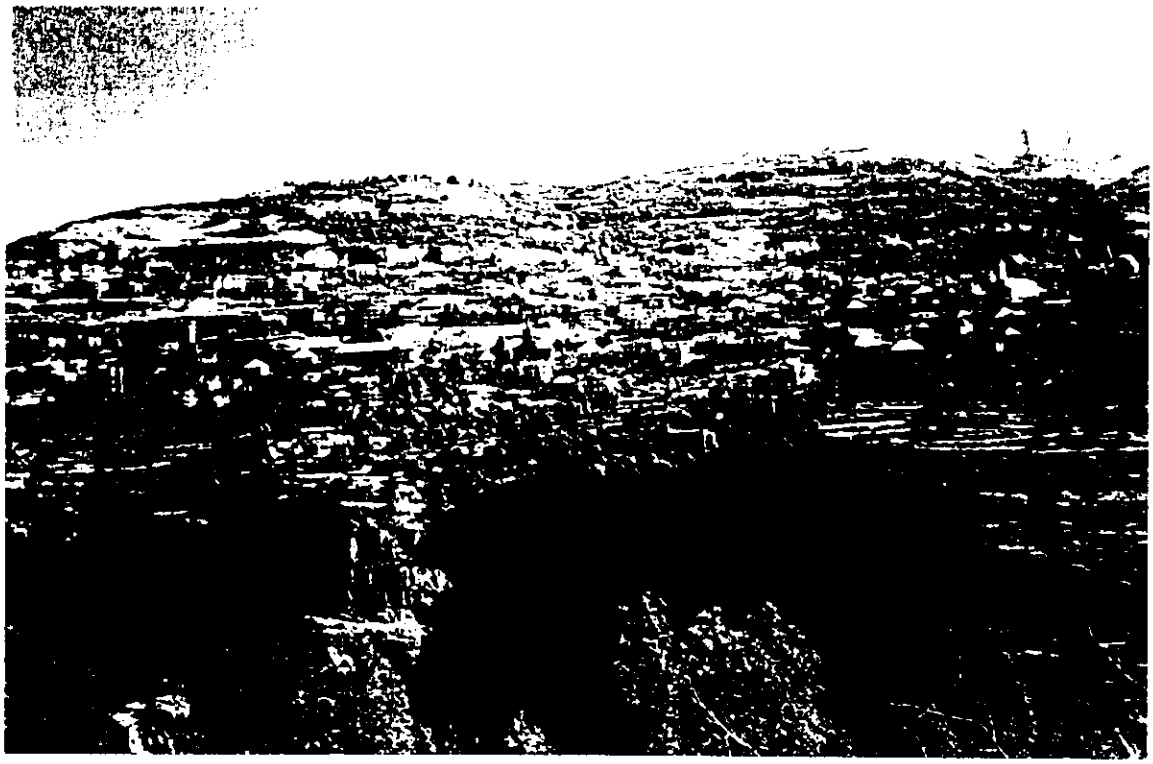
REPUBLIC OF LEBANON

Council For Development & Reconstruction

TOKTEN Assignment
For

Council For Environmental Protection, Becharrey



Feasibility Study to Install a Secondary Package Wastewater Treatment Plant

Prepared by:
Imad Abou-Dargham, P.E.
Global Engineering, Inc.
4895 Wood Pointe Way
Sarasota, Florida 34233
USA

United Nations Development Program
UNDP
1997

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

TABLE OF CONTENTS

SECTION 1.0

INTRODUCTION

1.1 Purpose

The United Nations Development Programme (UNDP) has commissioned a study to develop and evaluate secondary wastewater treatment alternatives for the Kannoubin Valley, Bechare, Lebanon. The UNDP-TOKTEN program commissioned Global Engineering, Inc. to prepare a report that summarizes the evaluations and to develop the capital cost needed to implement the recommended secondary treatment alternative.

1.2 Background

The UNDP, as mentioned commissioned a study to implement secondary wastewater treatment for the Kannoubin Valley. Secondary treatment consists of raw sewage pumping, screening, grit removal, package activated sludge treatment system, effluent filtration and disinfection. Solids (sludge) removed from the system will also have to undergo treatment prior to disposal. Treatment options include aerobic digestion and lime stabilization. It is assumed that sludge disposal will be to a landfill or land application. Currently no wastewater treatment currently exists in the Bechare area. The evaluations shall be for a community with approximately 2,000 households. It is assumed that four people live in each household and that each person will generate approximately 125 gallons per day of wastewater, which includes infiltration and inflow. Thus, the evaluations will be performed for a system with an average daily flow of one million gallons per day.

1.3 Objectives

The main objective of this study was to determine the most cost effective means to provide the Kannoubin Valley with a secondary treatment facility and to develop capital costs for each alternative and to recommend the most cost effective alternative.

SECTION 2.0

EVALUATIONS

2.1 General

The evaluation performed earlier assumed that primary treatment of domestic wastewater was the preferred treatment alternative for the region. However, the preferred treatment alternative has been revised to include secondary treatment. The following sections present the evaluation concerning the secondary treatment alternative for the Kannoubin Valley.

2.2 Basis of Design

The following presents the basis of design for the processes needed to provide secondary wastewater treatment for the Kannoubin Valley. The following processes were evaluated .

- Raw Sewage Pumping
- Screening
- Grit Removal
- Aeration
- Chlorination

The following processes are optional.

There are two options for sludge treatment, Lime Stabilization and Aerobic Digestion. Either of these options will provide a sludge suitable for landfill disposal. The following lists the processes required for Lime Stabilization.

- Sludge Thickening

2.3 Description of Alternative

The previous report presented a primary treatment alternative. However, since the initial report was submitted it has been decided to utilize secondary treatment to treat domestic wastewater from the Kannoubin Valley. The following presents the alternative to provide secondary wastewater treatment.

The secondary treatment alternative includes the following treatment units.

- Raw Wastewater Pumping
- Screening and Grit Removal
- Package Wastewater Treatment Plant (Aeration/Final Clarification)
- Effluent Filtration
- Disinfection

There are two options for sludge treatment and they are aerobic digestion and lime stabilization. Lime stabilization was the recommended alternative in the previous report and remains so in this report. The following treatment units are required for a lime stabilization system.

- Sludge Storage
- Sludge Thickening
- Lime Feed and Storage
- Lime Stabilization Tank
- Sludge Pumping
- Sludge Dewatering

2.4 Sizing of Units

The sizing of the treatment units is based on industry standard criteria and medium to strong wastewater concentrations. The influent wastewater strength is assumed to have the following concentrations.

- BOD 350 mg/L
- TSS 350 mg/L
- Ammonia-Nitrogen 25 mg/L

A peak hour factor for raw sewage pumping is assumed to be 2.5 and the average daily influent flow is assumed to be 1 MGD (based on 4 people per dwelling at 125 gpdpc). Using these assumptions including the data found in the mass balance table and the design criteria presented earlier the following tables summarizes the size of the Secondary wastewater treatment units.

Process Unit	Design Criteria
Raw Sewage Pumping	
Number	2
Type	Submersible
Flow, GPM	870 (each)
TDH, Ft. (Assumed)	50
Screening	
Number	2
Type	1, Mechanical; 1, Manual (bypass)
Channel Width, Ft.	2
Channel Depth, Ft.	5
Grit Removal	
Number	1, With Bypass
Type	Aerated
Volume, Gallons	2,250
Air Requirement, CFM	15
Secondary Treatment	
0.5 MGD Extended Aeration Package Plant	
Volume, Gallons	500,000
Clarifier Overflow Rate, GPD/Ft.^{2}	400
Filter Loading Rate, GPM/Ft.^{2}	3
Flow Equalization	
Number	1
Volume, Gallons	125,000
Compartments	3
Air Requirement, CFM	670

The following table presents the sizing of the sludge treatment processes.

Processes	Design Criteria
Sludge Pumping	
Number	2
Type	Diaphragm
Flow, GPD	6,000
Sludge Thickening	
Mechanical	
Number	1
Type	Gravity Belt
Flow, GPD	6,000
Storage Tank Volume, Gallons	12,000
Gravity	
Number	1
Volume, Gallons	12,000
Overflow Rate, GPD/SF	100
Lime Stabilization	
Number	
Volume, Gallons	12,000 (mixing), 6,000 (Storage)
Lime Feed System	3,000 Gallon Lime Storage & Feed
Dewatering	
Number	1
Type	Belt Filter Press
Flow, GPM	15

2.5 Recommended Alternative

The initial primary alternative assumed a single facility sized to treat one million gallons of domestic wastewater per day. However, the 2,000 dwelling units can be better served by installing two 0.5 MGD package plants. The proposed secondary treatment facilities will serve the valley better than a single secondary treatment facility. The main treatment unit should be an extended aeration activated sludge package plant complete with an integral secondary clarifier and sand filters. This will remove over 95 percent of the organics, suspended solids and ammonia normally found in domestic wastewater. The package plant is extremely easy to operate and is

able to handle shock loadings that may occur from time to time. This treatment system will also produce a minimum of sludge.

2.6 Opinion of Construction Cost

The following presents the opinion of construction cost to construct two 0.5 MGD packaged secondary treatment facilities. Our cost is based on our experience with facilities of this type and information we have collected from manufacturer's and their representatives.

Summary of Opinion of Construction Cost	
Treatment Units	Capital Cost, $
Influent Pumping Station	$100,000
Grit Removal and Screening	$75,000
Package Treatment Plant Including Clarifier and Filters	$700,000
Chlorination/Dechlorination	$50,000
Chemical Feed Chlorine Lime Soda Ashe	 $25,000 $50,000 $40,000
Thickening & Storage	$50,000
Lime Stabilization	$75,000
Sludge Pumping	$40,000
Building and Miscellaneous	$100,000
Base Cost	$1,305,000
Contingency (10 %)	$130,500
Construction Cost	$1,435,500
Land Cost	$75,000

SECTION 3.0

RECOMMENDATIONS

3.1 General

The previous sections presented the background and the results of the evaluations perform during the course of this investigation. The following presents the recommendations to implement secondary wastewater treatment to treat domestic wastewater from the Kannoubin Valley.

3.2 Recommendations

Implementing secondary wastewater treatment will remove over 95 percent of the organics and suspended solids found in the domestic wastewater from the Kannoubin Valley. Disinfection of the effluent from the secondary facilities will also remove bacterial and viral organisms that could be potentially harmful to downstream users of the streams and waterways where untreated wastewater is currently discharged. Thus, a key benefit of implementing secondary treatment is the improvement of water quality of streams and waterways found in the Kannoubin Valley. Treated residuals from the secondary facilities can be recycled fertilize and improve farm land. The practice of land applying wastewater residuals is widely used in the United States and Europe. The high pH treatment used to treat the sludge if land applied can condition the soil and reduce the impact of metals uptake by crops. The following presents the detailed description of the recommended alternative.

