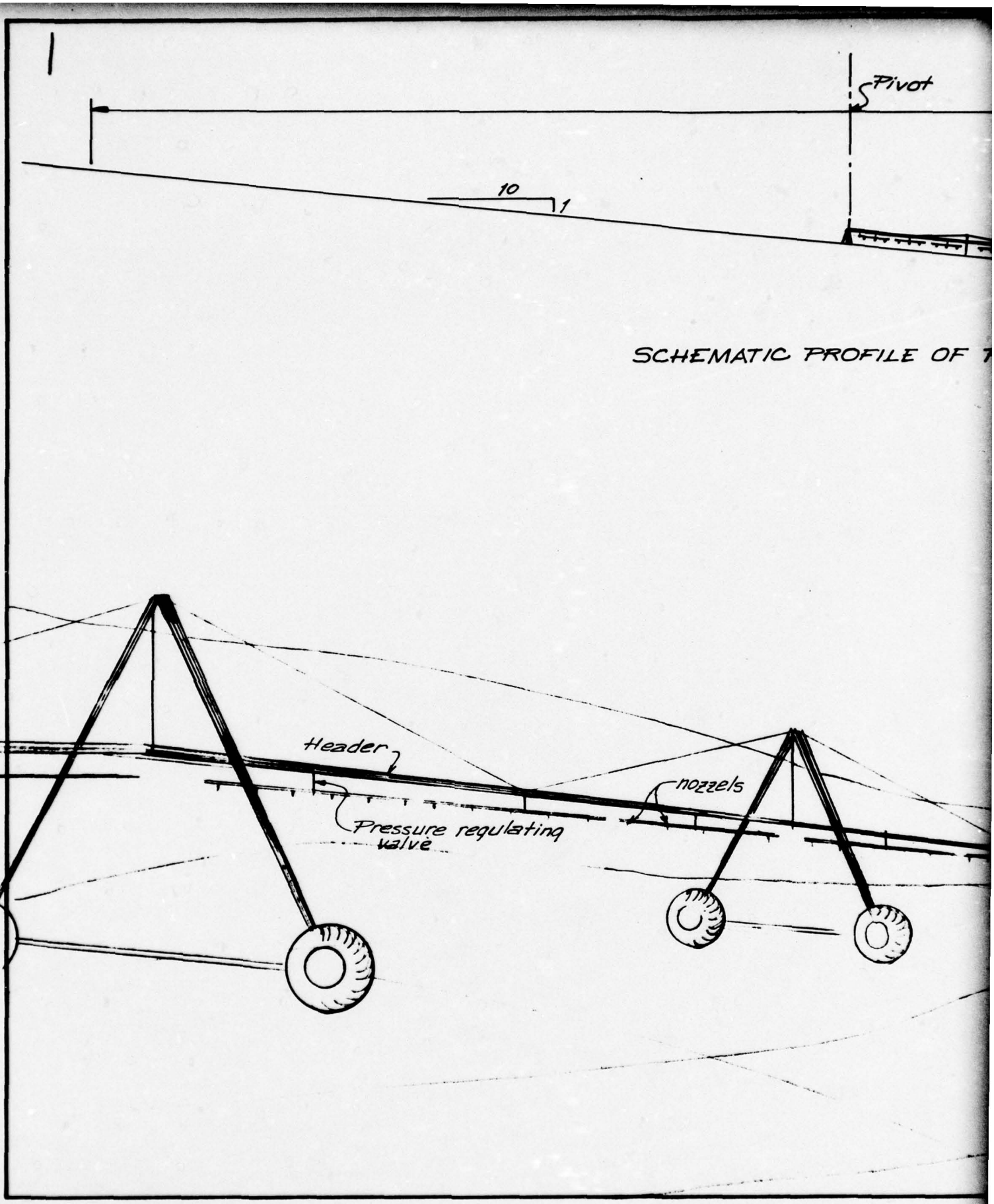
CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

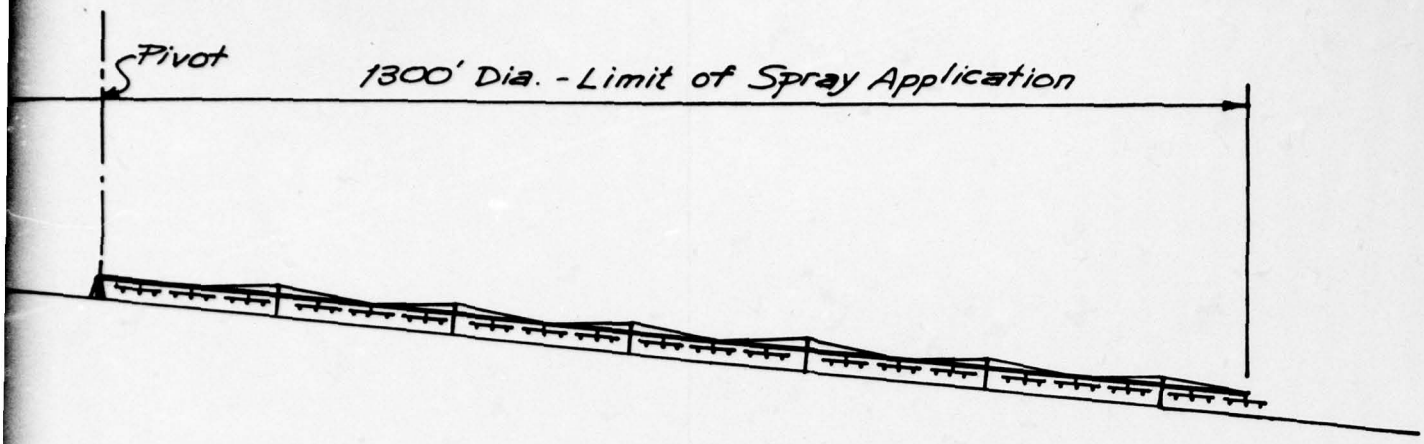
SYSTEM PLAN
YORK URBAN AREA

YULE, JORDAN & ASSOC. CAMP HILL, PA.

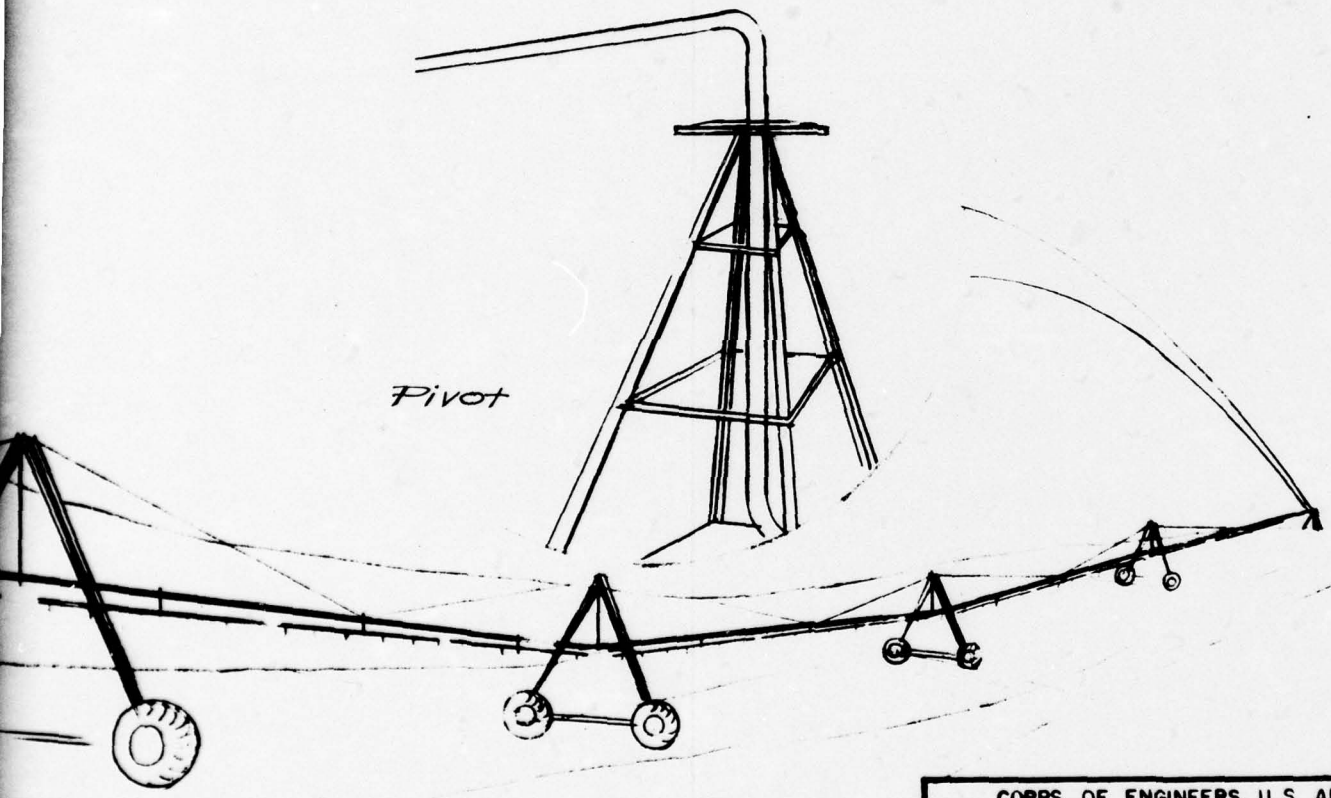
SCALE AS SHOWN



SCHEMATIC PROFILE OF T



PROFILE OF ROTATING IRRIGATION MACHINE



CORPS. OF ENGINEERS, U. S ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

CENTER PIVOT IRRIGATION MACHINE

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE AS SHOWN

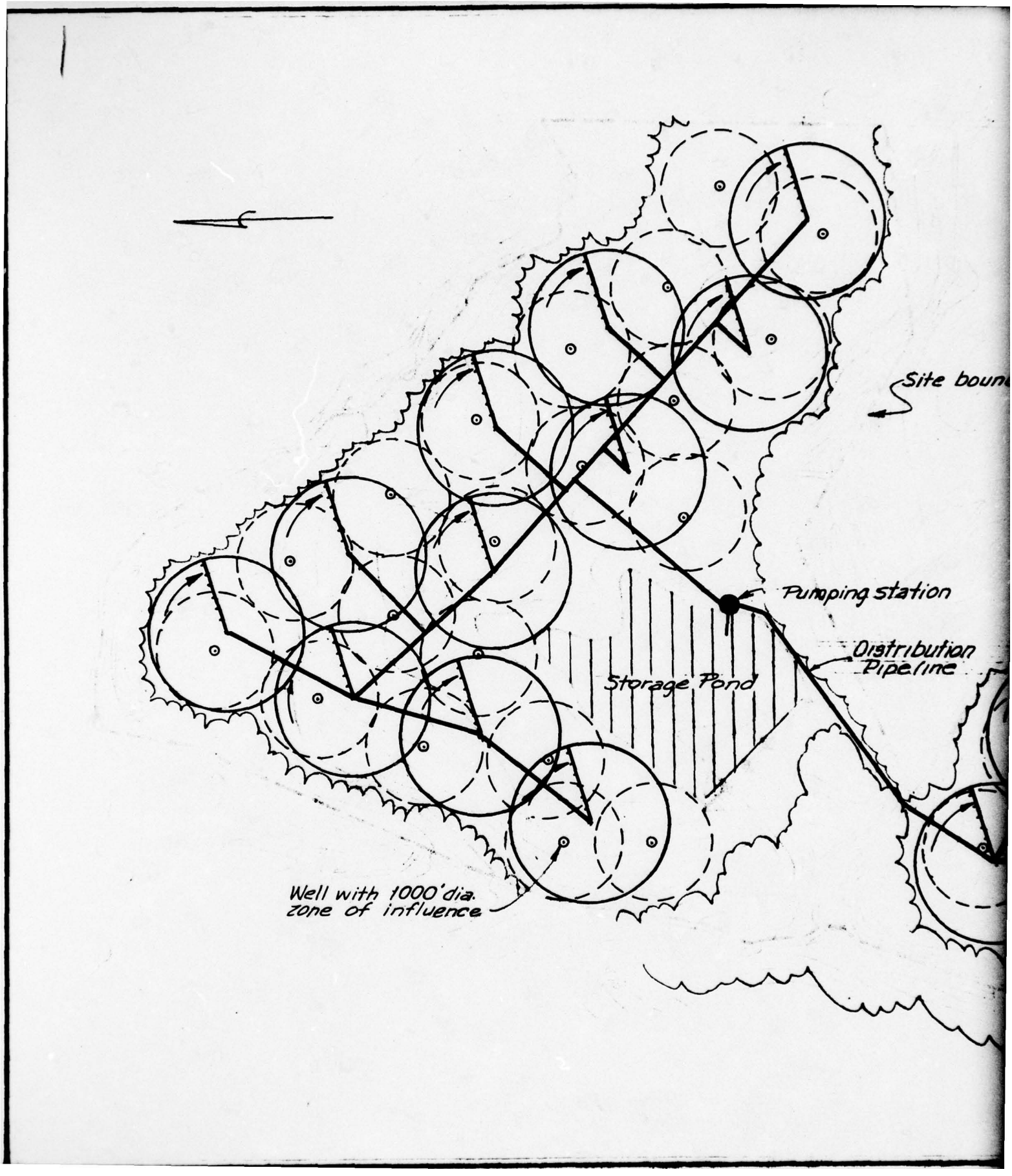
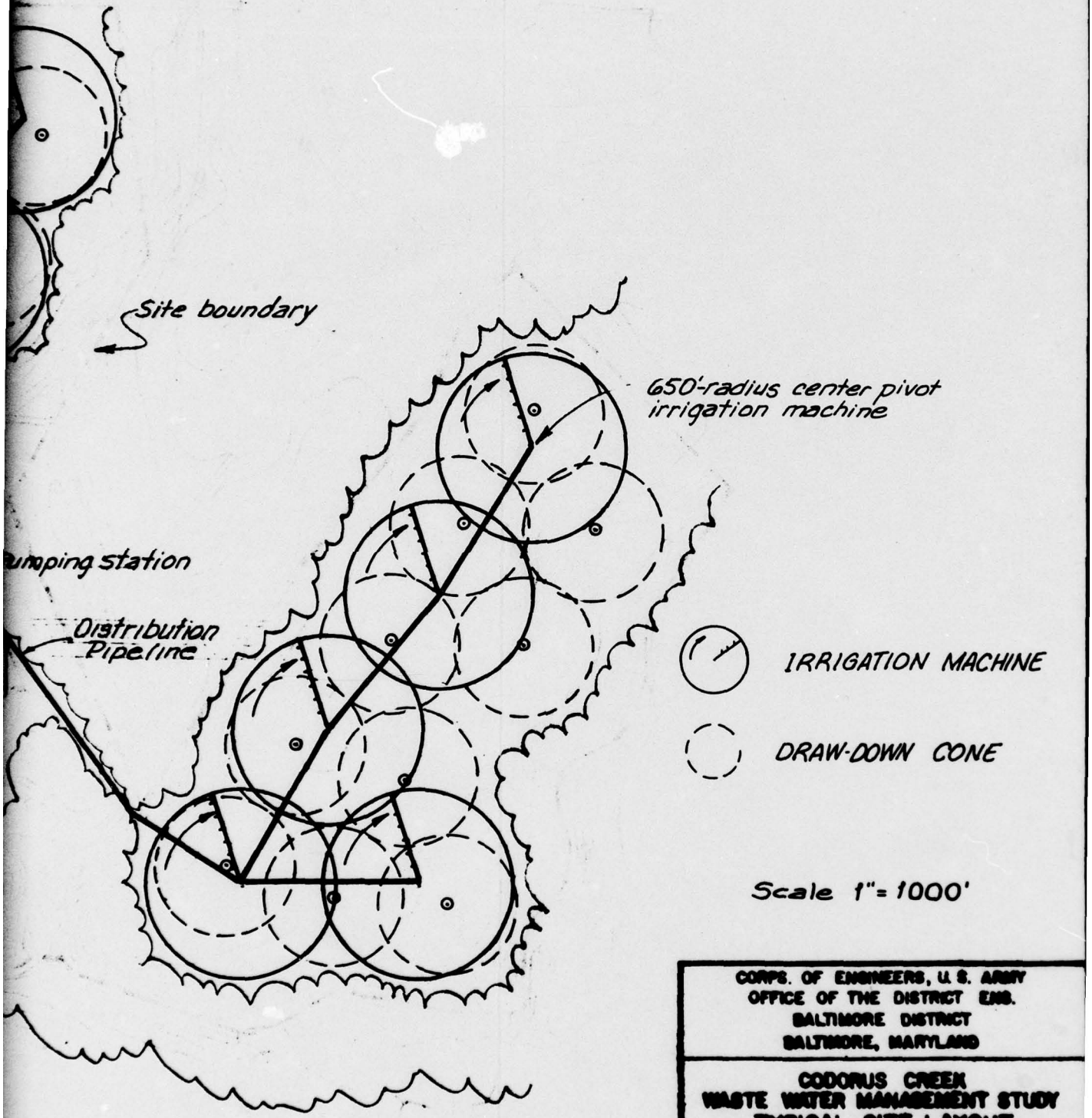

Site boun
Pumping station
Distribution Pipeline
Storage Pond
Well with 1000' dia. zone of influence