A. Preliminary Treatment

1. Raw Sewage Pumping

Construct a submersible pump station to receive raw sewage from the system users. The pump station should consist of a wet well (large enough for 3 pumps), valve vault and control panel.

The pumps should be sized for 1.25 MGD or each pump should have a capacity of 0.6125 MGD. The pump station should also be equipped with a DC magnetic flow meter to record influent flow.

2. Screening and Grit Removal

A headworks and grit removal system should be constructed to remove large objects and trash from the wastewater prior to secondary treatment. The screening area should consist of a mechanical and bypass bar screens. The screening area should consist of a aerated grit removal system with a manual bypass and overflow. The grit area should be equipped with a grit washer and dumpster to receive the grit removed from the wastewater. The dried grit should be disposed of in a landfill.

B. Secondary Treatment

The secondary treatment system should consist of a 0.5 MGD extended aeration package treatment plant with integral clarifier and effluent filters. This system is easy to operate and is cost effective for the flows expected from the Kannoubin Valley. This system can handle both peak flows and shock organic and solids loadings. This system will also remove over 95 percent of the organics and solids found in the wastewater from the Kannoubin Valley.

C. Disinfection/Dechlorination

The effluent from the filters should be disinfection with chlorine. A chlorine contact chamber should be used to provide the means to mix the chlorine with the effluent from the filters. The chlorine contact chamber should have a detention time of 30 minutes at average daily flow. A wall mounted chlorinator should be used to provide the chlorine needed to disinfect the effluent from the facility. 150 pound gas chlorine cylinders should be used for the chlorine supply. If dechlorination is required then a gas sulfur dioxide feed and storage system should be used to

dechlorinate the effluent following disinfection. The sulfur dioxide system will be similar to the gas chlorine system.

D. Sludge Treatment

Sludge treatment should consist of a lime stabilization system. Waste activated sludge wasted from the clarifier should be stored in a tank with a volume equal to three days flow and thickened prior to stabilization. The thickening tank can be used for sludge storage. Gravity thickening is recommended for thickening of the waste activated sludge. A lime stabilization tank with a volume of 12,000 gallons is recommended. The tank should be equipped with a mechanical mixer capable of mixing the entire tank contents. A liquid lime feed and storage system is recommended to provide the lime needed to elevate the sludge pH to 12.5 for at least 2 hours. This will stabilize the sludge and it can then be dewatered and land applied or disposed of in a landfill.

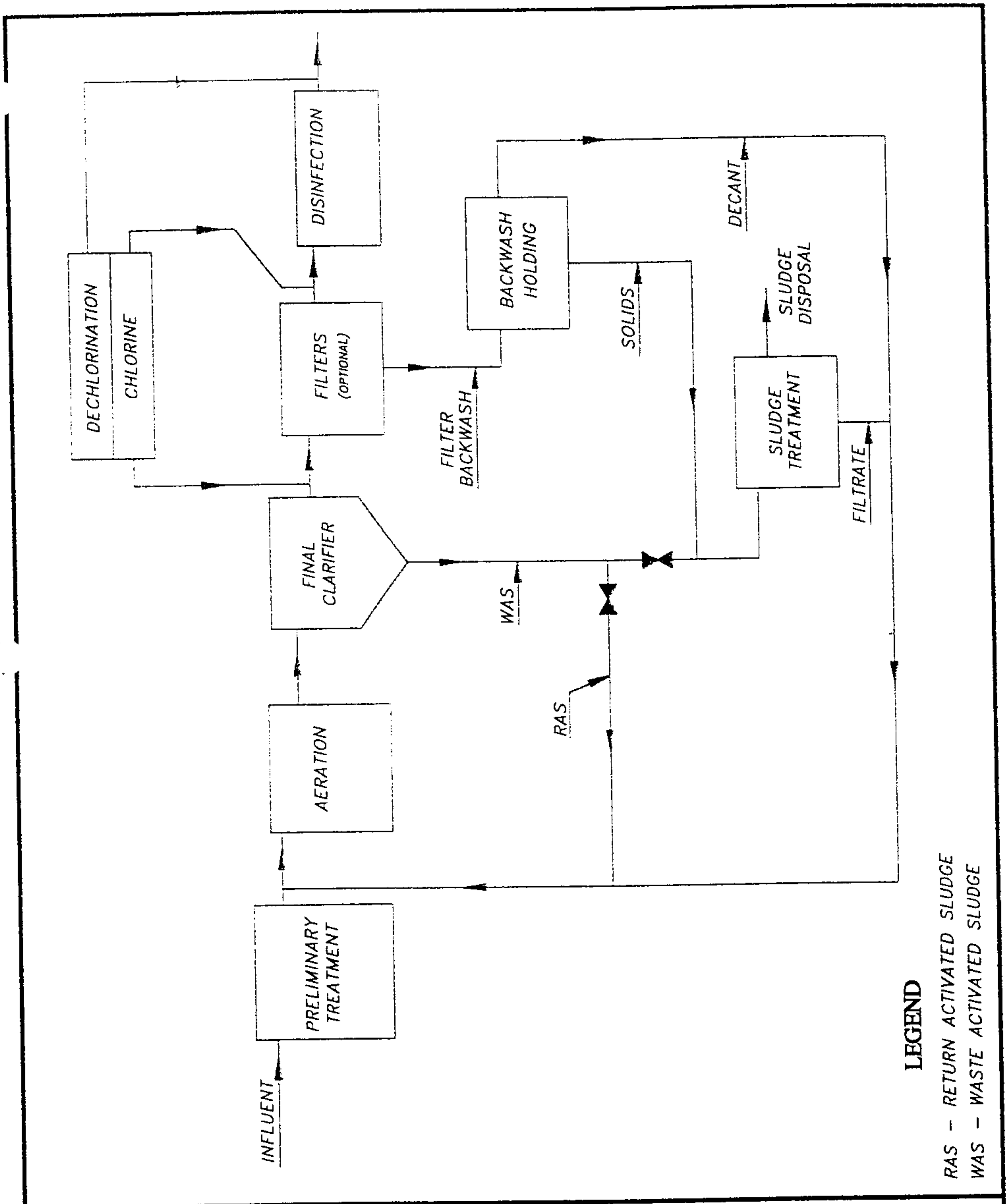
E. Ancillary Facilities

Ancillary facilities should include the following.

- Laboratory/Maintenance/Operations Building
- Effluent Flow Meter/Recorder
- Fenced Plant Site
- Maintenance Vehicles

F. Summary

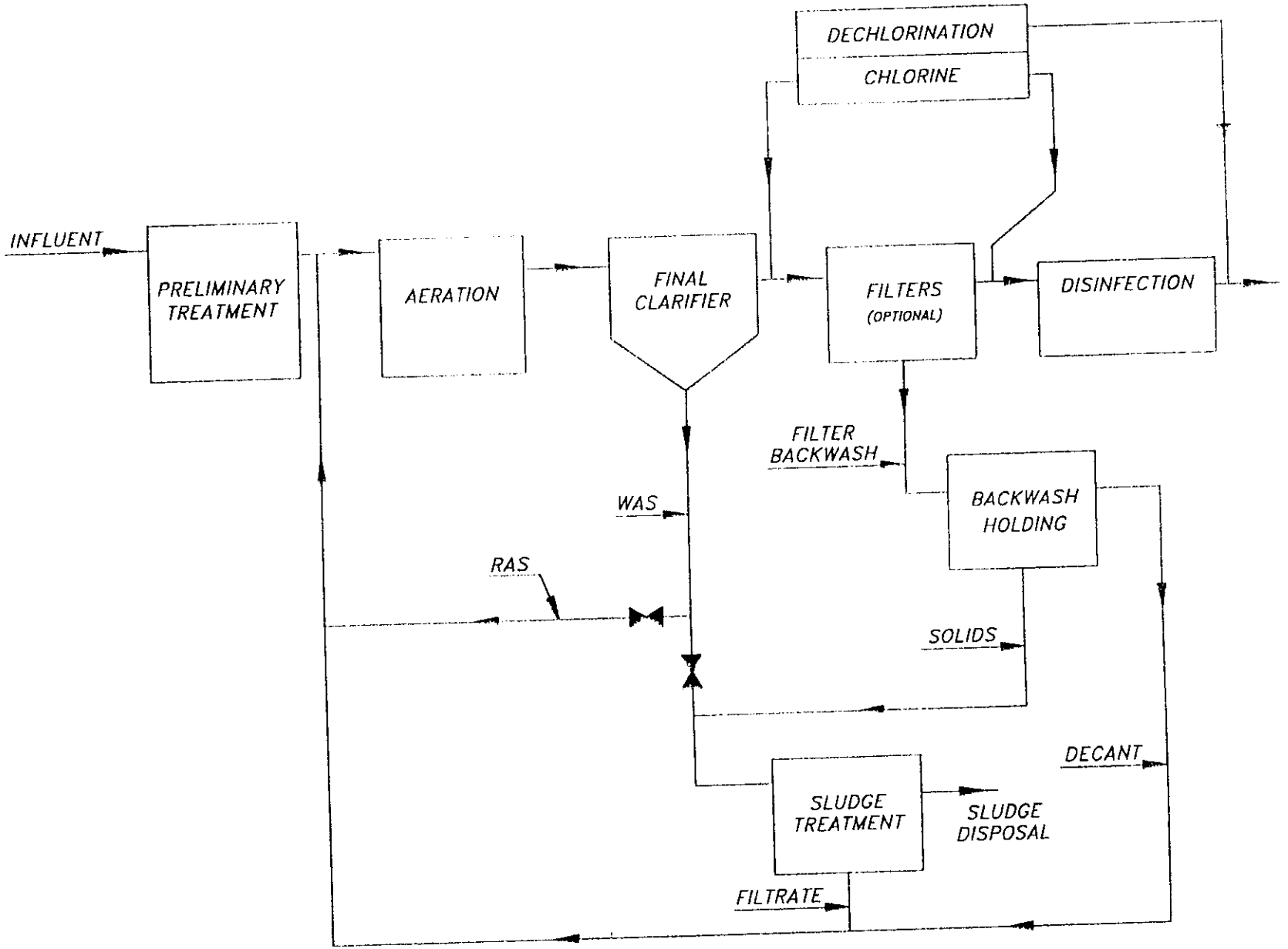
We recommend that the system presented in this report be implemented. At least two of these facilities should be constructed in the Kannoubin Valley to treat wastewater and improve the water quality of the streams and waterways found in the Kannoubin Valley. Figure 3-1 presents the process flow schematic of the recommended alternative. The construction cost is presented in Chapter 2.