EXHIBIT IV - 16

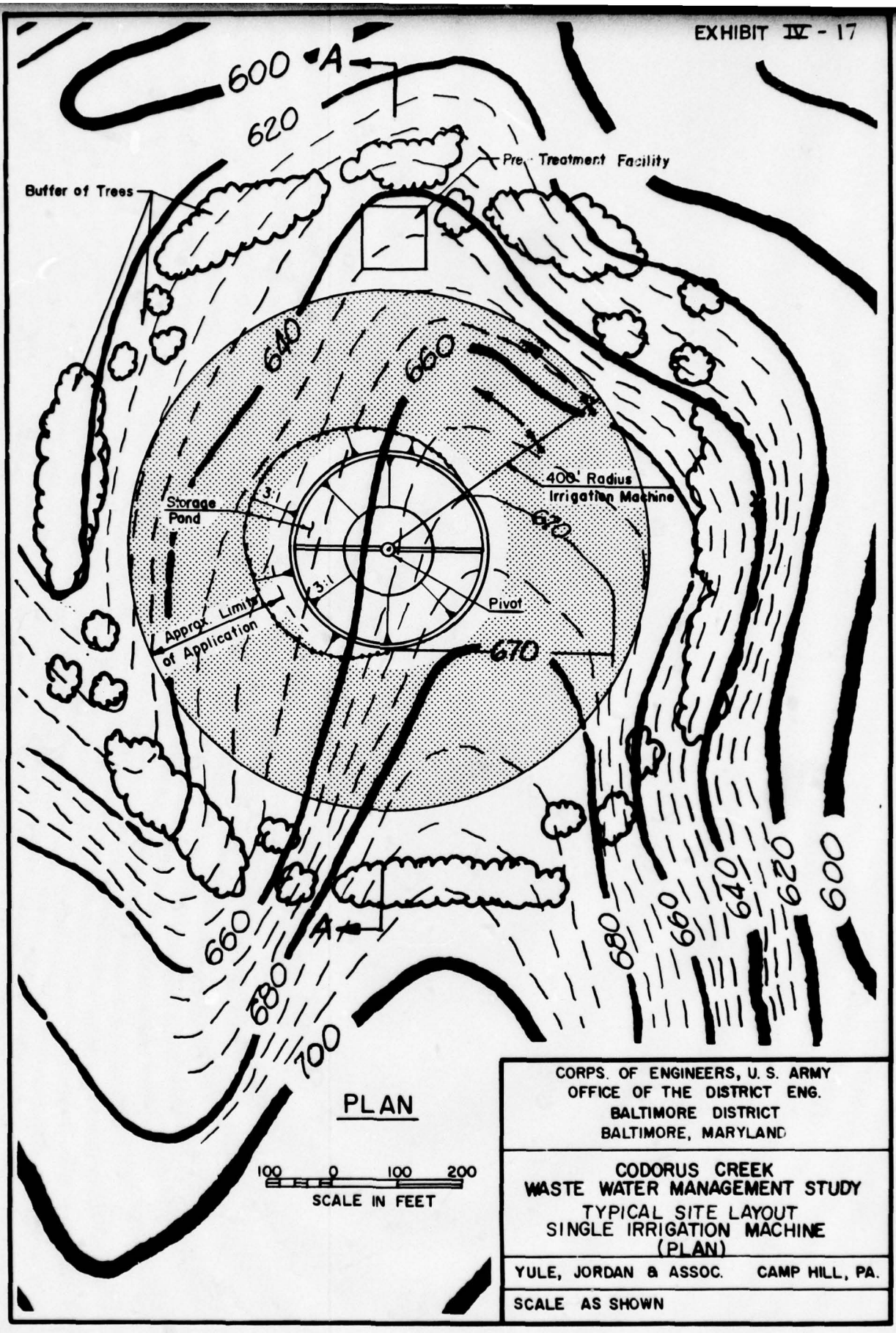


CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
TYPICAL SITE LAYOUT
MULTIPLE IRRIGATION MACHINES

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE AS SHOWN



PLAN

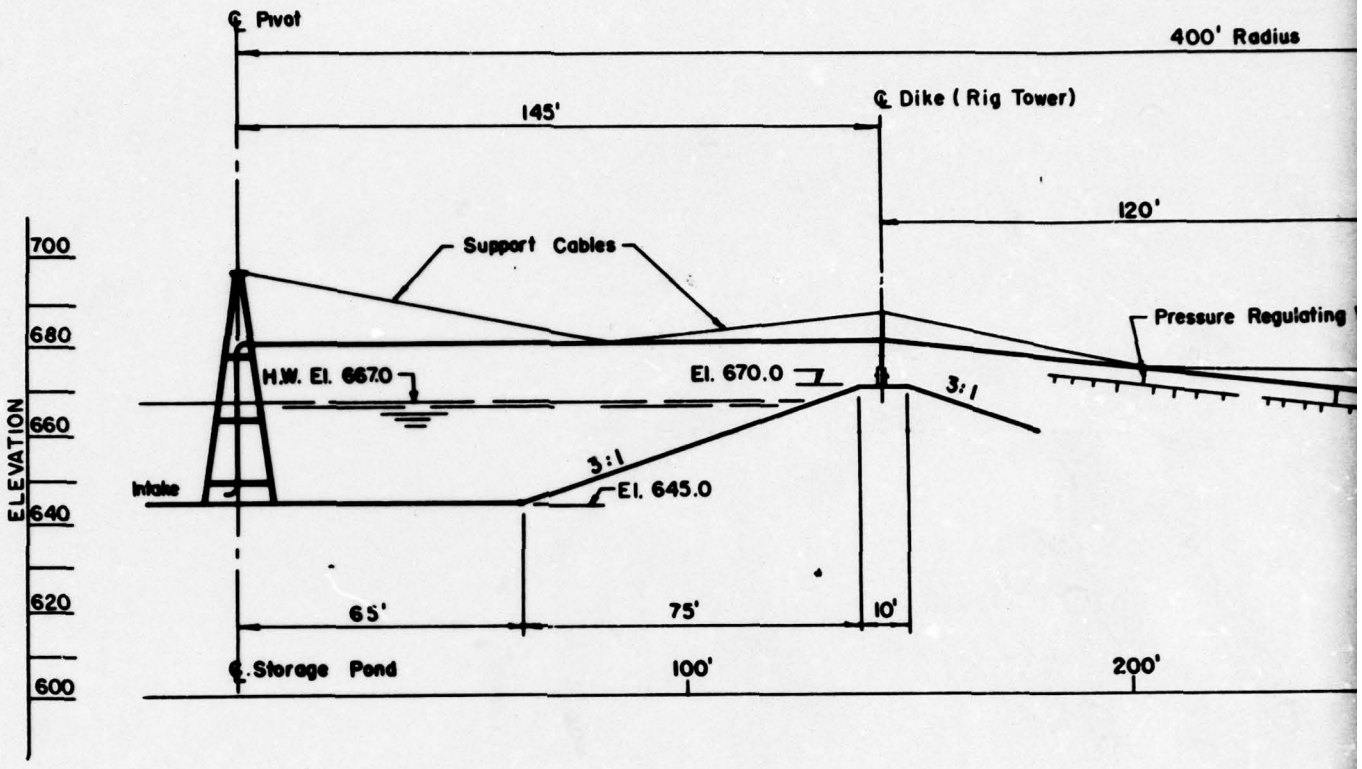
100 0 100 200
SCALE IN FEET

CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
TYPICAL SITE LAYOUT
SINGLE IRRIGATION MACHINE
(PLAN)

YULE, JORDAN & ASSOC. CAMP HILL, PA.

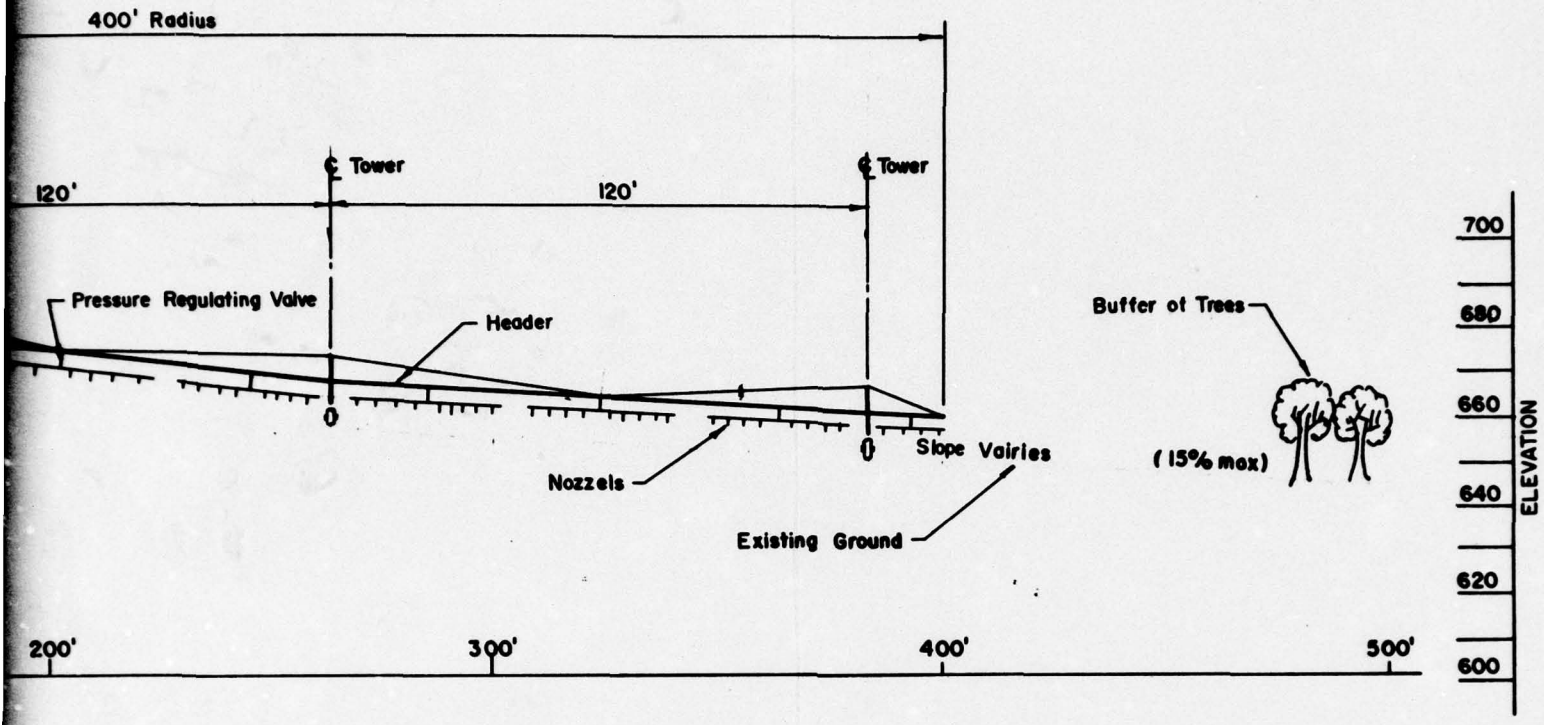
SCALE AS SHOWN


℄ Pivot
400' Radius
145'
℄ Dike (Rig Tower)
120'
Support Cables
Pressure Regulating
H.W. El. 667.0
El. 670.0
3:1
3:1
El. 645.0
Intake
ELEVATION
700
680
660
640
620
600
65'
75'
10'
℄ Storage Pond
100'
200'

HALF SEC

1"= 40

2



HALF SECTION A-A

1"= 40' HORIZ. & VERT.

TYPICAL SITE LAYOUT
SINGLE IRRIGATION MACHINE
(SECTION)


MIN. W.S. ELEV. 605.0
EXCAVATED RESERVOIR RIM
RESERVOIR A
MAX. W.S. ELEV
600
700
800
630
695
N

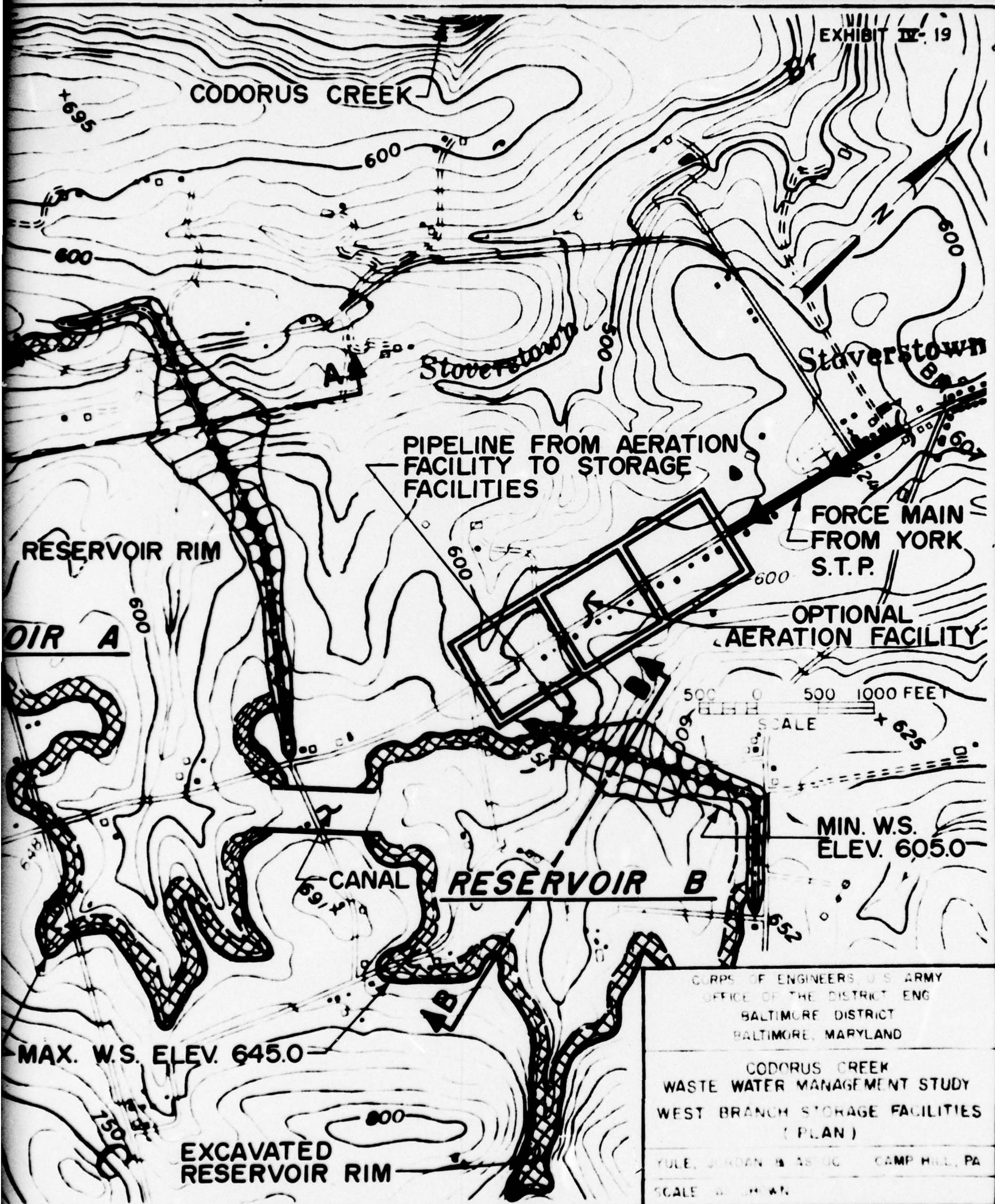
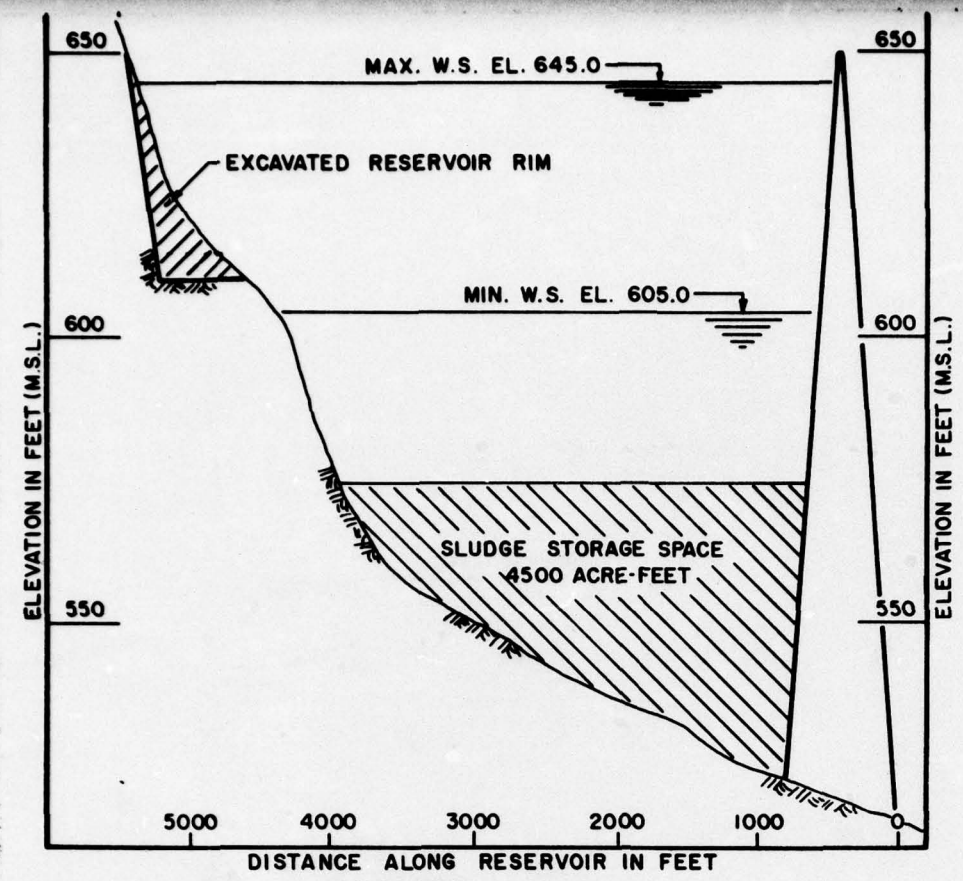
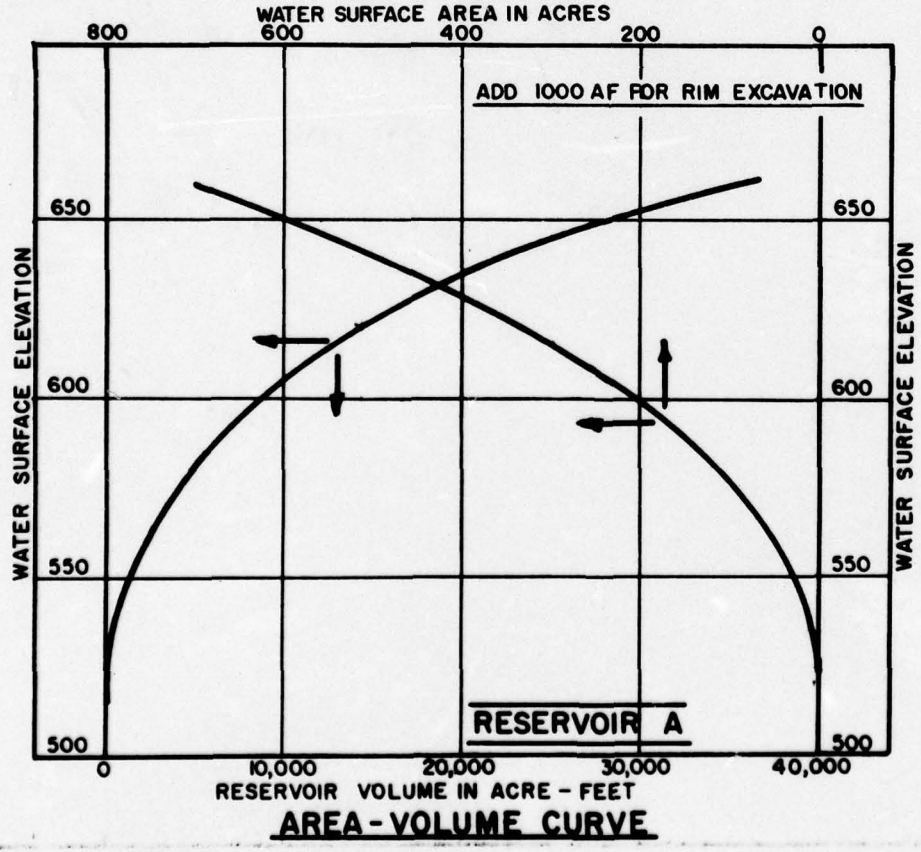


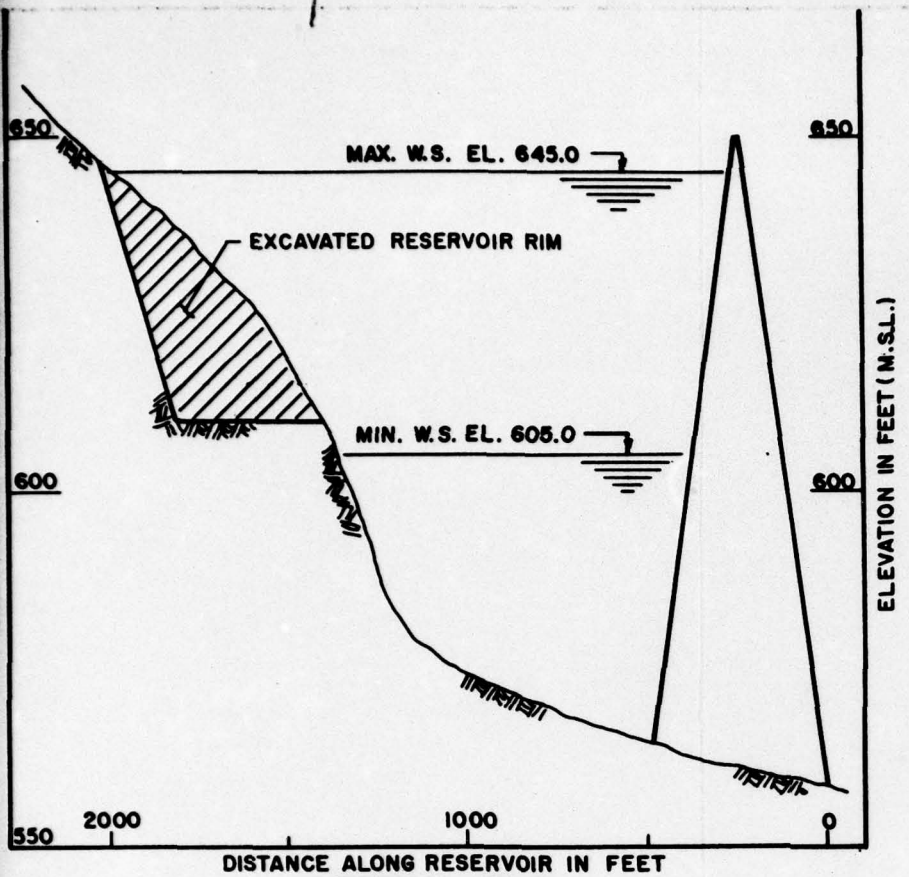
EXHIBIT IV-19
CODORUS CREEK
+695
600
600
Stoverstown
Stoverstown
A
PIPELINE FROM AERATION FACILITY TO STORAGE FACILITIES
RESERVOIR RIM
600
600
FORCE MAIN FROM YORK S.T.P.
OPTIONAL AERATION FACILITY
OIR A
500 0 500 1000 FEET
SCALE
+625
MIN. W.S. ELEV. 605.0
CANAL
RESERVOIR B
B
MAX. W.S. ELEV. 645.0
800
750
EXCAVATED RESERVOIR RIM
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENG
BALTIMORE DISTRICT
BALTIMORE, MARYLAND
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
WEST BRANCH STORAGE FACILITIES
(PLAN)
CAMP HILL, PA



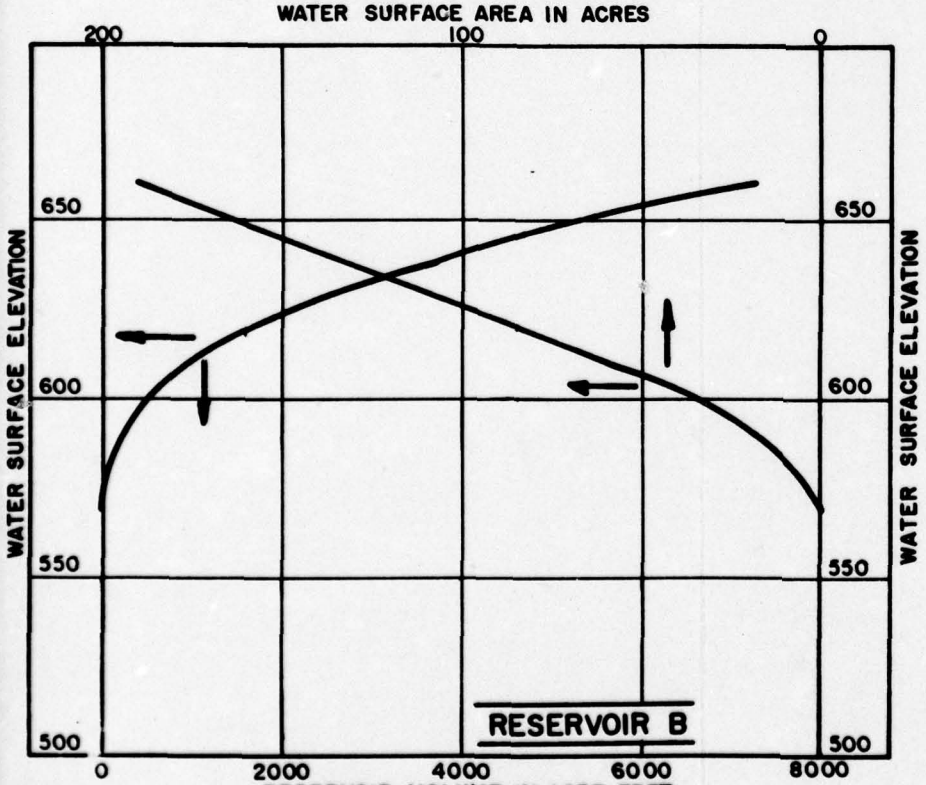
SECTION A-A



AREA-VOLUME CURVE

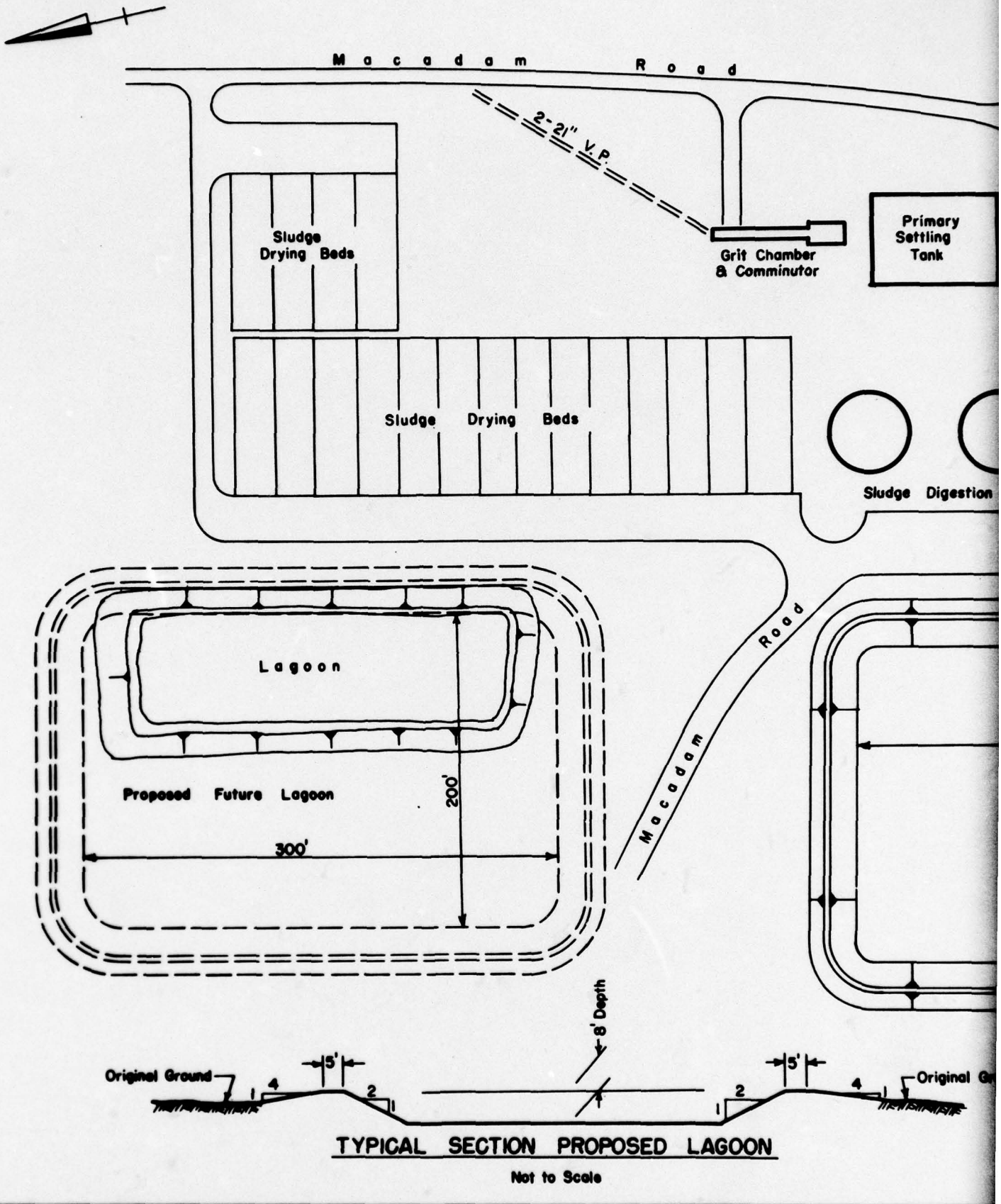


SECTION B-B



AREA-VOLUME CURVE

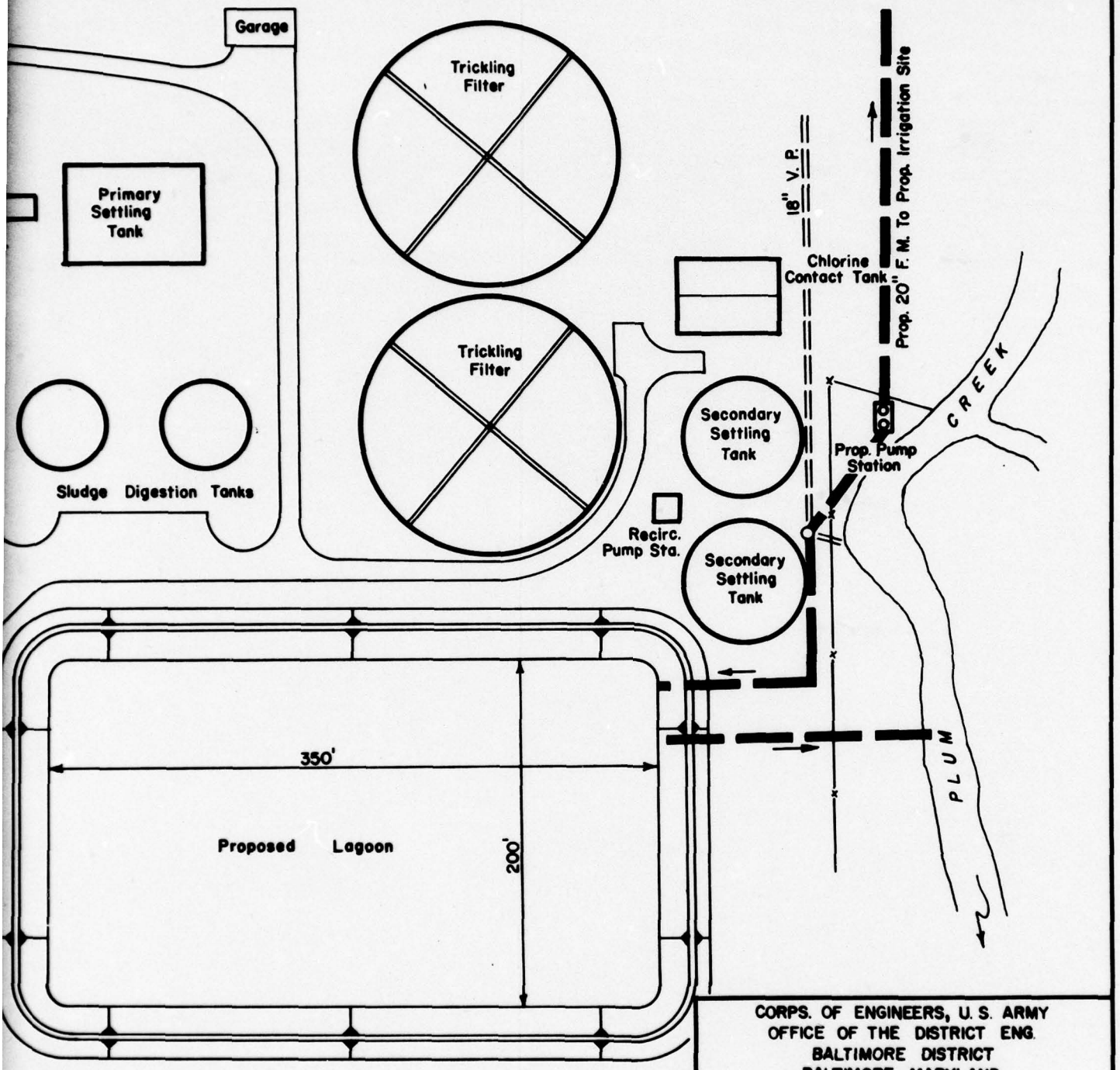
WEST BRANCH STORAGE FACILITIES
(SECTIONS & AREA-VOLUME CURVES)



TYPICAL SECTION PROPOSED LAGOON

Not to Scale

2



4 Original Ground

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BALTIMORE DISTRICT
BALTIMORE MARYLAND