GLOBAL ENGINEERING INCORPORATED

FIGURE 3-1
RECOMMENDED PROCESS FLOW DIAGRAM

GLOBAL ENGINEERING INCORPORATED



LEGEND

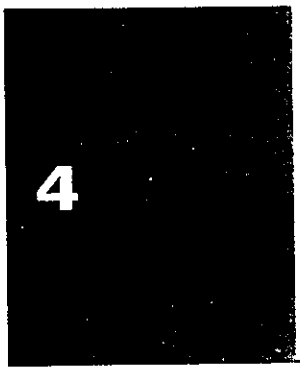
RAS – RETURN ACTIVATED SLUDGE
WAS – WASTE ACTIVATED SLUDGE

FIGURE 3-1
RECOMMENDED PROCESS
FLOW DIAGRAM

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

Table of Contents

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)



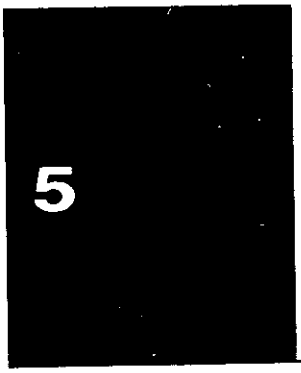


TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Executive Summary
Primary Wastewater Treatment Evaluation
Kannoubin Valley, Lebanon

The United Nations Development Program/TOKTEN is currently evaluating the need to provide primary wastewater treatment to the Konnubin Valley, Lebanon. TOKTEN began to solicit qualified firms and engineers with ties to Lebanon to perform a preliminary engineering study to determine the feasibility of constructing a primary wastewater treatment facility. The selected firm would have to determine the needed processes, the capital and operation cost of the proposed facility and to determine the impact of funding the primary wastewater facility. Global Engineering, Inc. (Mr. Imad Dargham, P. E., President) was selected to perform the evaluation. The evaluation was performed during the spring of 1997 and the results of the evaluation were summarized in a report. The following summarizes the results of the evaluation.

Treatment System

The recommended primary treatment system consisted of the following treatment processes.

- Influent Pump Station
- Headworks (Structure, Manual By-pass Bar Screen, Mechanical Bar Screen)
- Flow Equalization
- Aerated Grit Removal
- Primary Clarifiers
- Disinfection
- Dechlorination
- Sludge Storage
- Lime Stabilization
- Sludge Pumping

Global Engineering, Inc.
July 16, 1997

- Lime Feed
- Control/Laboratory/Maintenance Building

The project cost for the recommended system was also estimated. The following table presents the estimated opinion of project cost and operation and maintenance cost.

Summary of Project Capital and Operating and Maintenance Cost for Primary Treatment		
Treatment Unit	Capital Cost, $	O&M Cost $/1,000 Gals.
Influent Pump Station	$250,000	$0.09 --
Flow Equalization	$900,000	$0.28
Headworks Manual Bar Screen Mechanical Bar Screen Structure	 $5,000 $90,000 $125,000	 $0.01 $0.03 $0.01
Grit Removal	$100,000	$0.05
Primary Clarifiers	$175,000	$0.06
Chlorine Contact	$75,000	$0.05
Site Piping	$150,000	$0.04
Site Work	$150,000	$0.06
Chemical Feed Chlorine Dechlorination Lime	 $75,000 $50,000 $150,000	 $0.08 $0.05 $0.08
Sludge Storage	$110,000	$0.07
Lime Stabilization	$250,000	$0.12
Sludge Pumping	$125,000	$0.08
Building & Miscellaneous	$350,000	$0.08
Base Cost	$3,130,000	
Contingency (15 %)	$470,000	
Construction Cost	$3,600,000	
Engineering & Construction Management	$900,000	
Land	$1,200,000	
Project Capital Cost	$5,700,000	

The impact of funding the proposes system was also determined. The following tables present the

results of the evaluations concerning the impact of funding the proposed system using user charges to fund the project and annual operating cost for the facility.

Impact of Grants on the Assessment for Individual Residents			
Project Cost	Grant Amount	Balance	Assessment Amount
$5,700,000	$570,000	$5,130,000	$2,565
$5,700,000	$855,000	$4,845,000	$2,423
$5,700,000	$1,140,000	$4,560,000	$2,280
$5,700,000	$1,425,000	$4,275,000	$2,138
$5,700,000	$2,850,000	$2,850,000	$1,425

The following table presents the estimated annual operating cost for the primary treatment facility.

Annual Operating Costs for the Primary Treatment Facility	
Item	Cost
Salaries	$90,000
Benefits	$75,000
Office Supplies	$100,000
Capital Replacement Fund	$200,000
Operating Costs (Fuel, Chemicals, Power, etc.)	$450,000
Total	$915,000

The impact of the operating cost on the individual users of the system is estimated to be $38.50 per month. The following table presents the impact of funding the project cost with a loan to be paid back with monthly user fees to the users of the system.

Impact of a Loan to Fund the Remaining Balance of the Project Cost			
Project Cost	Grant Amount	Loan Amount	Monthly Payment[1]
$5,700,000	No Grant	$5,700,000	$11.87
$5,700,000	$570,000	$5,130,000	$10.69
$5,700,000	$855,000	$4,845,000	$10.09
$5,700,000	$1,140,000	$4,560,000	$9.50
$5,700,000	$1,425,000	$4,275,000	$8.90
$5,700,000	$2,850,000	$2,850,000	$5.94

(1): Based on 20 years at 8 percent.

The information presented in the Tables along with the assessment cost can be used to determine the impact of implementing the primary wastewater treatment facility. The following table presents the impact of implementing the facility on the individual users of the system.

Estimated Monthly User Fees for the Primary Wastewater Treatment Facility			
Loan Amount	Monthly Payment	Monthly Operating Cost	Total Monthly Payment
$5,700,000	$11.87	$38.50	$50.37
$5,130,000	$10.69	$38.50	$49.19
$4,845,000	$10.09	$38.50	$48.59
$4,560,000	$9.50	$38.50	$48.00
$4,275,000	$8.90	$38.50	$47.40
$2,850,000	$5.94	$38.50	$44.44

A review of the implementation costs shows that the cost to the individual users is somewhat high however, the monthly service fees and the one time assessment are not out of line with other user

fees that exist in the United States. Therefore, the project should be pursued by TOKTEN. Should secondary treatment be pursued at a later date then an additional $2,000,000 should be added to the project cost.

Global Engineering, Inc. would like to thank the TOKTEN staff for their assistance in performing this project. Global Engineering, Inc. is located in Sarasota Florida and has a web page that can be found at the following URL-HTTP//www.members.aol.com/global2id/ or we can be contacted at the following email address, global2id@aol.com. We encourage the TOKTEN staff to visit our web site to learn more about us or if the TOKTEN staff has any questions please contact us at out email address.

Global Engineering, Inc.
July 16, 1997

SECTION 1.0

INTRODUCTION

1.1 Purpose

The United Nations Development Programme (UNDP) has commissioned a study to develop and evaluate primary wastewater treatment alternatives for the Kannoubin Valley, Bechare, Lebanon. The UNDP commissioned Global Engineering, Inc. to prepare a report that summarizes the evaluations and to develop the capital cost and funding avenues needed to implement the recommended primary treatment alternative.

1.2 Background

The UNDP, as mentioned commissioned a study to implement primary wastewater treatment for the Kannoubin Valley. Primary treatment consists of raw sewage pumping, screening, grit removal, primary clarification and flow equalization. Solids (sludge) removed from the system will also have to undergo treatment prior to disposal. Treatment options include anaerobic digestion and lime stabilization. It is assumed that sludge disposal will be to a landfill. Currently no wastewater treatment currently exists in the Bechare area. The evaluations shall be for a community with approximately 2,0000 households. It is assumed that four people live in each household and that each person will generate approximately 125 gallons per day of wastewater, which includes infiltration and inflow. Thus, the evaluations will be performed for a system with an average daily flow of one million gallons per day.

1.3 Objectives

The main objective of this study was to determine the most cost effective means to provide the Kannoubin Valley with a primary treatment facility and to develop capital costs for each

alternative and possible funding routes to implement the recommended alternative.

SECTION 2.0

EVALUATIONS

2.1 Process Requirements

Prior to performing the Detailed Evaluations a detailed review of the process requirements was performed to determine the impact of the process requirements on sizing of the proposed primary treatment units. The review of the process requirements centered on major treatment processes and the results of the review is summarized in the following table.

TABLE 2-1

Review Summary of Process Design Requirements	
Process	Requirements (min.)
Pumping Stations	
No. Units	2, Variable speed; 3, Constant speed
Flow (maximum)	2.5 Times Design Flow
Variable Speed	0.5 to 2.5 times Design Flow
Lighting	VOSH Requirements
Ventilation:	
Wet Wells (per hr.)	12 (continuous); 30 (Intermittent)
Dry Wells (per hr.)	6 (Continuous); 30 (Intermittent)
Preliminary Treatment	
Screening:	
Manual Bar Screens	1" to 1/34" openings
Mechanical Screens	
No. Units	1 min.
Approach velocity	1.25 to 3 f/s
Slope	30 to 60 degrees
Grit Removal:	
No. Units	1 minimum for flows >0.15 MGD
Detention Time	3 mins. (Aerated) @ Design Flow
Air Flow	3-5 cfm/ft. of Length
Grit Removal	Grit Washer
Bypass	Required for single units

Process	Requirements (min.)
Sedimentation	
General:	
Inlet Velocity	1 f/s @ 0.5 Design Flow
No. of Units (min.)	2 @ Design Flow >0.04 MGD
Weir Loading	15,000 gpd/ft (max)
Surface Settling Rates:	
Primary Clarifiers (GPD/ft^2)	1,000 @ Design Flow 2,500 @ Peak Flow 1,200 @ Peak Flow
Flow Equalization	
Basic Design Parameters:	
Raw Wastewater Mixing (Min)	@TSS avg. >45 mg/L, mixing Hp≥ 0.02 Hp/1,000 gallons
Oxygen Requirement	>15 mg/L
Treated Wastewater:	
Mixing (Min)	@TSS <45 mg/L, mixing Hp≥ 0.01 Hp/1,000 gallons
Oxygen Requirement	>15 mg/L
Storage:	Based on review of flow data or 8 hour detention time based on I/I Study. 1/3 of Average Daily Flow (Min)
Compartmentalization	Required for facilities where flows exceed 20,000 gpd
Pumping	Flows exceed 20,000 gpd multiple pumping units required.
Chlorine Contact	
Detention Time	30 mins @ Design Flow 20 mins @ Peak Flow
Sludge Treatment	
Anaerobic Digestion	
No. of Units	2 (Min) for flows > 0.5 MGD
Supernatant	Min. 6' of depth required or 10% of total volume Sidestream treatment required if not provided for in design of main units.
Capacity	>35°C with control for ±4°C and >15 days capacity for primary digester. 60 days required for unheated digesters
Complete Mix Systems	Loading <200 lbs VSS/1,000 CF/day Min. Gas flow - 15 CFM/1,000 CF/day and 0.5 Hp/1,000 CF of digester volume.