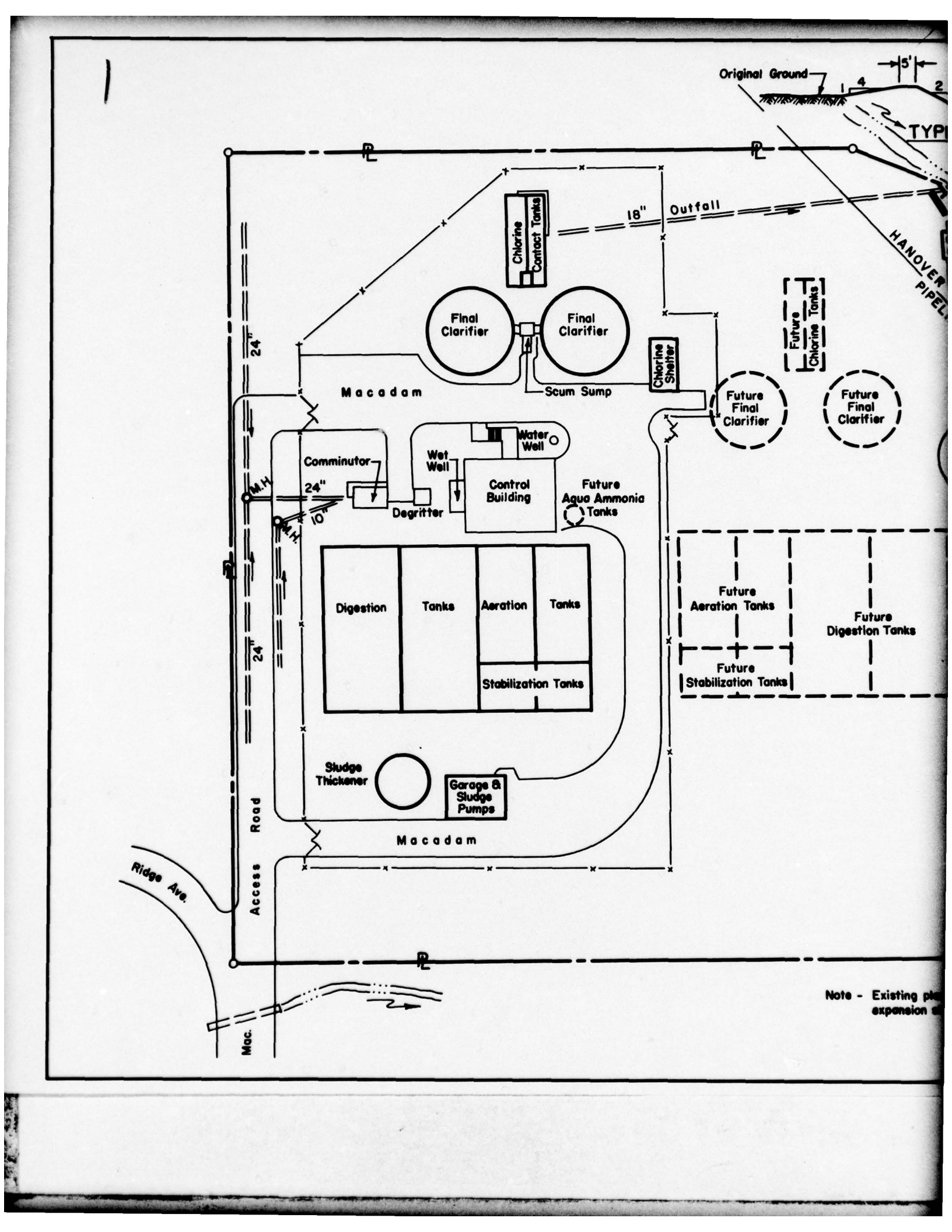
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

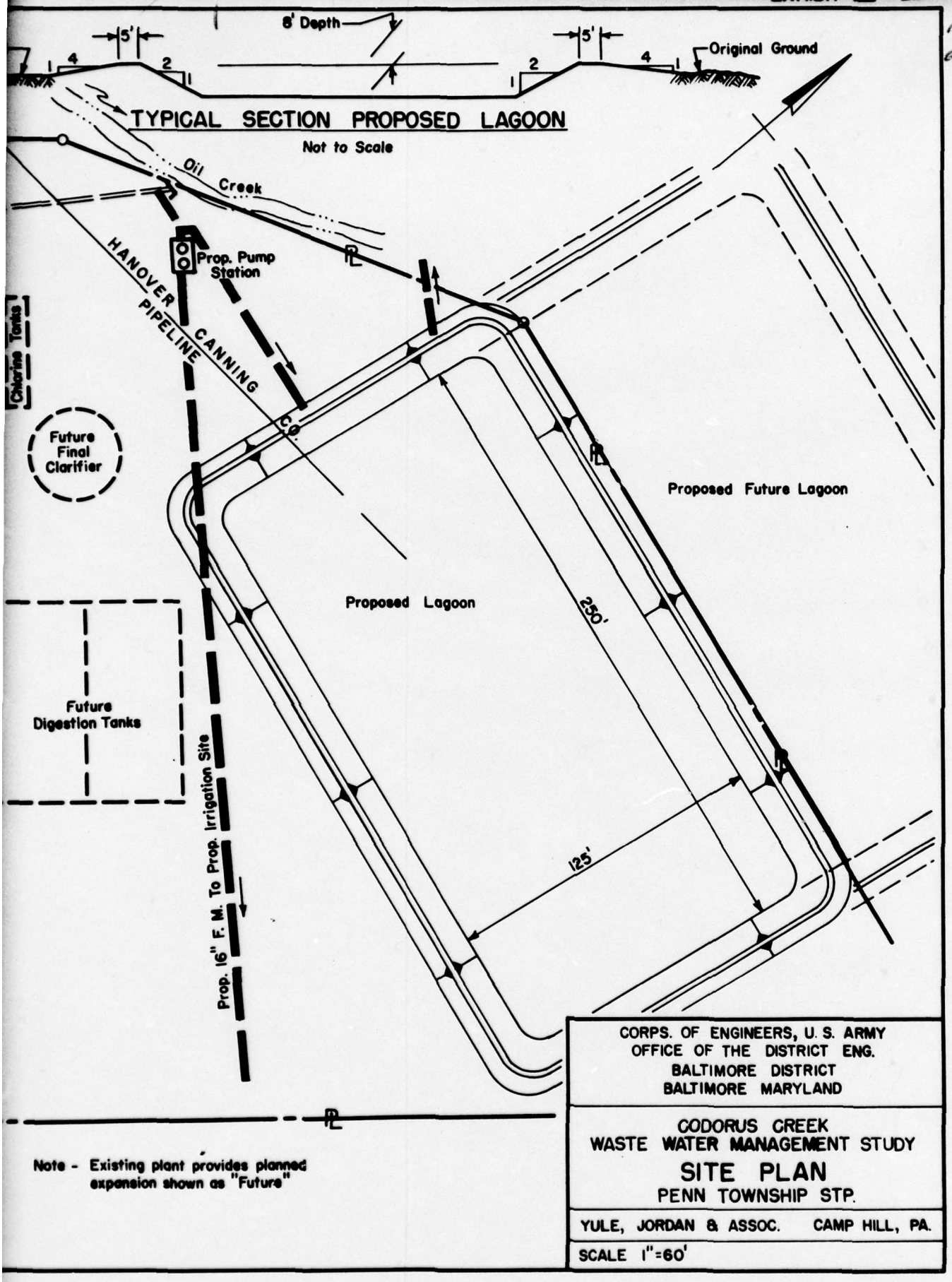
SITE PLAN

HANOVER BORO. STP.

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE 1"=80'


Original Ground
5'
TYP
18" Outfall
HANOVER
PIPEL
Chlorine Contact Tanks
Final Clarifier
Final Clarifier
Future Chlorine Tanks
Chlorine Shelter
24"
Macadam
Scum Sump
Future Final Clarifier
Future Final Clarifier
Water Well
Wet Well
Comminutor
M.H.
24"
10"
M.H.
Degritter
Control Building
Future Aqua Ammonia Tanks
Digestion Tanks
Aeration Tanks
Stabilization Tanks
Future Aeration Tanks
Future Digestion Tanks
Future Stabilization Tanks
Sludge Thickener
Garage & Sludge Pumps
Macadam
24"
Access Road
Ridge Ave.
Mac.
Note - Existing pl
expansion



CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND

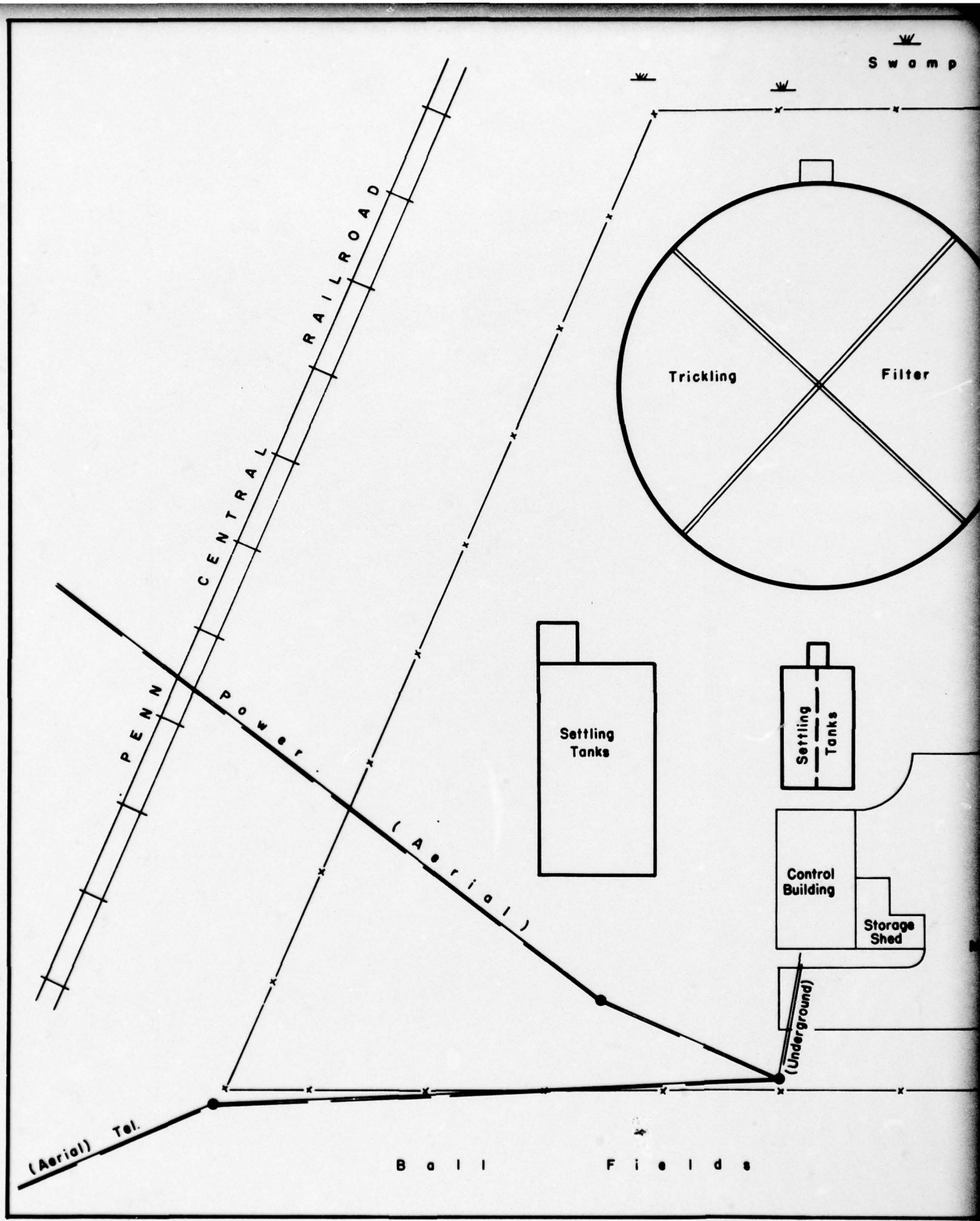
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

SITE PLAN

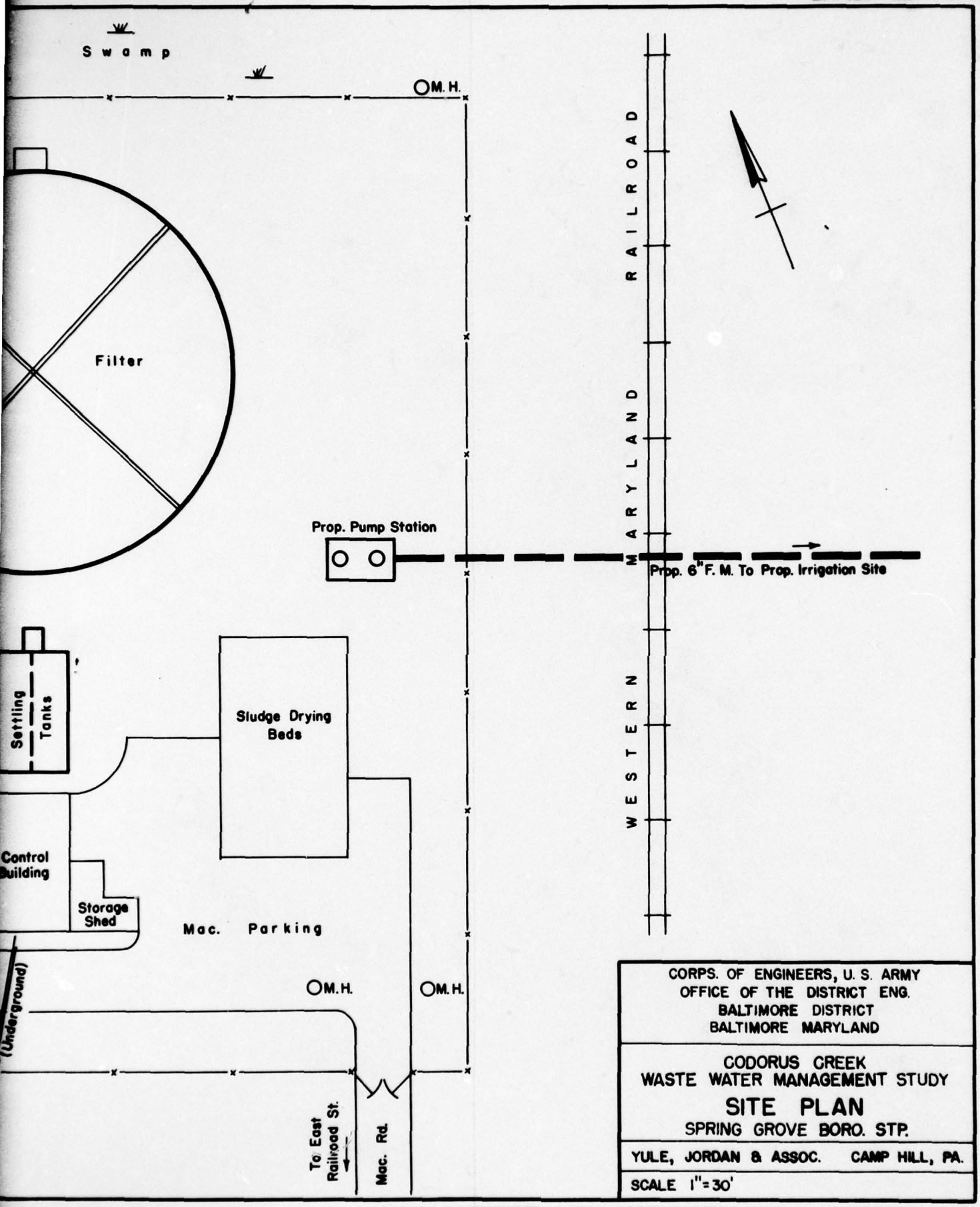
PENN TOWNSHIP STP.