Process	Requirements (min.)
Aerobic Digestion	
No. of Units	≥2 for flows >0.5 MGD
Volume	20 percent of total facility design capacity or 25 percent if temperature <10°C for more than 60 days.
VSS Loading	0.1 to 0.2 lbs. VSS/CF/day
Mixing	0.5 to 1 Hp/1,000 CF for mechanical aerations or 20 to 30 CFM/1,000 CF of tank volume.
Gravity Thickening	
Performance	Based on pilot testing
Surface Loading Rate	Justify
Overflow Rates	400 - 800 gpd/ft^2
Site Water Depth	10 ft.
Bottom Slope	>1.5 in./ft.
Scrapper RPM	15-20 ft/min.
Dewatering	
Sand Drying Beds:	
Loading	
Anaerobic	20 lbs Digested sludge/SF/day
Aerobic	15 lbs Digested sludge/SF/day
Physical Parameters:	
Gravel	12" deep, in 2 layers with top layer (2" of 1/2" to 1/4" gravel)
Sand	12" deep with U.L. <40 and effective grain size between 0.3 to 0.75 mm
Walls	Watertight and extend 15" to 18" above sand

The table above presents the industry accepted design standards for the primary wastewater treatment processes that would comprise a primary treatment system.

2.2 Basis of Design

TOKEN has selected primary wastewater treatment in an effort to provide the Kannoubin Valley some means of domestic wastewater treatment. Currently raw sewage is discharged into the nearby river. Primary wastewater treatment will reduce the organic material in the wastewater by 35 percent

and reduce suspended solids by approximately 65 percent. Further, disinfection of the wastewater discharge will also remove viral and bacteria contaminants that can potentially cause disease to anyone using the river downstream of the discharge location. Dechlorination of the effluent is also provided to keep the chlorinated discharge from the facility from harming aquatic species that that exist in the river.

The influent wastewater strength is assumed to have the following concentrations.

- BOD 350 mg/L
- TSS 350 mg/L
- Ammonia-Nitrogen 25 mg/L

A peak hour factor for raw sewage pumping is assumed to be 2.5 and the average daily influent flow is assumed to be 1 MGD (based on 4 people per dwelling at 125 gpdpc). Using these assumptions and the design criteria presented earlier the following table summarizes the mass balance loadings for the proposed primary treatment facility.

Table 2-2

Mass Balance Loadings			
Parameter	Max. Day[(1)]	Max. Day[(1)]	Peak Hour[(1)]
Flow	1.0	NA	2.5
BOD_5	350	2,919	4,378
TSS	350	2,919	4,378
NH_3-N	25	208.5	313

(1): mg/L for all parameters except flow which is MGD and peak hour peaking factors are 2.5 for flow and 1.5 for all other parameters.

2.3 Description of Alternatives

The following presents the alternative to provide primary treatment for the Kannoubin Valley. The

main alternative provides for the removal of trash, organics and solids and disinfection and dechlorination following primary treatment. The following processes comprise the liquid phase of the Primary Treatment Alternative.

- Raw Sewage Pumping
- Screening
- Grit Removal
- Primary Clarification

The following processes are optional.

- Flow Equalization

There are two options for sludge treatment, anaerobic digestion and lime stabilization. Either of these options will provide a sludge suitable for landfill disposal if dewatered or liquid land spreading if land application is implemented. The following lists the processes required for anaerobic digestion.

- Primary Anaerobic Digester
- Secondary Anaerobic Digester
- Sludge Thickening (Gravity Belt or Gravity)
- Dewatering
- Sludge Pumping

The following lists the units required for a lime stabilization system.

- Sludge Storage Tank
- Lime Stabilization Tank
- Lime Feed System
- Sludge Pumping System

After reviewing the operational considerations and labor and other operation and maintenance information anaerobic digestion and aerobic digestion were eliminated for further review due to capital cost, complexity of operation and operation and maintenance cost. Therefore, only lime stabilization was evaluated for sludge treatment. Figures 2-1 and 2-2 show the plan view and the section for the primary treatment alternative.

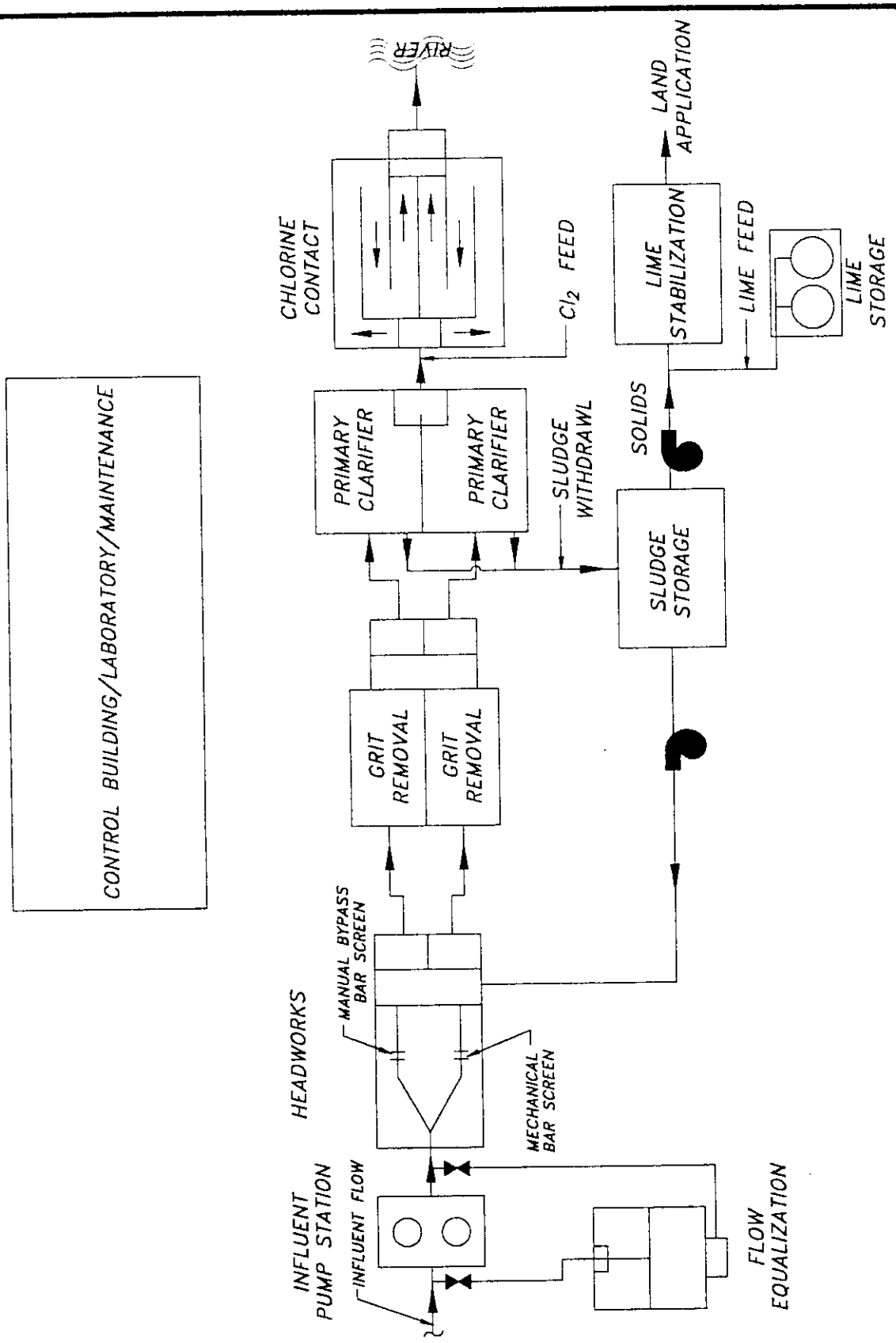
Sizing of Units

The sizing of the treatment units is based on industry standard criteria (such as Ten States Standards) and medium to strong wastewater concentrations. The following lists the processes that will comprise the primary treatment system for the Becahre Primary Wastewater Treatment facility.

- Bypass Bar Screen
- Mechanical Bar Screen
- Aerated Grit Removal
- Grit Washer
- Primary Clarifiers
- Sludge Pumping
- Sludge Treatment
- Chlorination
- Dechlorination

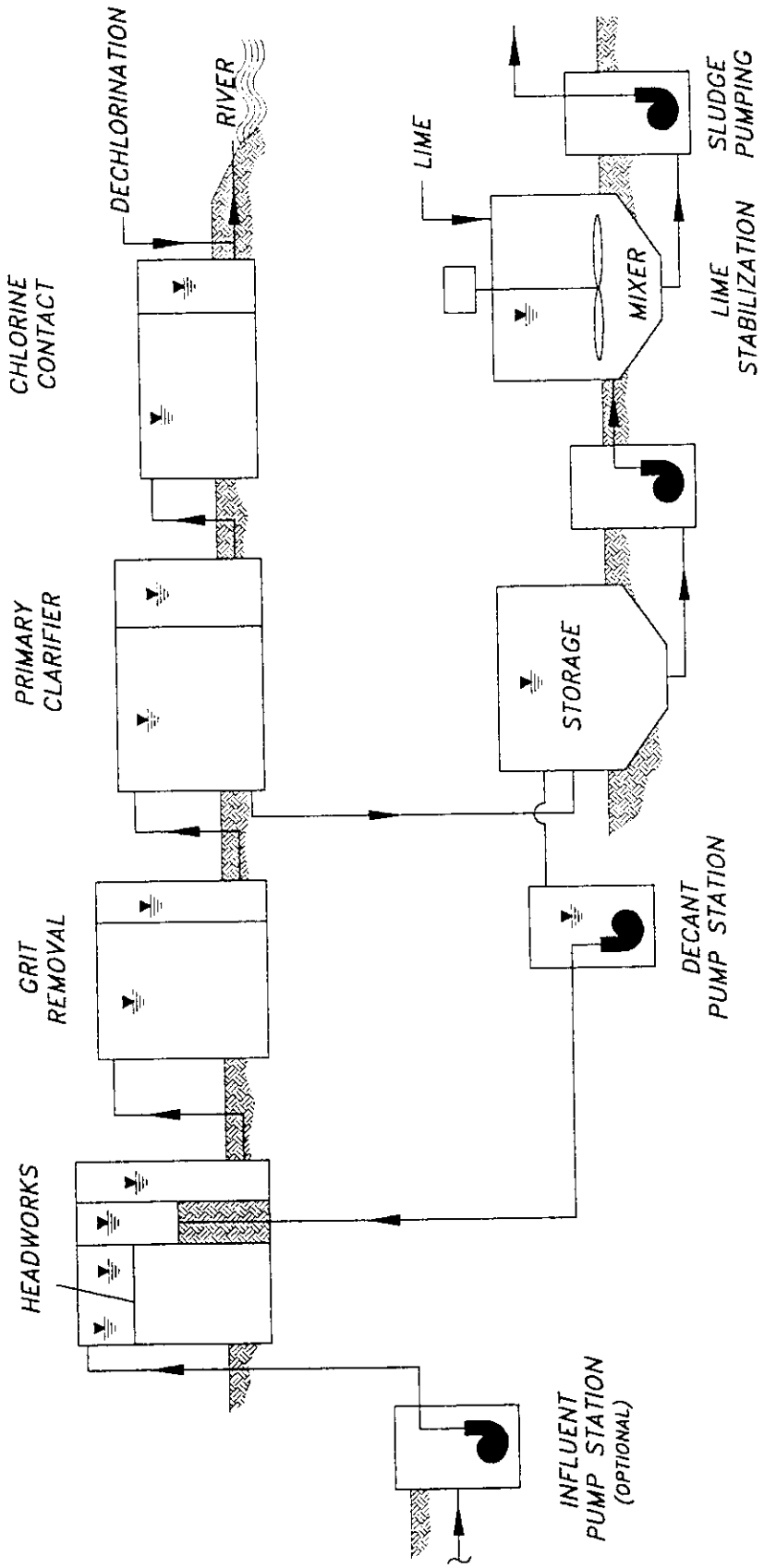
The primary treatment facility will also require ancillary facilities. The ancillary facilities required consist of the following.