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE 1"=60'


Swamp
PENN CENTRAL RAILROAD
Trickling
Filter
Settling Tanks
Settling Tanks
Control Building
Storage Shed
Power (Aerial)
(Underground)
(Aerial) Tel.
Ball Fields

2



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BALTIMORE DISTRICT
BALTIMORE MARYLAND

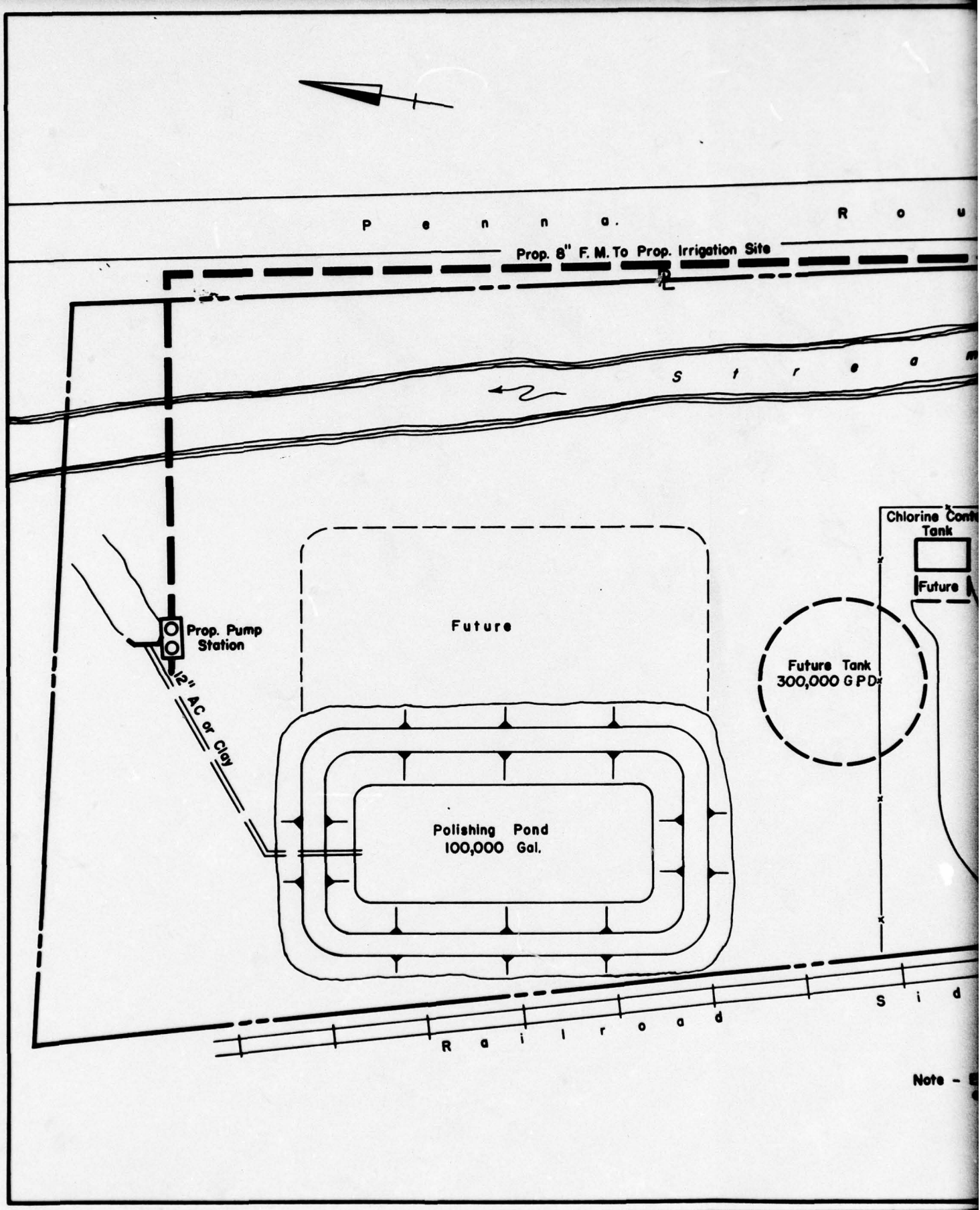
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

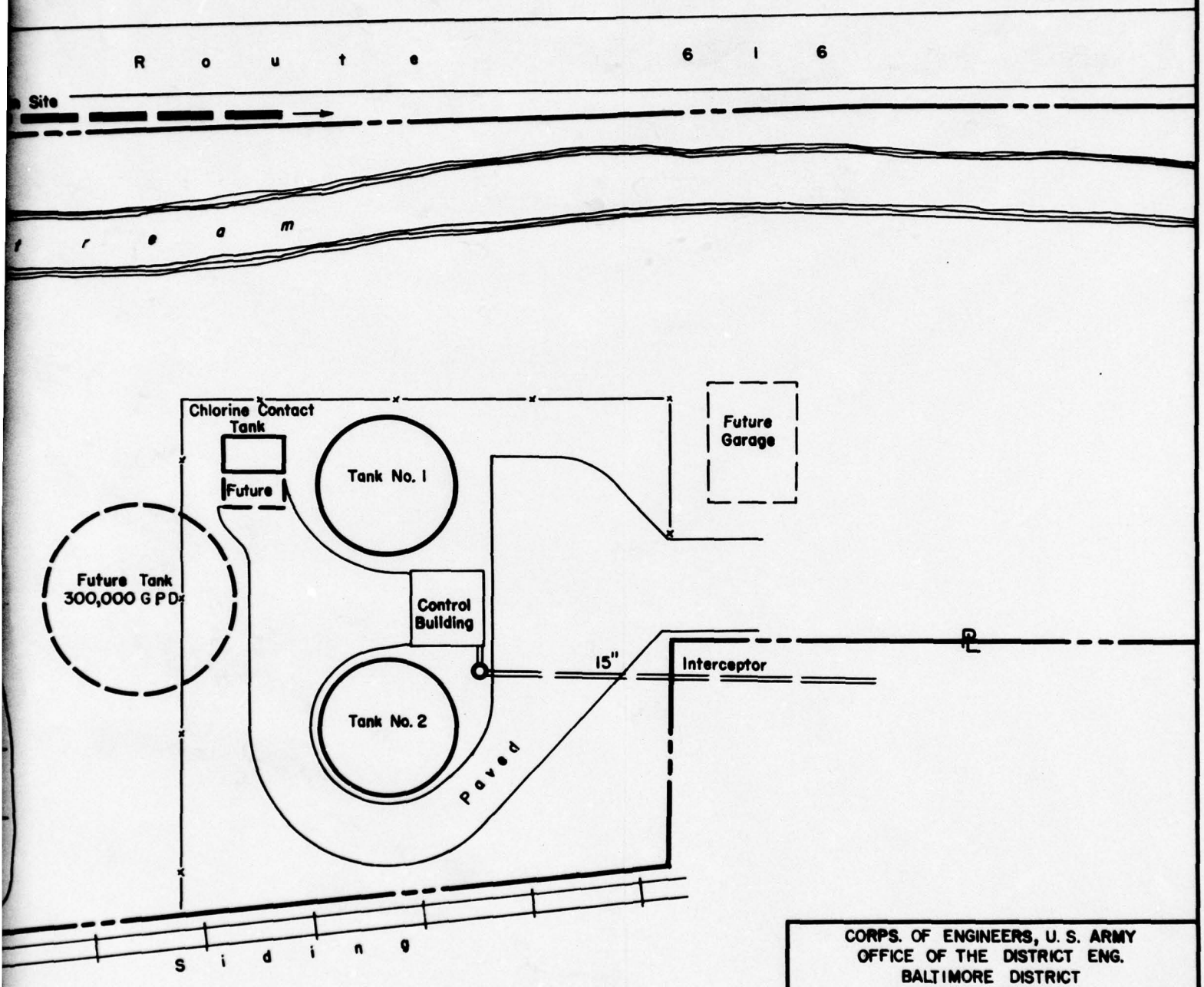
SITE PLAN

SPRING GROVE BORO. STP.

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE 1"=30'


Penna. R o u
Prop. 8" F. M. To Prop. Irrigation Site
S t r e a m
Chlorine Cont
Tank
Future
Future
Prop. Pump
Station
12" AC or Clay
Future Tank
300,000 G P D
Polishing Pond
100,000 Gal.
R a i l r o a d
S i d
Note -



Note - Existing plant provides planned expansion shown as "Future"

CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND

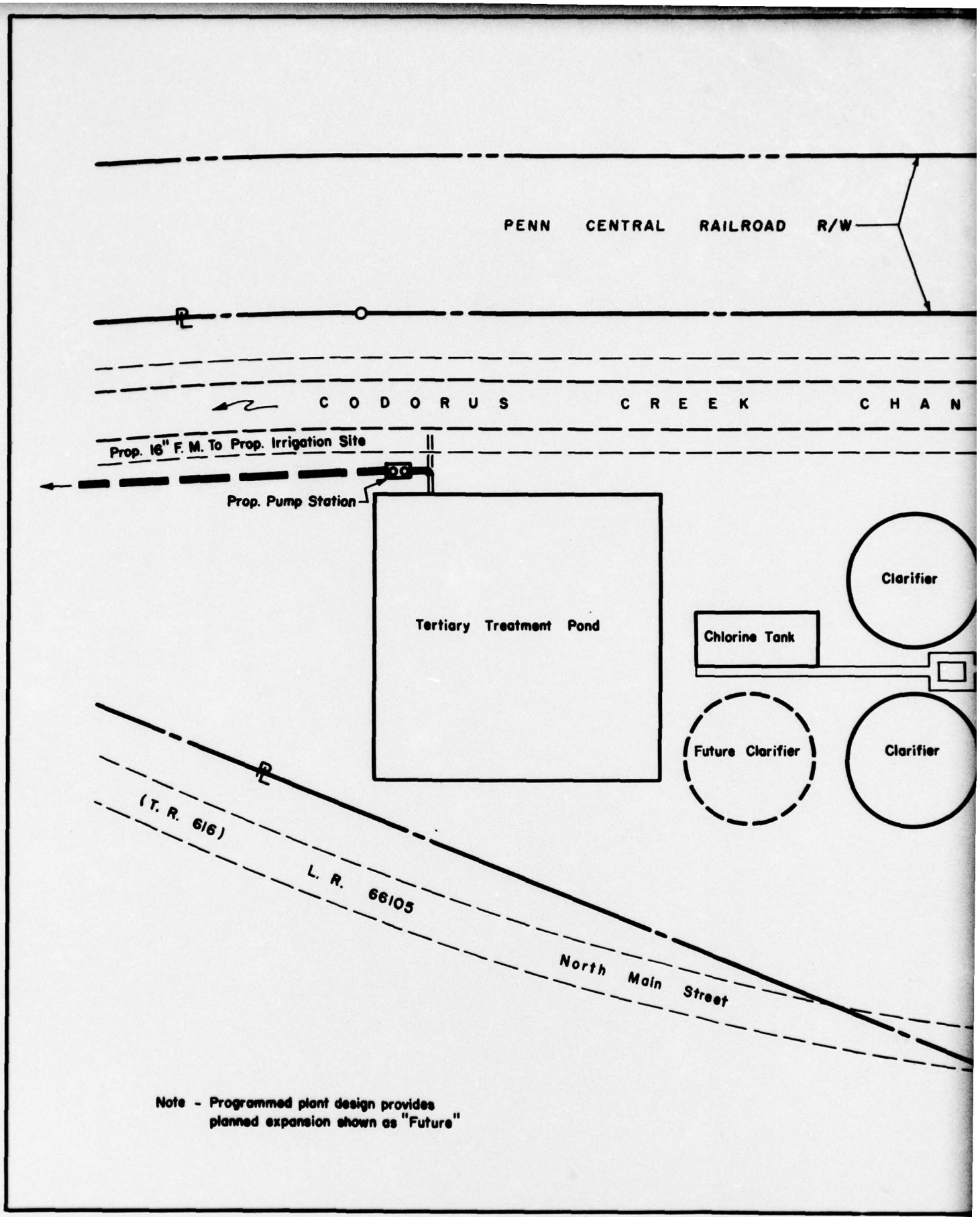
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

SITE PLAN

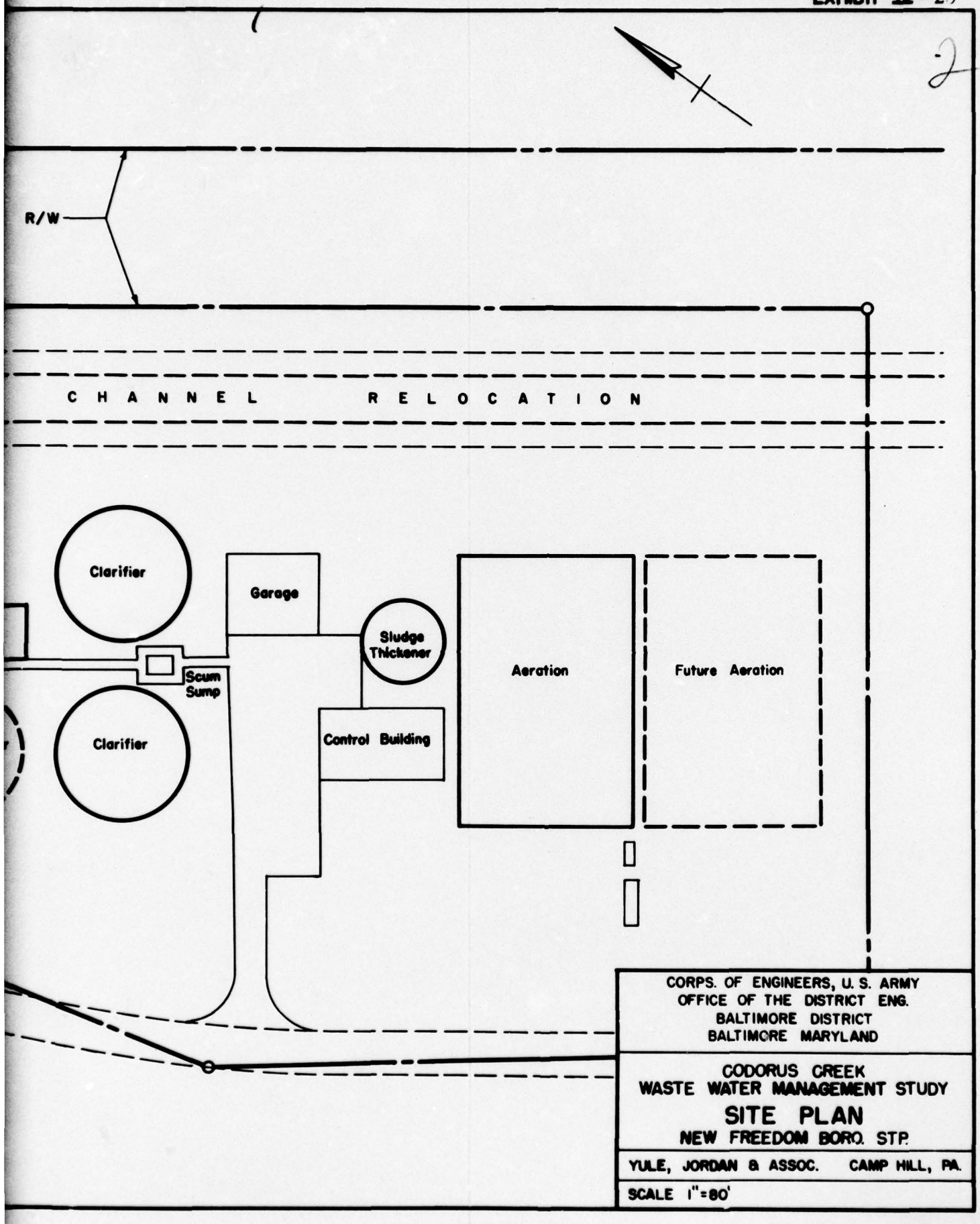
GLEN ROCK BORO. STP.

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE 1"=40'



Note - Programmed plant design provides planned expansion shown as "Future"



CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND

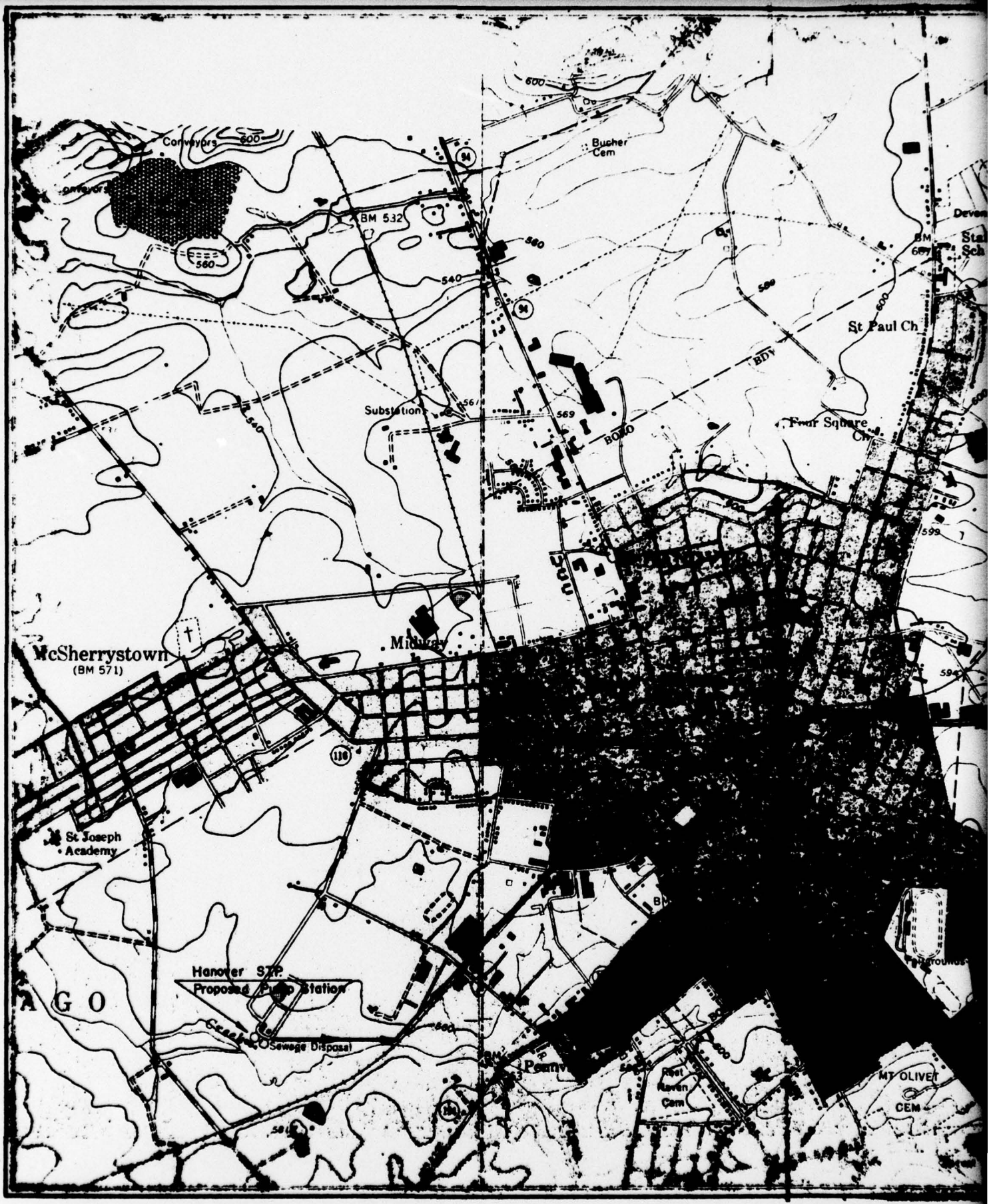
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY

SITE PLAN

NEW FREEDOM BORO. STP.