- Influent Flow Structure
- Influent Pumping Facility



GLOBAL ENGINEERING INCORPORATED

FIGURE 2-1
PRIMARY TREATMENT ALTERNATIVE



GLOBAL ENGINEERING INCORPORATED

FIGURE 2-2
PRIMARY TREATMENT ALTERNATIVE
HYDRAULIC PROFILE

- Flow Split Structures
- Instrumentation
- Control/Laboratory/Maintenance Building
- Site Access

The following table presents preliminary sizing of the main primary treatment units.

TABLE 2-3

Preliminary Sizing of Main Primary Treament Units	
Process Unit	Requirements (min.)
Influent Pumping Station No. Units Flow (maximum) TDH Horsepower Voltage Power	 3 1.25 MGD (Each) 50 Feet 60 480 3 phase
Preliminary Treatment Screening: Manual Bar Screens Mechanical Screens No. Units Grit Removal: No. Units Detention Time Air Flow Grit Removal Volume	 1 w/1" openings 1 2 3 mins. 25 CFM Grit Washer 5,250 Gallons Each
Primary Clarifier No. of Units Surface Settling Rates Volume Type	 2 800 GPD/SF 41,000 Gals. Each Rectangular

Process Unit	Requirements (min.)
Flow Equalization No. Compartments Volume Air Flow	 1 3 333,000 Gals. 900 CFM
Chlorine Contact No. Volume	 2 53,000 Gals. Total
Sludge Treatment Anaerobic Digestion No. of Units Primary Digester Volume Secondary Digester Volume	 2 90,000 Gals. 90,000 Gals.
Lime Stabilization No. of Units Sludge Storage Lime Treatment	 2 50,000 Gals. 24,000 Gals.
Gravity Thickening No. Volume	 1 24,000 Gals.
Dewatering Belt Press No. Size	 1 15 GPM

2.4 Opinion of Cost

The following presents the opinion of capital cost to implement the primary treatment alternative as well as the O&M cost to maintain and operate the facility. Our opinion of cost is based on our experience with performing similar projects and information obtained from manufacturers and their representatives. The following table summarizes the project cost and the operating cost for the primary treatment system.

TABLE 2-4

Summary of Project Capital and Operating and Maintenance Cost for Primay Treatment		
Treatment Unit	Capital Cost, $	O&M Cost $/1,000 Gals.
Influent Pump Station	$250,000	$0.09
Flow Equalization	$900,000	$0.28
Headworks Manual Bar Screen Mechanical Bar Screen Structure	 $5,000 $90,000 $125,000	 $0.01 $0.03 $0.01
Grit Removal	$100,000	$0.05
Primary Clarifiers	$175,000	$0.06
Chlorine Contact	$75,000	$0.05
Site Piping	$150,000	$0.04
Site Work	$150,000	$0.06
Chemical Feed Chlorine Dechlorination Lime	 $75,000 $50,000 $150,000	 $0.08 $0.05 $0.08
Sludge Storage	$110,000	$0.07
Lime Stabilization	$250,000	$0.12
Sludge Pumping	$125,000	$0.08
Building & Miscellaneous	$350,000	$0.08
Base Cost	$3,130,000	
Contingency (15 %)	$470,000	
Construction Cost	$3,600,000	
Engineering and Construction Management	$900,000	
Land (20 acres)	$1,200,000	
Project Capital Cost	$5,700,000	

SECTION 3.0

CONCLUSIONS AND RECOMMENDATIONS

3.1 General

The previous sections of the facility study described and presented the results of the various evaluation performed as part of this project. The evaluations were performed to determine the feasibility and costs to implement primary wastewater treatment in the Kannoubin. Section 2 of this report presented the basis of design and cost to implement the primary treatment alternative. The following presents our recommendations and conclusions concerning implementing the primary treatment alternative.

3.2 Conclusions

The following conclusions are offered as a result of our evaluations.

A. Treatment

Implementing a primary treatment system will remove 35 percent of the incoming and organics and 65 percent of the incoming solids to the primary treatment facility. Further, disinfection of the wastewater discharge from the facility will also will remove potentially harmful and disease causing viral and bacterial organisms from the wastewater discharge. Thus, improving the quality of water in the river for downstream users. Solids removed from the wastewater can be recycled as fertilizer by land applying the lime stabilized on nearby farm land. This practice is in widespread use in the U.S. and Europe. The high pH content of the sludge also helps condition the soil pH thus mitigating problems with metal uptake by the crops.

During the evaluations a single primary treatment alternative was evaluated and three (3)sludge treatment alternatives were evaluated. They are:

1. Anaerobic Digestion
2. Aerobic Digestion
3. Lime Stabilization

The following presents our conclusions concerning sludge treatment.

1. Anaerobic Digestion

This process is extremely complex and labor intensive. This process also has a high maintenance cost associated with it. This process was not pursued further, due to the complexity of operation and the high operation and maintenance cost associated with it.

2. Aerobic Digestion

Aerobic digestion like anaerobic digestion is a complex process and is labor and energy intensive. This process was also not pursued further due to the high capital and operation and maintenance cost.

3. Lime Stabilization

Lime stabilization offers a uncomplicated process along with a low capital cost when compared to the other processes evaluated. The operation and maintenance cost for this process is much lower than the other two processes evaluated. This process will produce a Class B (EPA 503 Requirements) that is suitable for land applying on nearby farms.

4. Solids Disposal

Two (2) methods were evaluated for sludge disposal. These methods were landfill disposal, land application and selling the sludge as a soil amendment or fertilizer. Landfill disposal is a cost effective method for sludge disposal, however, the sludge has to be dewatered prior to landfill disposal. Land application of lime stabilized sludge is an accepted practice and the primary treatment

facility will produce a Class B sludge which is suitable as fertilizer for crops grown in the Kannoubin Valley.

3.3 Recommendations

The following recommendations were derived form the evaluations performed during the course of this study.

A. Primary Treatment

1. Influent Pumping

Construct a submersible pump station to receive raw wastewater from the users of the system. The pump station should have three pumps each sized for half of the peak flow (1.25 MGD). The pump station should include a DC Pulse Magnetic Flow meter to record the influent flow to the facility.

2.. Screening

A headworks with both a mechanical and by-pass manual bar screen is needed to remove trash from the incoming wastewater. The headworks should also include a flow split structure with gates to evenly split the flow to the grit removal units. The gates will also allow operators to isolate flows to the grit removal units.

3. Grit Removal

Two aerated grit removal units should be provided to remove grit and other debris from the incoming wastewater. The units should be aerated so that organic matter can be removed from the grit and kept in the primary wastewater stream.

3. Flow Equalization

Flow equalization is recommended to allow the facility to handle peak flows and keep downstream units from overflowing during extreme rainfall events. This will also eliminate raw sewage from entering the river by also preventing bypasses from the facility during extreme rainfall events..

4. Primary Clarifiers

Provide two rectangular primary clarifiers with positive sludge removal. The units should have a length to width ratio of 3 to 1 and be approximately 8 to 10 feet deep. The units should sized for an overflow rate of 800 gallons per day per square foot.

5. Disinfection

Two chlorine contact tanks should be provided. These tanks will provide the contact time needed to disinfect the wastewater prior to discharge to the river. This will ensure that viral and bacterial organisms are removed from the wastewater and thus improve the downstream water quality.

6. Dechlorination

Dechlorination of the chlorinated effluent is recommended to prevent the high chlorine level in the effluent from harming aquatic life found in the river.

7. Sludge Treatment and Disposal

Lime stabilization of the sludge removed from the primary clarifiers is recommended. This process is not complex and is not as labor and energy intensive as anaerobic and aerobic digestion. The lime stabilization system should include a sludge storage tank, lime stabilization tank, lime feed system and sludge pumping. Further, land application of lime

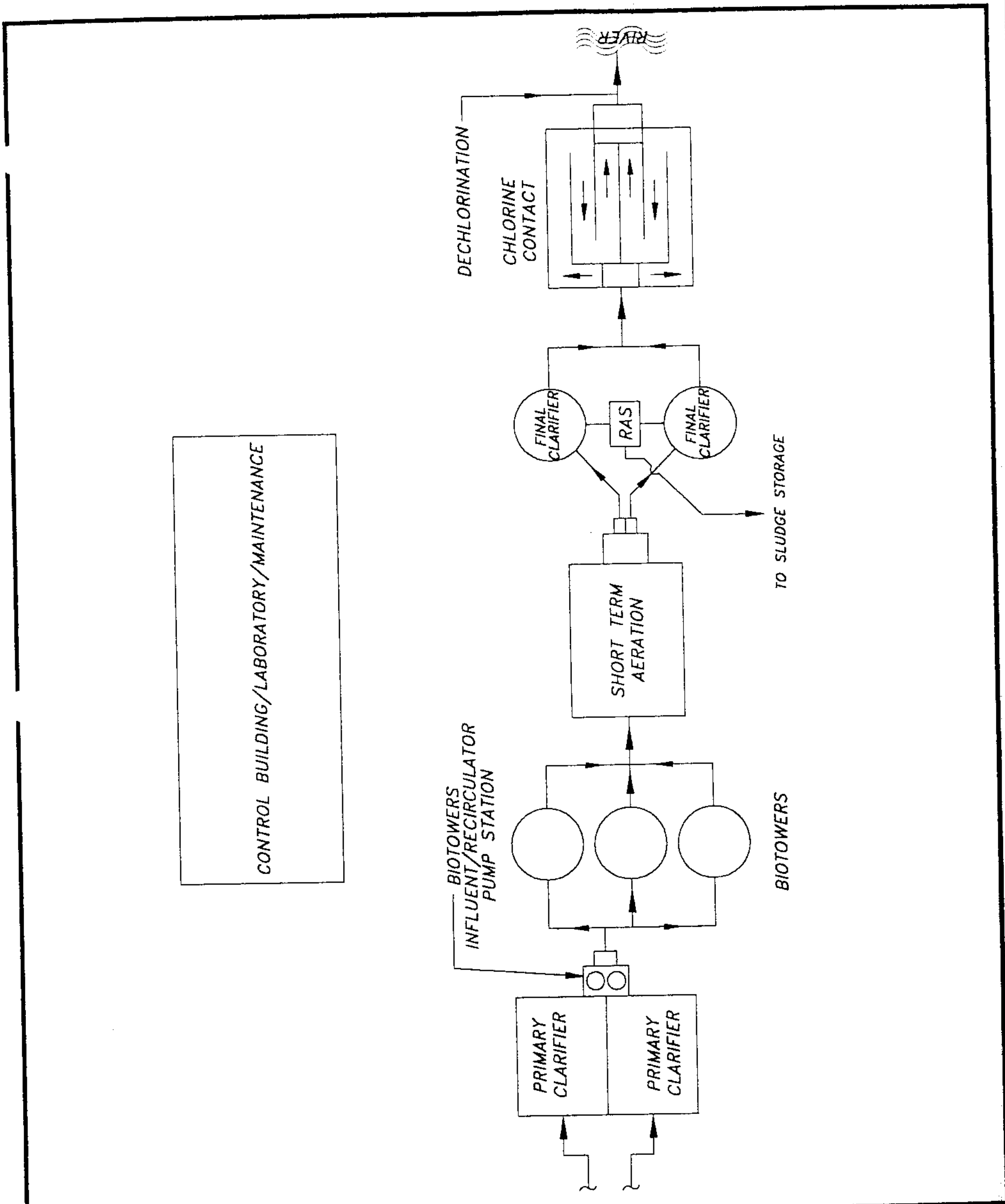
stabilized sludge is also recommended since this system will produce a Class B sludge that is suitable for crops grown in the area. The sludge does not require dewatering and can be land applied in a liquid form.