YULE, JORDAN & ASSOC. CAMP HILL, PA.

SCALE 1"=80'


Conveyors
Bucher Cem
BM 532
St Paul Ch
Substation
Four Square
McSherrystown
(BM 571)
Midway
St Joseph Academy
Hanover STP
Proposed Pump Station
Sewage Disposal
Reel Raven Cem
MT OLIVET CEM


Jacobs Mills
Heidelberg Sch
Devener Airport
Stallers Sch
St Paul Ch
Gitts Run
Storage Pond
PENN CENTRAL
Bears Sch
York Road Cem
Penn Twp. S.T.P.
Proposed Pump Station
Smiths Station
York Road
MARYLAND
8000 L.F. 16" F.M.
30,500 L.F. 20" F.M.
WESTERN
Storage Pond
Bethel Ch
Fellowship Camp Grove
Bloomingrove
MT OLIVET CEM

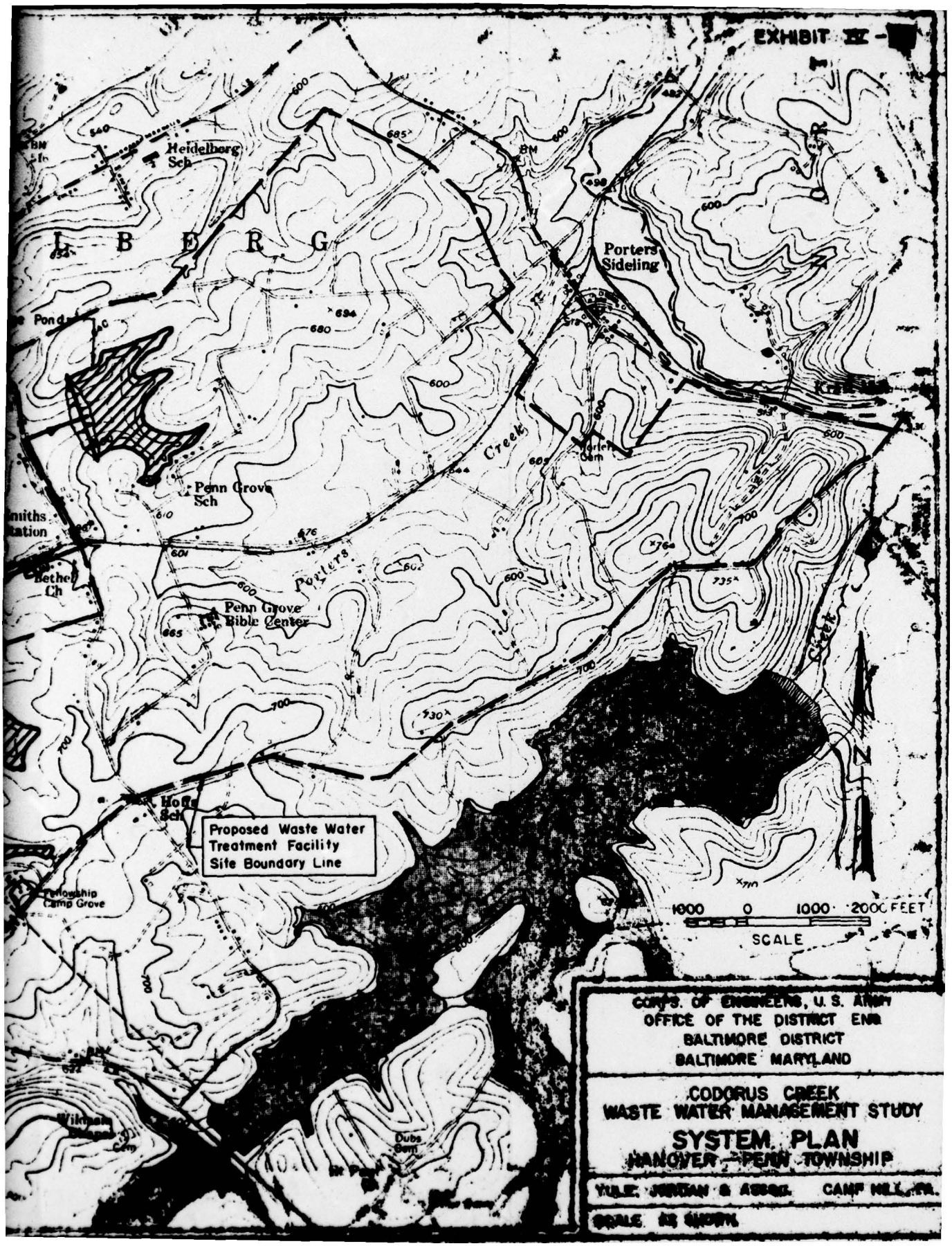


EXHIBIT
Heidelberg Sch
Porters Sideling
Penn Grove Sch
Penn Grove Bible Center
Porters Creek
Proposed Waste Water Treatment Facility Site Boundary Line
1000 0 1000 2000 FEET
SCALE
CORPS. OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENG
BALTIMORE DISTRICT
BALTIMORE MARYLAND
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
SYSTEM PLAN
HANOVER - PENN TOWNSHIP
YALE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE AS SHOWN

EXHIBIT IV-2

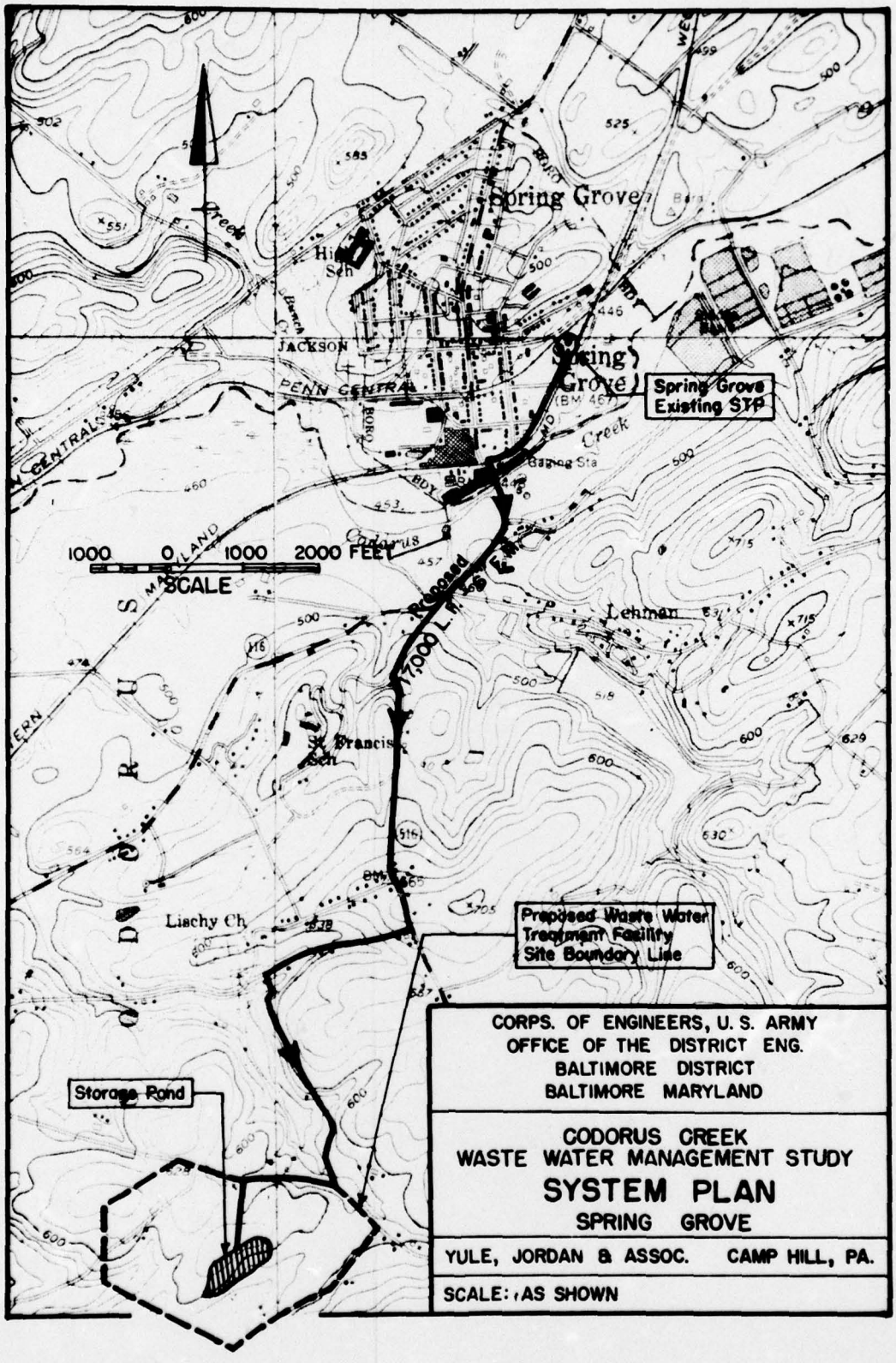

Spring Grove
Spring Grove Existing STP
Proposed Waste Water Treatment Facility Site Boundary Line
Storage Pond
17,000 L.F. 15" Force Main
1000 0 1000 2000 FEET
SCALE
Codorus Creek
Lischy Ch
St Francis Sch
Lehman
PENN CENTRAL
JACKSON
CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
SYSTEM PLAN
SPRING GROVE
YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE: AS SHOWN

EXHIBIT IV-2

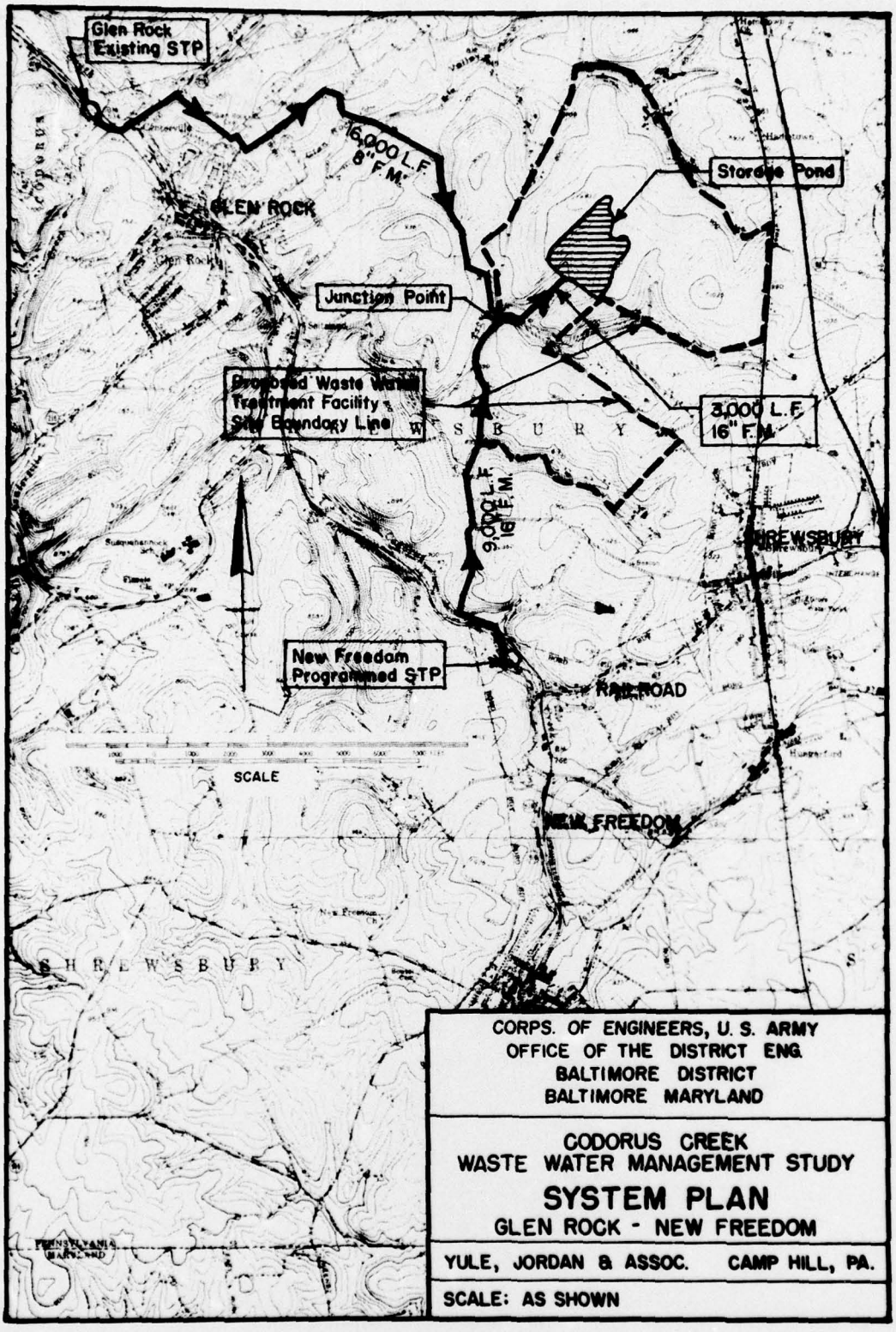

Glen Rock Existing STP
16,000 L.F. 8" F.M.
GLEN ROCK
Junction Point
Storage Pond
Proposed Waste Water Treatment Facility & Site Boundary Line
3,000 L.F. 16" F.M.
9,000 L.F. 16" F.M.
SHREWSBURY
New Freedom Programmed STP
RAILROAD
SCALE
NEW FREEDOM
SHREWSBURY
PENNSYLVANIA
MARYLAND
CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
SYSTEM PLAN
GLEN ROCK - NEW FREEDOM
YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE: AS SHOWN

EXHIBIT IV-2

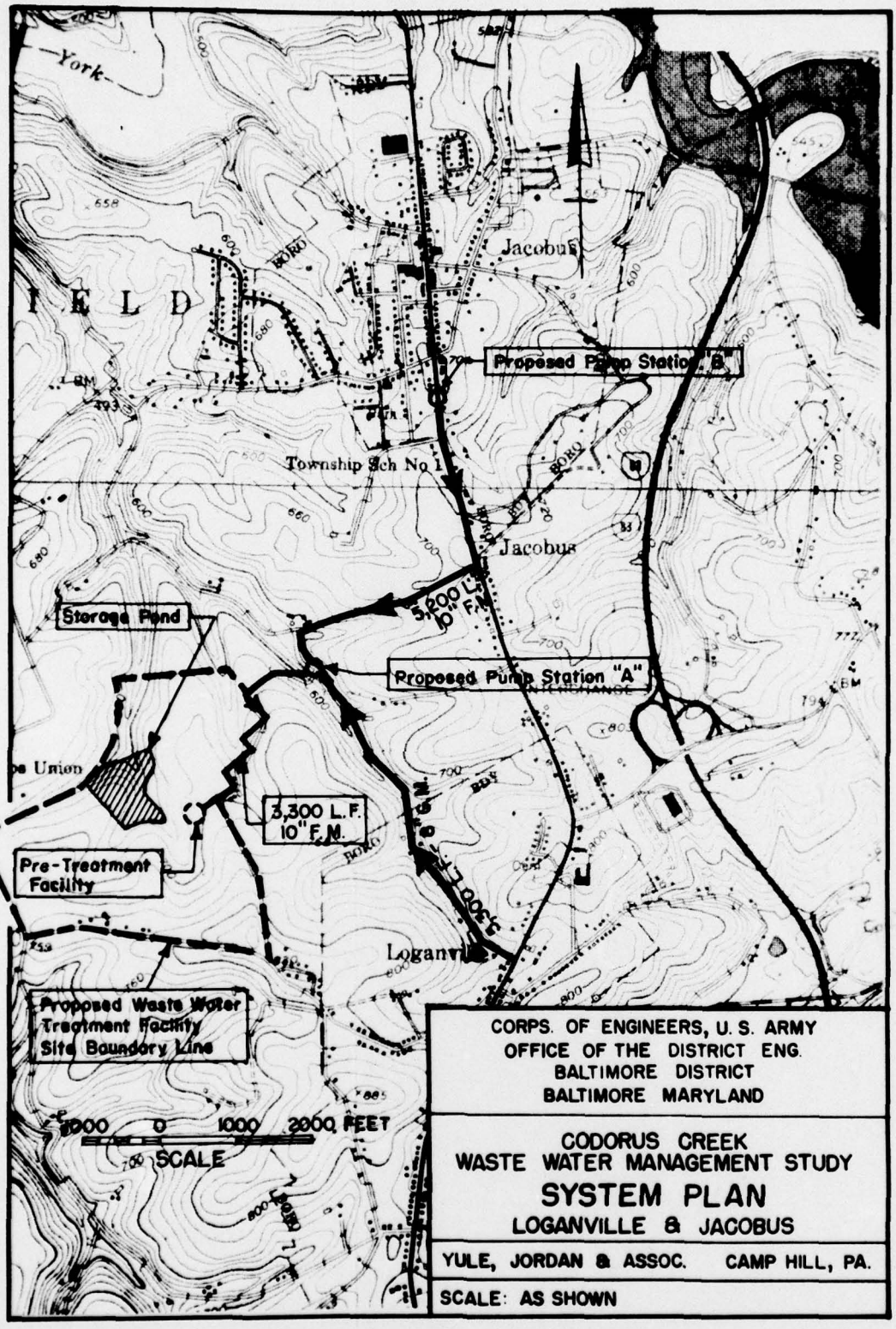

York
Jacobus
Township Sch No 1
Jacobus
Proposed Pump Station "B"
Storage Pond
5,200 L.F. 10" F.M.
Proposed Pump Station "A"
3,300 L.F. 10" F.M.
Pre-Treatment Facility
Proposed Waste Water Treatment Facility Site Boundary Line
3000 0 1000 2000 FEET
SCALE
CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
SYSTEM PLAN
LOGANVILLE & JACOBUS
YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE: AS SHOWN