8. Ancillary Items

We also recommend that a Control/Laboratory/Maintenance building be included with this treatment system. The control building will house the main offices for the facility and the laboratory used by the operators to evaluate how the system is performing. A maintenance area should also be provided to allow the operators a place to perform routine maintenance on equipment. The building would also provide restrooms and showers for the staff and meeting rooms.

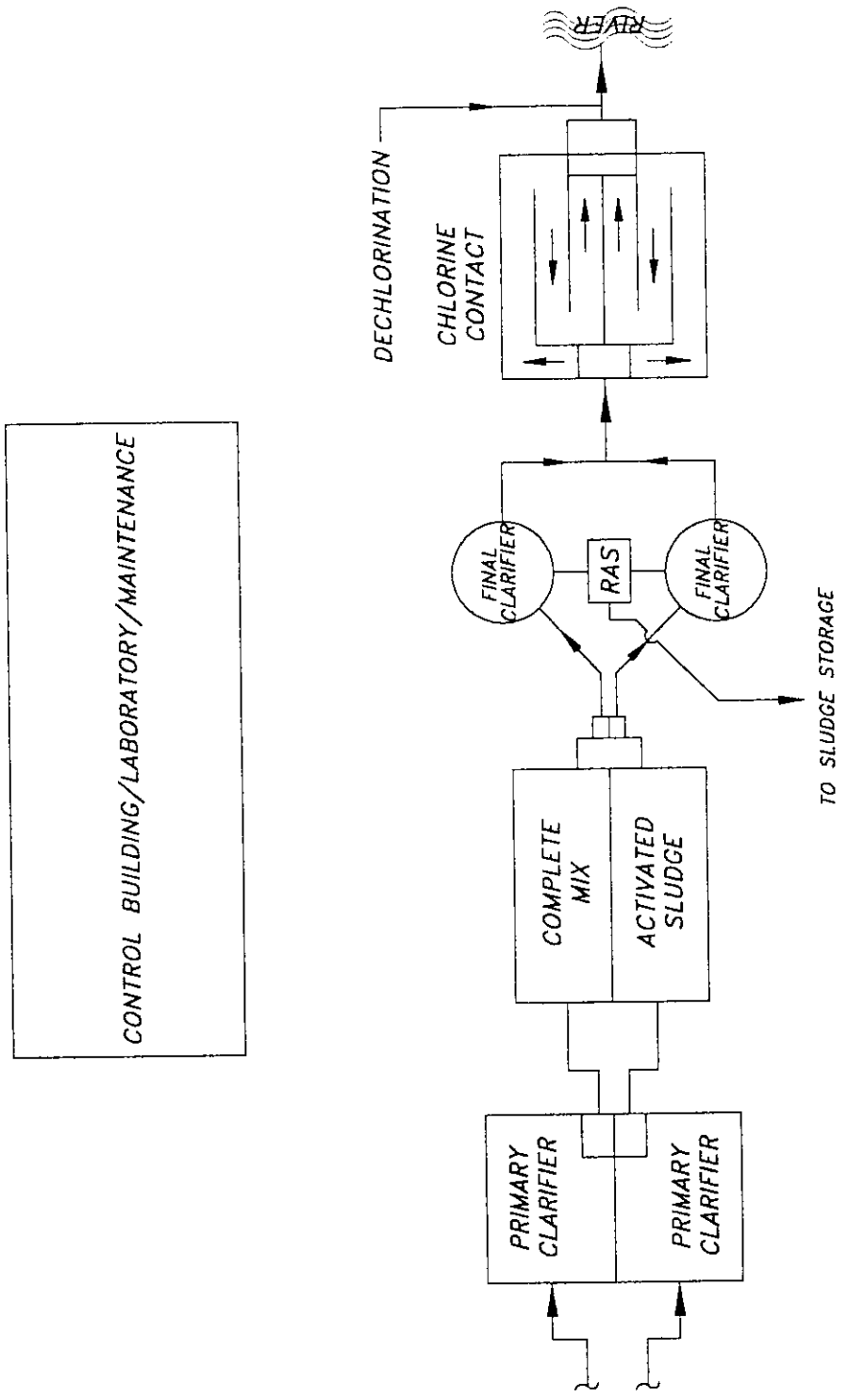
9. Summary

We recommend that the primary treatment system presented in this report be implemented. The primary treatment system will provide a cost effective first step for cleaning up the river and its tributaries. Later phases could include installing secondary treatment along with the primary treatment system. Secondary treatment will remove 85 to 95 percent of the organics and 85 to 95 percent of the solids found in the wastewater coming to the facility. Figures 3-1 and 3-2 show two options to add secondary treatment to the recommended primary treatment system. This will further, assist with improving the water quality of the rivers and streams found in the area. This will help reduce the potential for any outbreaks of waterborne disease from users of the rivers.



GLOBAL ENGINEERING INCORPORATED

FIGURE 3-1
OPTION 1 - SECONDARY TREATMENT
BIOTOWERS/SHORT TERM AERATION



GLOBAL ENGINEERING INCORPORATED

FIGURE 3-2
OPTION 2 - SECONDARY TREATMENT
ACTIVATED SLUDGE

SECTION 4.0

IMPLEMENTATION

4.1 General

The previous sections of this report presented the results of the various evaluations conducted concerning implementing a primary wastewater treatment facility in the Kannoubin Valley. The evaluations were concerned with determining the processes needed to implement primary wastewater treatment, the land area needed, the capital and operating cost of the recommended processes and the impact of the cost on the local residents and the impact of various funding alternatives. The following presents how the recommended alternative should be implemented. Implementation of the recommended alternative is based on cost, the impact of the project cost on local residents and the impact of various funding alternatives.

4.2 Recommended Alternative

Section 2.0 presented the results of the evaluations concerning the main treatment units. The evaluations were concerned with selection of primary treatment processes and the project cost to implement the recommended alternative. The project capital cost and operation and maintenance cost were presented.

Section 3 presented the conclusions and recommendations derived from the evaluations presented earlier. Section 3 recommended the following treatment units to implement a primary treatment system.

- Preliminary Treatment

  Headworks with manual bypass and mechanical bar screen

- Influent Pump Station

- Aerated Grit Removal
- Primary Clarification
- Disinfection
- Dechlorination
- Sludge Treatment/Disposal

  Sludge storage and Gravity thickening
  Lime stabilization with lime feed
  Land application for disposal of lime stabilized sludge

- Ancillary Facilities

  Control/Laboratory/Maintenance Building
  Site Piping/Site Work/Sludge Pumping

The project cost was presented in Table 2-4. A review of Table 2-4 shows that it will cost approximately $5,700,000 to implement a primary wastewater treatment system in the Kannoubin Valley.

4.3 Impact of Project Cost

The following presents the impact of project cost on the 2,000 dwellings estimated to be served by the primary wastewater treatment system. If the individual dwellings are assessed then the one time cost for each dwelling will be approximately $2,900. If a grant is obtained then the impact on the residents would be lessened. Table 4-1 shows the impact that a grant would have on the assessment to individual users.

TABLE 4-1

Impact of Grants on the Assessment for Individual Residents			
Project Cost	Grant Amount	Balance	Assessment Amount
$5,700,000	$570,000	$5,130,000	$2,565
$5,700,000	$855,000	$4,845,000	$2,423
$5,700,000	$1,140,000	$4,560,000	$2,280
$5,700,000	$1,425,000	$4,275,000	$2,138
$5,700,000	$2,850,000	$2,850,000	$1,425

The following table presents the estimated annual operating cost for the primary treatment facility.

TABLE 4-2

Annual Operating Costs for the Primary Treatment Facility	
Item	Cost
Salaries	$90,000
Benefits	$75,000
Office Supplies	$100,000
Capital Replacement Fund	$200,000
Operating Costs (Fuel, Chemicals, Power, etc.)	$450,000
Total	$915,000

The impact of the operating cost on the individual users of the system is estimated to be $38.50 per month. The following table presents the impact of funding the project cost with a loan to be paid back with monthly user fees to the users of the system.

TABLE 4-3

Impact of a Loan to Fund the Remaining Balance of the Project Cost			
Project Cost	Grant Amount	Loan Amount	Monthly Payment[1]
$5,700,000	No Grant	$5,700,000	$11.87
$5,700,000	$570,000	$5,130,000	$10.69
$5,700,000	$855,000	$4,845,000	$10.09
$5,700,000	$1,140,000	$4,560,000	$9.50
$5,700,000	$1,425,000	$4,275,000	$8.90
$5,700,000	$2,850,000	$2,850,000	$5.94

(1): Based on 20 years at 8 percent.

The information presented in Tables 4-2 and 4-3 along with the assessment cost can be used to determine the impact of implementing the primary wastewater treatment facility. The following table presents the impact of implementing the facility on the individual users of the system.

TABLE 4-4

Estimated Monthly User Fees for the Primary Wastewater Treatment Facility			
Loan Amount	Monthly Payment	Monthly Operating Cost	Total Monthly Payment
$5,700,000	$11.87	$38.50	$50.37
$5,130,000	$10.69	$38.50	$49.19
$4,845,000	$10.09	$38.50	$48.59
$4,560,000	$9.50	$38.50	$48.00
$4,275,000	$8.90	$38.50	$47.40
$2,850,000	$5.94	$38.50	$44.44

A review of the implementation costs shows that the cost to the individual users is somewhat high however, the monthly service fees and the one time assessment are not out of line with other user

fees that exist in the United States. Therefore, the project should be pursued by TOKTEN.

Should secondary treatment be pursued at a later date then an additional $2,000,000 should be added to the project cost.

IMAD DARGHAM, MSCE, P.E.
4895 Wood Pointe Way
Sarasota, Florida 34233
Tel. (941) 923-2359

CAREER OBJECTIVE: To apply my education and experience in professional engineering services to public water and wastewater systems especially in the United States of America and Lebanon. Enjoy exploring, designing and applying state-of-the art techniques.

RESUME 1: **GENERAL INFORMATION**

EDUCATIONAL DATA:

Youngstown State University
Degree: Master's in Civil Engineering, December, 1987, with concentration area in Environmental.

Youngstown State University
Degree: Bachelor of Science in Civil Engineering, June, 1986 with two concentration areas, Transportation and Environmental.

PROFESSIONAL REGISTRATION:

Professional Engineer, Florida, U.S.A.
Registration Number 48143

Professional Engineer, Country of Lebanon
Registration Number 13681

PROFESSIONAL AFFILIATIONS:

Florida Engineering Society
National Society of Professional Engineers
American Druze Society
American Young Druze Professionals
American - Lebanese Engineering Society

CONFERENCES: "Practical Approaches For Effective Erosion and Sediment Control.
"Florida Water Resources Conference", sponsored by:

- Florida Section American Water Works Association
- Florida Water Environment Association
- Florida Water and Pollution Control Operators Association

"The Professional Water Storage Tanks Design, Construction, Specification, Inspection Service, and Maintenance", Orlando, Florida 1995.

"CYBERNET" by Haestad Method - Computer Program for Modeling a Water Distribution Network and sewer force mains.

"Reuse Sprinkler System" by Netafim - used under low and high pressure applications.

"Variable Speed Pumps" by Flygt, ABS, Fairbanks Morse and Hydromatic Pumps.

"Primavera System", a project management computer program conducted by Evans Technology Incorporation.

"Florida Department of Environmental Protection" annual seminar which covered many aspects and among them the reuse system in State of Florida, discharge of effluent alternatives and reverse osmosis process.

"Wastewater odor production and detection, sulfide production, sulfide chemistry, hydrogen sulfide gas and odor/corrosion control alternatives" by James M. Montgomery Engineering.

"Trends in water/wastewater plant automation" by Allen - Bradley.

"Construction Inspection" sponsored by the Ohio Department of Transportation.

Among others

APPLIED EXPERIENCE:

02/08/88 - 01/31/92	Greeley and Hansen: Project Engineer
02/06/92 - 04/1/92	Hole, Montes & Associates: Project Engineer
04/06/92 - Present	Global Engineering, Inc.: Professional Engineer, President

Experience Summary

I have eleven years of experience in the fields of water and wastewater engineering and environmental engineering. For the past eleven years, I have served as project manager, project engineer, and design engineer for several environmental and civil engineering projects for the County and private consultants.

Representative projects include potable and irrigation transmission, distribution pipelines, pump stations, wastewater treatment plants, wastewater collection and transmission facilities, master plans and modeling.

Management activities have involved coordination of various consultant and contractor activities, state agencies, contract administration, project scheduling, project cost control and report preparation.

Additionally, I have two years of experience in construction of commercial and residential buildings. Since April, 1997, I have been involved with United Nations Development Program (UNDP) via TOKTEN Group in New York to undertake a mission with NGO Council for Environmental Protection in Becharre, Lebanon. The project consists of writing a design report for a primary treatment plant to serve 2000 housholds (2 Million Gallons per day) and make recommendation to how to fund the project. This project is based soley on volunteering basis to help the government of Lebanon.

Area of Responsibility

The primary area of responsibility is engineering extensive environmental studies, reports, proposal contracts, network modeling, design and construction activities; master planning of water, wastewater, and reuse systems for major Counties and Cities in the State of Florida and overseas. I have served as project engineer and design engineer for several projects in the field of potable water, reclaimed water, wastewater, and master planning.

RESUME 2: **Interception and Collection - Combined Sewer Overflows Storm Sewer Handling Facilities**

- Project Manager for design, programming and configuration, and construction services for a Supervisory Control and Data Acquisition (SCADA) or Telemetry system for the **wastewater system** in Sarasota County, Florida. Duties included representing the County in managing Black & Veatch Consultant throughout the project.

- Project Engineer for design and programming a computer program of over 150 miles of gravity sewer lines and over 25 miles of force mains for the South Venice area in Sarasota County, Florida. Duties included figuring the assessment per dwelling unit in the special sewer district.

- Project Engineer for design of large force main and several intercepting sewers in FDOT right-of-way for the City of Tampa, Florida. The project included 2,200 feet of 42-inch, 3,000 feet of 36-inch and 1,400 feet of 30-inch RCP of intercepting sewers and 1,700 feet of 36-inch DIP force main.

- Project Engineer for the design and permits for 4,530 feet of 24-inch diameter sanitary force main which is a segment of the proposed Wastewater Transmission System to Sheldon Road Wastewater Treatment Plant.

- Design Engineer for design of relocation of existing 60-inch diameter RCP sanitary sewer including lateral sewers, junction chambers, and special stream crossings for the City of Alexandria, Virginia.

- Project Engineer for design of over 100 miles of low pressure sewer transmission and collection pipelines utilizing a personal program for the City of Cape Coral, Florida.

Duties also included adapting information from the City and coordination with utility companies, and providing necessary surveying support to suit the project. In addition, duties included participation in public hearings.

RESUME 3: **Wastewater Treatment and Disposal - Wastewater Reclamation Sludge Treatment and Disposal**

- Project Manager for design and construction services of Central County Water Reclamation Facility Expansion from 2 Million Gallons Per Day to 4 Million Gallons Per Day in Sarasota County, Florida. Duties included representing the County in managing Hole, Montes & Associates and Post, Buckley, Schuh & Jernigan consultants throughout the design, permitting, and construction of the project .

- Prepared an Operating Permit Renewal Application Package for the Sarasota County Circlewood Wastewater Treatment Plant and submitted to Florida Department of Environmental Protection, October 1995. This report included Capacity Analysis Report, Operation and Maintenance Performance Report, Updated Flow and Loading Information Based on Monthly Operating Report and Analyses of Composite Effluent Samples.

- Prepared an Operating Permit Renewal Application Package for the Sarasota County Plantation Wastewater Treatment Plant and submitted to Florida Department of Environmental Protection, April 1995. This report included Capacity Analysis Report, Operation and Maintenance Performance Report, Updated Flow and Loading Information Based on Monthly Operating Report, Reuse Water Agreement, Analyses of Groundwater Monitor Well Samples, and Analyses of Composite Effluent Samples.

- On behalf of the Sarasota County, Utilities Engineering,. managed and coordinate activities with Davis Water & Waste engineers to build a computerize system "ALKA-PRO" at Plantation Wastewater Treatment Plant in south Venice, Sarasota - Florida.

  This system is to monitor the biological process activities in the plant and feed the plant with oxygen as needed. The graphic enhancement was interfaced in monitoring the movement and the function of the cells in different zones so the PH, Level of Oxygen, and the Alkalinity level could very easily adjusted. This state-of-the-art has eased the operation process and results with a better effluent water and lessen the energy cost perpetually.

- "Port of the island Wastewater Treatment Plant", Collier County, Florida. Responsible for cost estimating, Permitting, and hydraulic and flow calculations.

"Sheldon Road Wastewater Treatment Plant Effluent Outfall Force Main Evaluation". Responsible for a study to recommend an economical size for the effluent pipe from Sheldon Road Wastewater Treatment Plant to channel "A" for Hillsborough County.

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

RESUME 4: **Wastewater and Reclaimed Water Planning and Studies**

- Project Engineer responsible for managing, studying, modeling and designing a large Reclaimed Water System along with high pressure pumps for Sarasota County Bent Tree residential area. This project included over 25 miles of reuse transmission and distribution pipelines between 4" and 16", ponds, and reuse water services. Duties also included computation of the assessment and impact fees per dwelling unit.

- Project Engineer responsible for determining the number of wastewater treatment plants needed to ultimately serve Sarasota County. Other factors included in the analysis such as disposal of effluent and sludge, population/flow generation patterns and transmission economics and engineering.

- Prepared a "Franchise Acquisition, Consolidation, Implementation Plan For Wastewater Collection and Treatment Master Plan". This plan recommended the consolidation of 114 package and franchise wastewater treatment plants into five regional wastewater plants. The Sarasota County Commission adopted the master plan on July 27, 1993 for the consolidation and acquisition of sewer utilities throughout the County.

  Advanced wastewater process was selected to treat the source wastewater and using its effluent for irrigating golf courses, residential, commercial, industrial, and agriculture lawns.

- Prepared a reuse master plan for Sarasota County, Florida to explore the benefits of developing a regional reuse system, the regulatory environment, marketing reclaimed water for substituting reuse for irrigation from wells or with potable water, and previous studies and activities regarding reuse.

- Project Engineer for Amendment to the existing 201 Facilities Plan for Wastewater Improvements including planning and preliminary engineering for several new and old pumping stations, force mains, and intercepting sewers for the City of Kissimmee, Florida.

Duties also included preparation of flow projection allocation for the service area and association with the East Central Florida Regional Planning Council to evaluate and approve the flow projections based on the projected population for 1990 through 2005; allocation of capital, operation and maintenance costs to communities service the program and also new improvements.

Project Engineer for 201 Facilities Plan Update for Lee County, Florida. The study included wastewater improvements and planning in the central area of the County.

Duties also included defining project area, estimating wastewater flows, developing alternatives of service, evaluating alternatives for the wastewater collection and the reuse/effluent disposal systems.

RESUME 5: **Water Supply - Planning and Studies, Storage, Transmission and Distribution**

- Project Manager for design, programming and configuration, and construction services for a Supervisory Control and Data Acquisition (SCADA) or Telemetry system for the **Water System** in Sarasota County, Florida. Duties included representing the County in managing TRANSDYN CONTROL supplier and Black & Veatch Consultant throughout the project

- Project Manager and Design Engineer for 5.5 miles of 12" water main on Center Road and U.S. 41 in Venice Gardens service area, Sarasota County, Florida. The assignment included a complete field investigation for right-of-ways, easements and selection of feasible routes. This project improved the system in general by closing loops and adding fire hydrants.

- Project Manager and Design Engineer for 1.5 miles of 6" water mains in DeSoto Lakes Service Area in Sarasota County, Florida. The assignment included a complete field investigation for right-of-ways, easements and selection of feasible routes. This project improved the system in general by closing loops and adding fire hydrants.