EXHIBIT IV

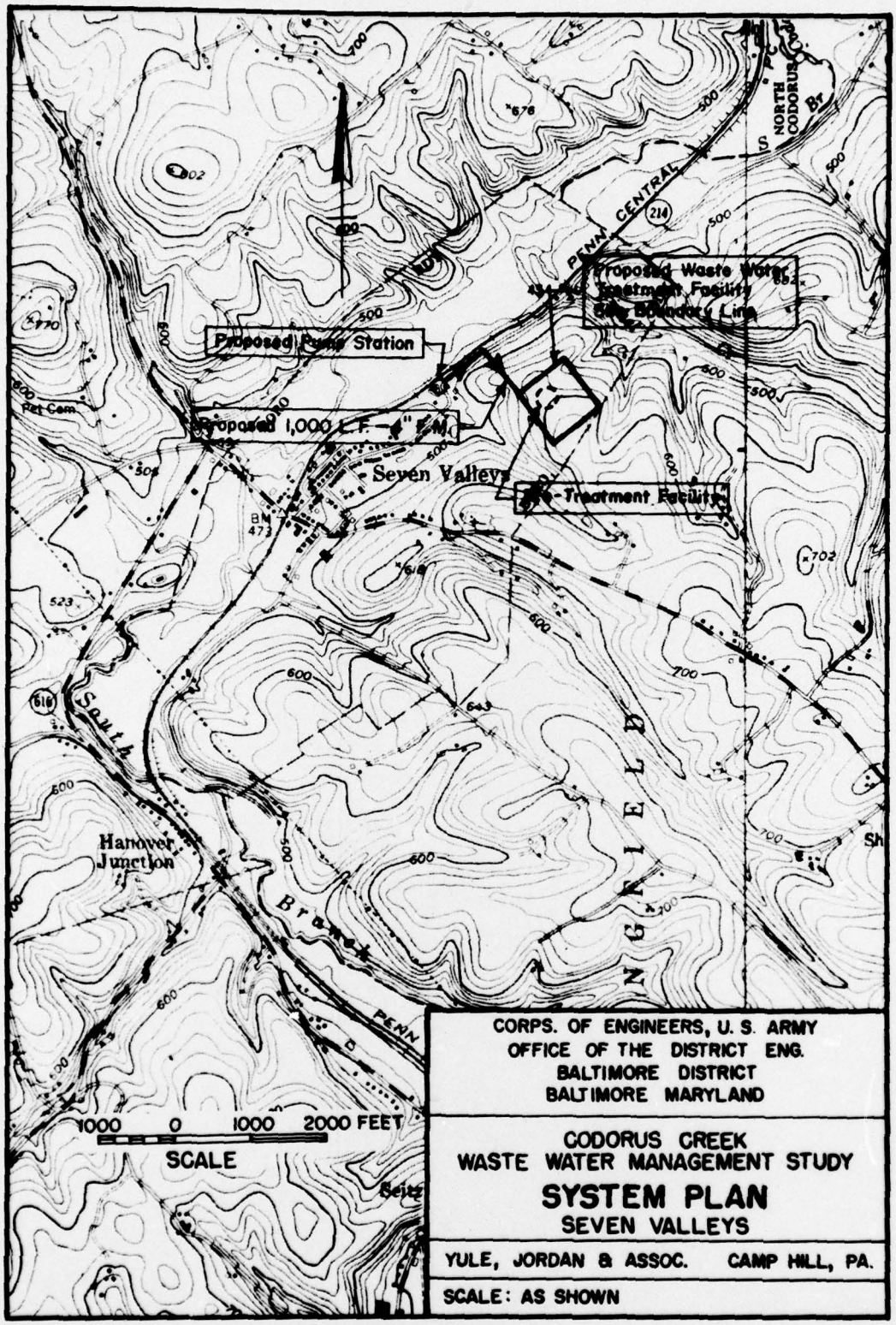

Proposed Pump Station
Proposed 1,000 L.F. - 4" F.M.
Seven Valleys
Proposed Waste Water Treatment Facility
Site Boundary Line
Treatment Facility
PENN CENTRAL
NORTH CODORUS CR.
South
Hanover Junction
Branch
PENN
ENGLEBERT
1000 0 1000 2000 FEET
SCALE
CORPS. OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENG.
BALTIMORE DISTRICT
BALTIMORE MARYLAND
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
SYSTEM PLAN
SEVEN VALLEYS
YULE, JORDAN & ASSOC. CAMP HILL, PA.
SCALE: AS SHOWN

EXHIBIT IV-[redacted]

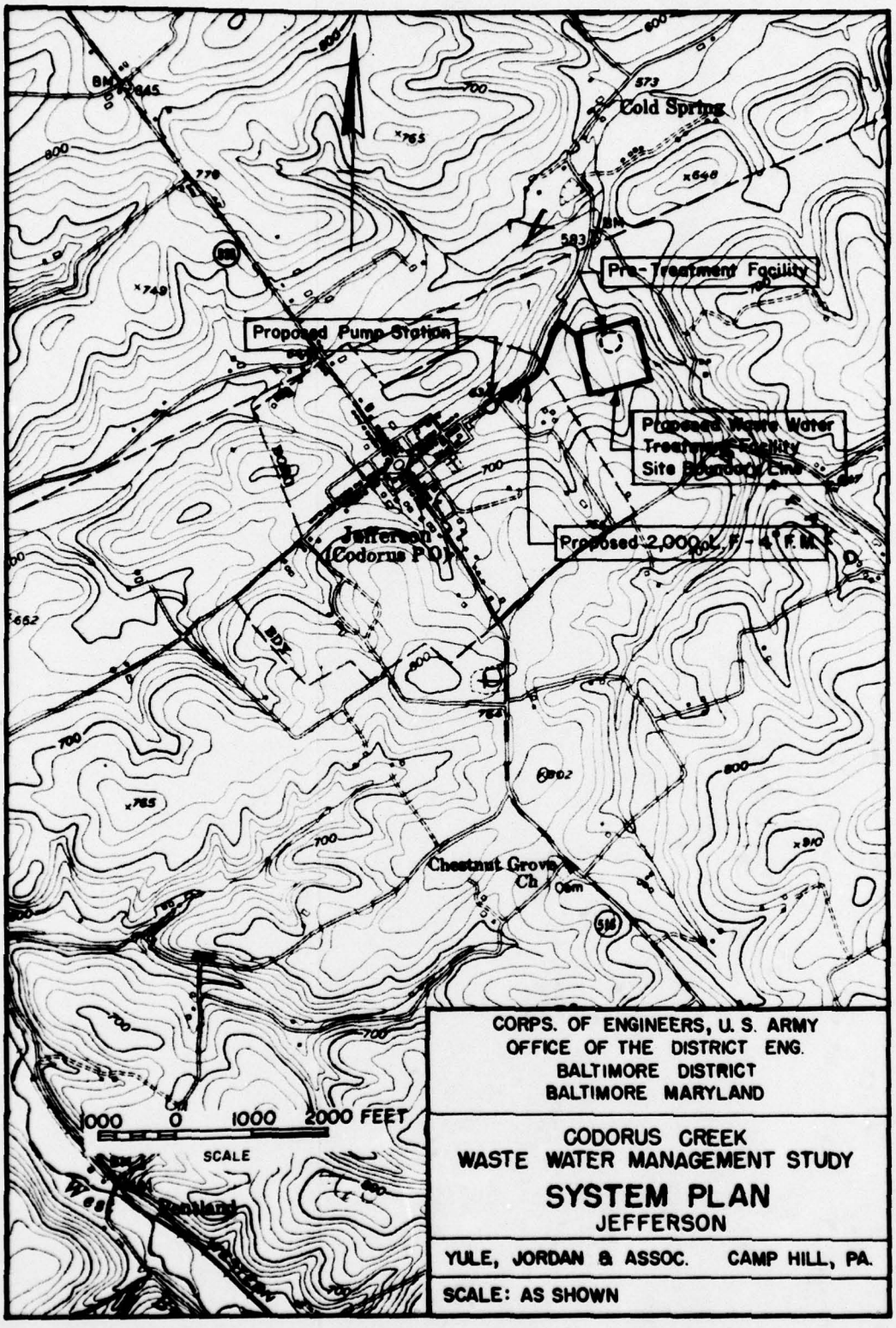
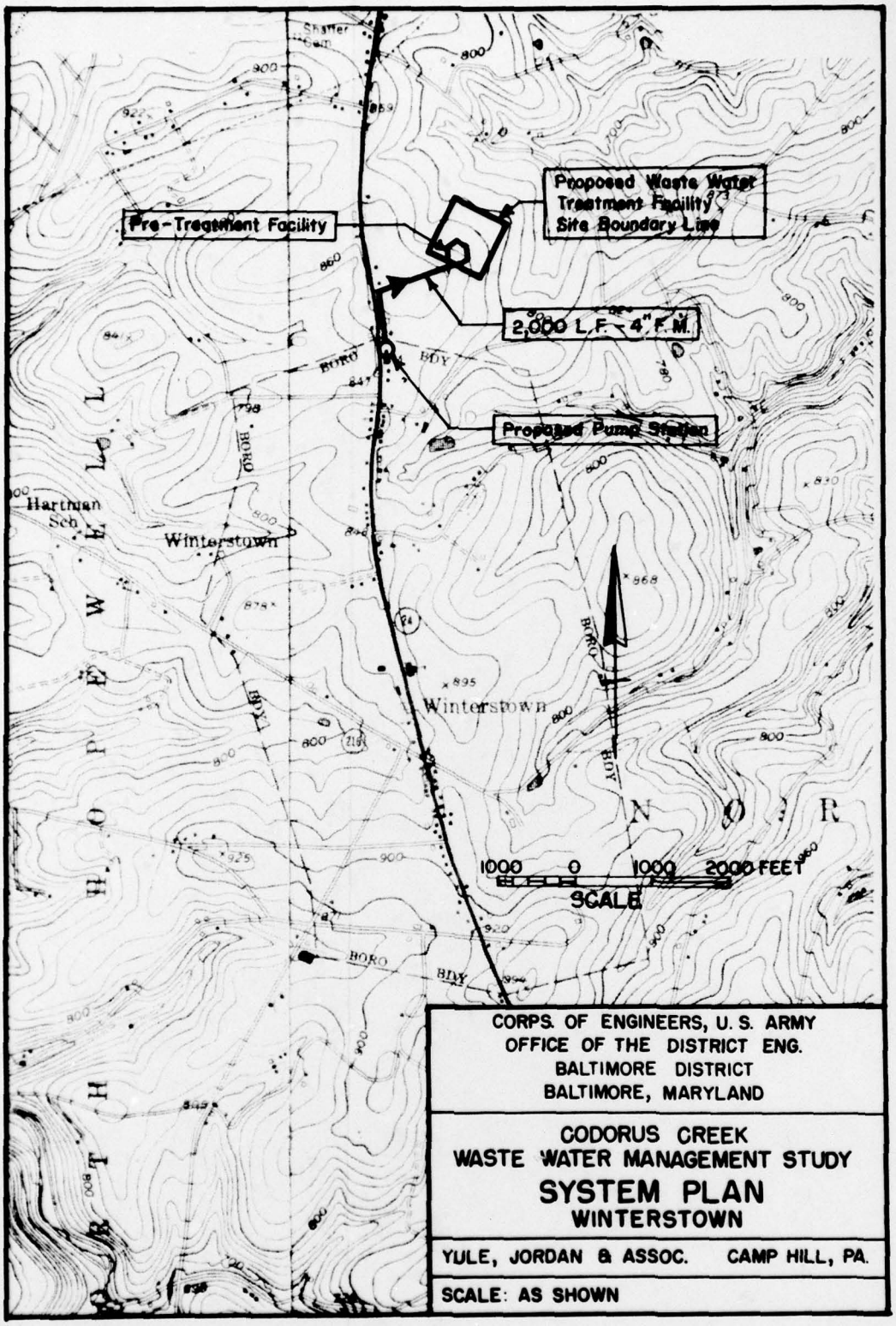


EXHIBIT IV-[redacted]



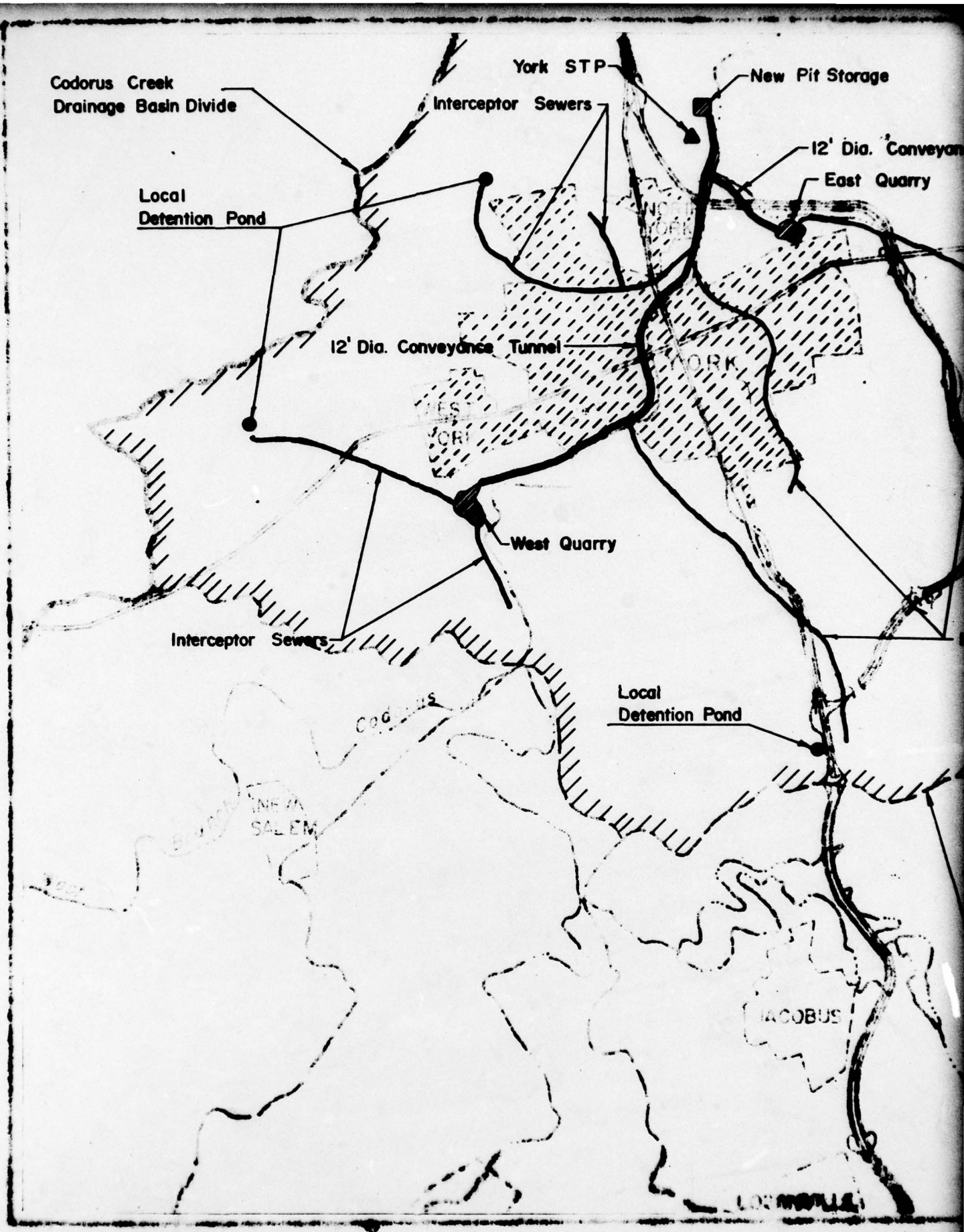
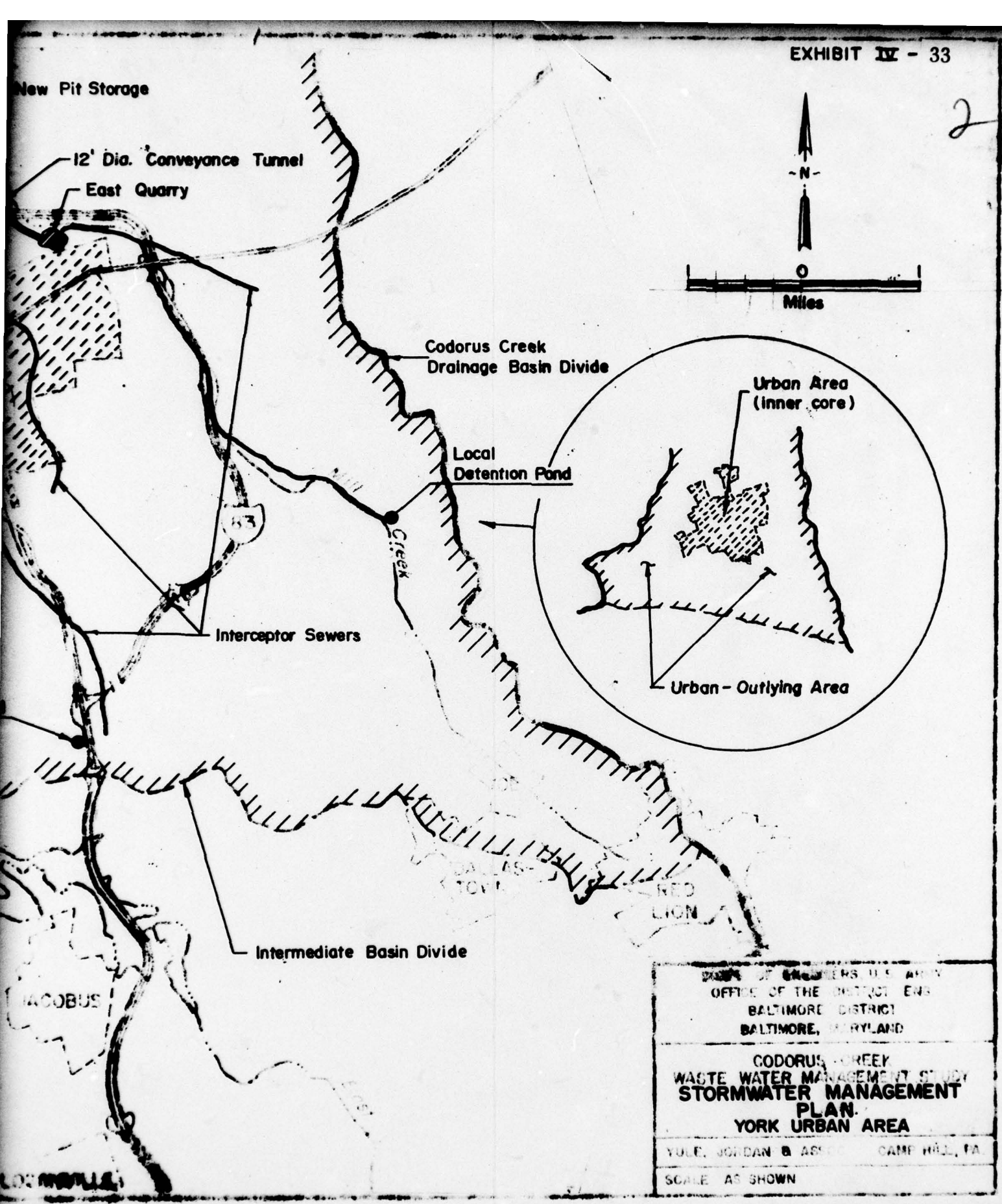

Codorus Creek
Drainage Basin Divide
York STP
Interceptor Sewers
New Pit Storage
12' Dia. Conveyan
East Quarry
Local
Detention Pond
12' Dia. Conveyance Tunnel
West Quarry
Interceptor Sewers
Local
Detention Pond
NEW
SALEM
JACOBUS

EXHIBIT IV - 33



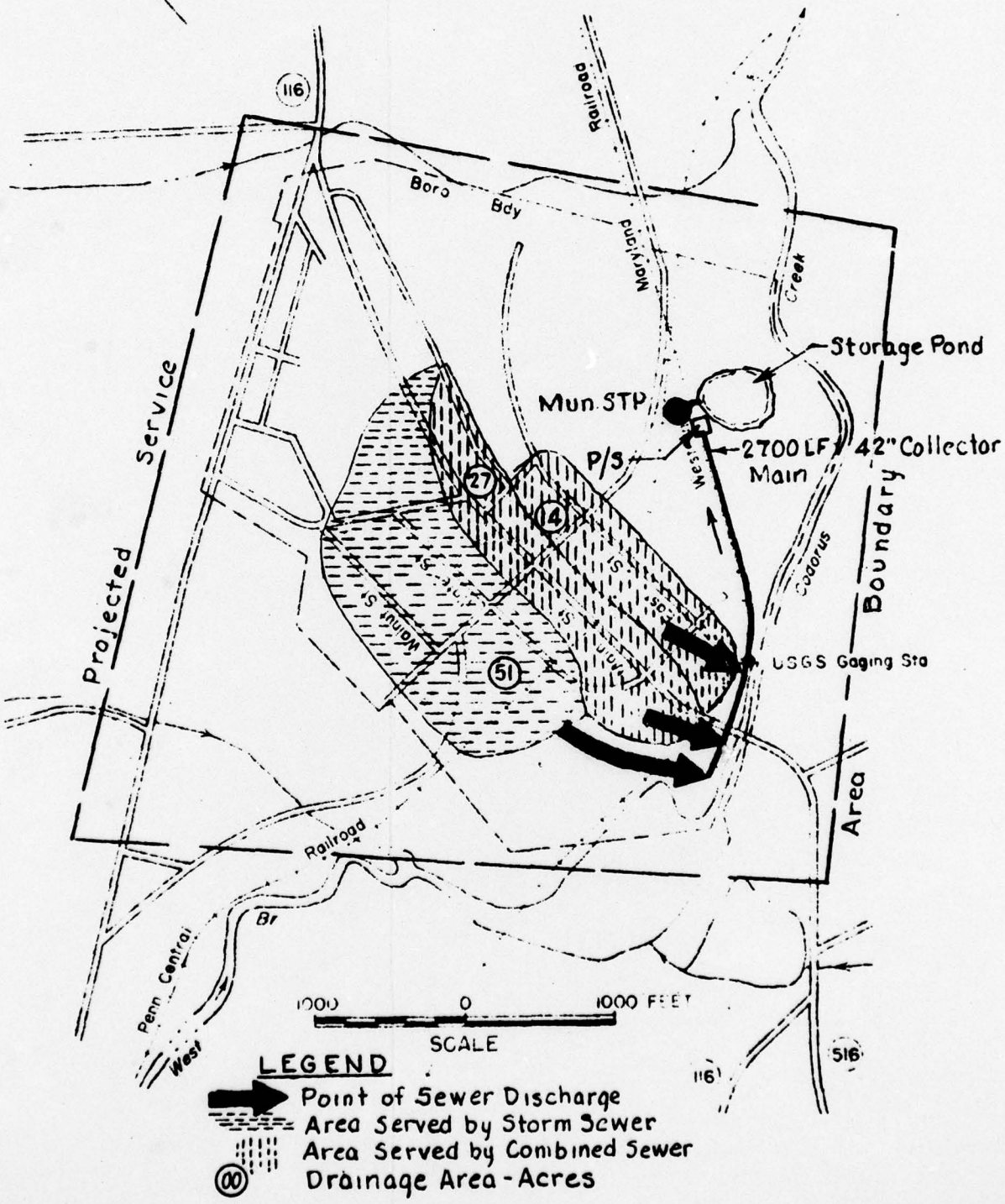
OFFICE OF THE DISTRICT ENGINEERS U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

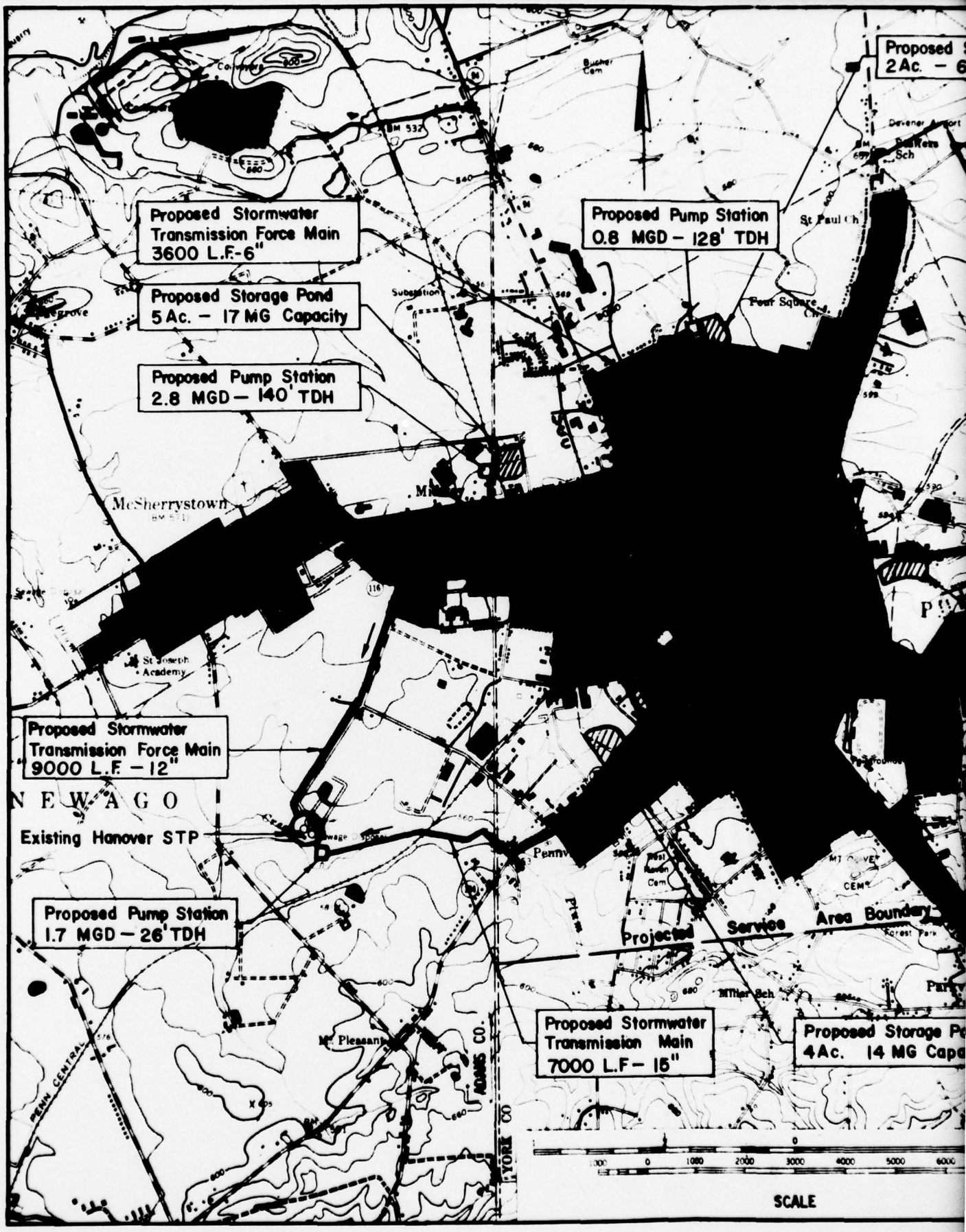
CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
STORMWATER MANAGEMENT PLAN
YORK URBAN AREA

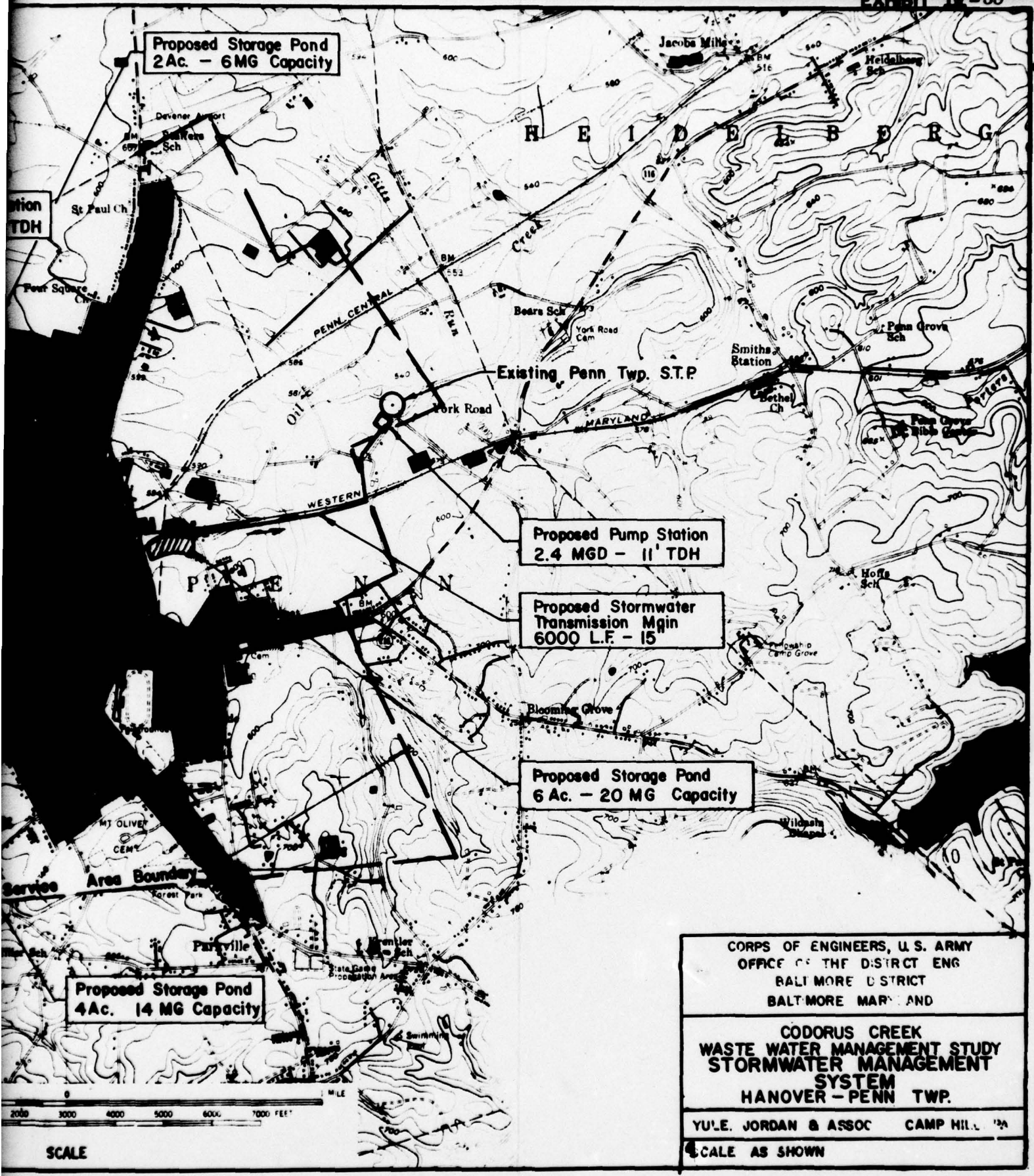
YOUNG, JORDAN & ASSOCIATES CAMP HILL, PA.

SCALE AS SHOWN

SPRING GROVE BORO
STORMWATER MANAGEMENT SYSTEM




Proposed Stormwater Transmission Force Main 3600 L.F.-6"
Proposed Storage Pond 5 Ac. – 17 MG Capacity
Proposed Pump Station 2.8 MGD – 140' TDH
Proposed Pump Station 0.8 MGD – 128' TDH
Proposed Stormwater Transmission Force Main 9000 L.F. – 12"
NEWAGO
Existing Hanover STP
Proposed Pump Station 1.7 MGD – 26' TDH
Proposed Stormwater Transmission Main 7000 L.F – 15"
Projected Service Area Boundary
McSherrystown
St Joseph Academy
Mt Pleasant
PENN CENTRAL
ADAMS CO.
YORK CO
SCALE



CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENG
BALTIMORE DISTRICT
BALTIMORE MARYLAND

CODORUS CREEK
WASTE WATER MANAGEMENT STUDY
STORMWATER MANAGEMENT SYSTEM
HANOVER – PENN TWP.

YULE. JORDAN & ASSOC CAMP HILL PA

SCALE AS SHOWN