- Project Manager and Design Engineer for 2.0 miles of 6" and 8" water mains in Fruitville Road Service Area in Sarasota County, Florida. The assignment included a complete field investigation for right-of-ways, easements and selection of feasible routes. This project improved the system in general by closing loops and adding fire hydrants.

- Project Manager and Design Engineer for 1.0 mile of 6" and 8" water mains on Hamlets Boulevard in Sarasota County, Florida. The assignment included a complete field investigation for right-of-ways, easements and selection of feasible routes. This project improved the system in general by tieing-in two service areas to each other and by closing loops and adding fire hydrants.

- Project and Design Engineer for modeling and design of 5 miles of 12" potable water main for the County of Sarasota to provide water for the Sarasota Memorial Hospital and Manatee Community College in South Venice, Florida.

- Project Engineer responsible for modeling and Calibrating the existing water system of Sarasota County that comprises of five major pumping stations and storage tanks facilities and 600 miles of piping between 6 inches and 30 inches. In addition, this project covers modeling of the entire water system to accommodate for year 2020's demand.

- Project coordinator between the State of Florida Department of Environmental Protection (FDEP) and Sarasota County. Assignment encompasses of abandoning 14 contaminated commercial businesses wells and building a water main with fire protection and connecting the businesses to the County water system. Moreover, making sure the performance of the contract meets the public expectation and fulfill the agreement between the two parties. The project was financed by the FDEP.
- Project Engineer for modeling and design of over 75 miles of potable transmission and distribution pipelines for the South Venice area in Sarasota County, Florida. In addition, duties included participation in public hearings and in providing the public with necessary information. Duties also included determining the assessment per dwelling unit for the project.

- Project Engineer for modeling and design of over 300 miles of potable and reuse irrigation transmission and distribution pipelines for the City of Cape Coral, Florida. In addition, the project included field work to locate existing utilities.

- Project Engineer for the design and permits for 16,240 feet of 12-inch water main for the City of Cape Coral, Florida.

- Project Engineer for the design and permits for 10,298 feet of 16-inch water main for Collier County, Florida.

- Project Engineer for the design and permits for 5,544 feet of 16-inch water main for Collier County, Florida.

RESUME 6: **Ohio Department of Transportation: Summer 1987**

. Title: Field Inspector

Duties: Inspection of excavation of full depth patches, placement of filter fabric and PVC underdrain, and compaction of aggregate base and asphalt concrete.

RESUME 7: **Blue Sea Construction - Suleimaneih Riyadh, Saudi Arabia: 1981-1982**

. Title: Financial Manager

Duties: Entirely responsible for the daily financial activity.

Prince Faisal Bin Turki - Malez Riyadh, Saudi Arabia: 1980-1981.

. Title: Operation Manager

Duties: Responsible for manufacturing and distribution of catering services and products.

RESUME 8: **Savanna Construction Company - Lebanon: 1979-1980**

. Title: Foreman

Duties: In charge of numerous projects ranging from foundation construction to interior finishing of multi-level commercial structures.

SPECIAL SKILLS: Graduate Assistant for the Civil Department at Youngstown State University:

Winter, Spring and Fall 1987.

. Duties: Computer programming, surveying, teaching, and special departmental assignments.

- Research Assistant for complete study on volume and heavy metals content of sediment deposits in Lake Newport including surveying work (i.e. depth soundings in Lake Newport and elevation measurements at the watering basin site). Summer and Fall 1987.

HOBBIES: Cycling, swimming, tennis, volleyball, soccer, and traveling.

REFERENCES: Furnished upon request.

Former Beiruti brings back his expertise

by Gareth Smyth
Special to The Daily Star

Imad Dargham's grinning face is topped by a baseball cap with a Nike symbol, and he speaks with a Florida drawl. He wears Calvin Klein jeans not as a fashion statement but because that's what you wear in his 'home' town of Sarasota. He seems very American.

Dargham has been away from Lebanon for some time. At 37, he has lived in the United States for nearly two decades, since leaving Achrafieh, originally for Saudi Arabia, at 18.

This summer he returned to Lebanon, bringing his skills as a qualified civil engineer. Educated at Youngstown State University, he has for four years been president of his own engineering company. Dargham emphasises environmental protection and specialises in clean water supply and waste management.

He has high standards and wants to apply them here. "I am very patriotic," he said. "I love Lebanon."

The Tokten project which drew Dargham here was the design of a waste-water treatment plant for Bsharri. Nestled under the peaks around Qornet es Saouda, it is one of Lebanon's most outstanding areas of natural beauty. Yet the Qadisha valley, which plunges steeply into the rock as the river begins its journey down to Tripoli, is becoming seriously polluted.

"Can't you smell it?" asks Imad Dargham at Bsharri

GARETH SMYTH

At the top of Bsharri is a café by a picturesque waterfall. When a family approached, father and son splashed water on their faces. Dargham climbed down to a pipe pouring water from under the road into the stream at the bottom of the waterfall. "Sewage," he said. "Can't you smell it? That runs down into the river."

He was equally convinced there was contamination and was proved correct: just metres from the café tables was sewage.

The existing system merely moves waste and deposits in the river. "The existing system was probably French," Dargham noted, "and I guess it's around 80 years old." He was unimpressed. "The Lebanese should be using the latest technology," he said. "We had high standards before (the war)."

Tokten found Dargham through the Centre for Lebanese Studies in Oxford which publicised the scheme through the Hariri Foundation in New York, which in turn publicised it through the American-Lebanese Engineers' Society, of which Dargham is a member.

His scheme for Bsharri, developed at first in Florida and refined on his visit, is for a primary treatment plant to reduce 'total suspended solid' (TSS) to around 250mg per litre. For 2,000 households, the plant would need a capacity of 1m gallons a day with a staff of up to four. He estimated the capital cost at $5.7m allowing 15 per cent for contingencies, and operating costs at around $915,000 a year.

Discussing his figures with Mouawad, Dargham was keen to stress the cost of high standards. Mouawad, aware that it might be prohibitive, argued that he was using US figures for running costs and consultancy fees. This tension between the US-acquired standards and Lebanese 'political realities' was a real one.

The idea for a study into a possible sewage treatment plant came from Environmental Protection of Bsharri, a group of concerned local people led by Yusef Tawk, a doctor. "We see the valley as a natural, historic resource, a treasure to be preserved," he explained. "Water is a natural resource. We must prevent pollution from sewage and rubbish. Two years ago, we had a problem with garbage being dumped in the valley: the smell was becoming disgusting. We collect the rubbish in conjunction with the employees of the municipality."

As yet, Dr Tawk has detected few health problems which may result from impure water. Although he feels there may be more cases of gastroenteritis, instances of hepatitis B remain "very, very few". But his concern is not primarily public health, rather the "preservation of a valley which has a history going back 2,000 years".

The future of Dargham's scheme is uncertain. It may or may not have an influence on an overall plan drawn up by the ministry of hydraulic resources for sewage plants across the country, and which is to be implemented first in Baalbek. Dargham and Mouawad first knew of the ministry's plan when he presented his report on Bsharri to CDR.

Dargham's sense of urgency about the pollution of Lebanon's waterways was acute. When he found time to visit the Litani, he was shocked by what he found: "What's in it, man, would put grey hairs on your head – there are plastic bags, dead animals, you name it. The water is still going, but it's mainly raw sewage." For Dargham, there is a real question of priorities, or as he put it: "Building sewers is more important than building roads."

But waste management, he stressed, is not simply a question of developing infrastructure. It is also imposing responsibilities on polluters. This can range from introducing grease filters on restaurant outlets (anti-grease bacteria can also help, apparently) to implementing requirements on chemical-producing factories which will require action from the government, he says. "Regulations are very important. No matter how much money you spend if you don't regulate, you're going in a circle."

Expatriate talent offers a helping hand

From Page ONE

hands and they don't know what to do with it – it depends how professional they are."

The 'foreign' consultants can sometimes be seen as a threat to locals. There have been complaints, Mouawad admits.

"But we only bring on average 17 consultants a year, which is not a big deal. And at the same time Tokten can create an opportunity for local consultants to follow up.

"This happened with the ministry of transport where the consultant was cooperating with a local at the AUB. There can be an exchange of information. The ex-nationals too, will learn from the people here."

Some consultants may develop a long-term commercial interest in Lebanon. Others may stimulate further action from the government or the private sector. Some come back to live and for them Tokten is a stepping stone. For others who have built new lives abroad, it is simply a way to help their land of origin.

Tokten's home page on the net is at http://web.cyberia.net.lb.tokten

The e-mail address is: tokten@cyberia.net.lb

برنامج الأمم المتحدة الإنمائي
تنمية بشرية مستدامة

United Nations Development Programme
Sustainable human development

LEB97/001/1048/HM

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

TOKTEN

07 November,1997

TOKTEN Mission Report : Feasibility Study to install a Secondary Package Wastewater Treatment Plant for the region of Becharrey

Dear Mr. El-Jisr,

I have the pleasure to enclose, for your information, the TOKTEN Feasibility Study on " *Installment of a Secondary Package Wastewater Treatment Plant- Becharrey* ". Mr. Imad Abou-Dargham, a Lebanese expatriate residing in Florida/USA, undertook the TOKTEN consultancy mission upon the request of the Council for Environmental Protection of Becharrey, from July 22nd up to August 14th ,1997.

The main objective of this study is to determine the most cost effective means to provide the Kannoubin Valley with a secondary treatment facility and to develop capital costs for each alternative and to recommend the most effective alternative. Investigations were made on site and upon consulting with officials at CDR and the Ministry of Electricity & Hydraulic Resources as well as with private consulting firms and manufacturer's representatives in Lebanon, it was recommended that at least two facilities should be constructed in the Valley to treat wastewater and improve the water quality of the streams and waterways . Figure 3-1 presents the process flow shematic of the recommended alternative. The construciton cost of two 0.5 MGD packaged facilities is presented in Chapter 2.

Hoping the findings of the report would be of interest for your future projects.

Kind regards.

Sincerely Yours,

Ross Mountain

Resident Representative

Mr. Nabil El-Jisr
President
C D R
Beirut-

cc: Mr. Boutros Labaki, Vice President, CDR ; Mr. Nouhad Baroudi, Vice-President, CDR
Mr. Ghassan Siblani, CDR/UN Co-ordinator. Mr. Charafeddine, Environment Section / CDR

Encl: TOKTEN Report : *Feasibility Study to install a Secondary Package Wastewater Treatment Plant- Becharrey*

RESUME FOR

ALEX L. MONROE, P.E.

EDUCATION:

M.S., Engineering, University of North Carolina at Charlotte, 1987.
B.S., Engineering, University of North Carolina at Charlotte, 1978.

PROFESSIONAL EXPERIENCE:

APRIL 1996 - PRESENT:VICE PRESIDENT, GLOBAL ENGINEERING INCORPORATED, SARASOTA, FLORIDA.

Responsible for supervision of engineering staff in the areas of engineering evaluation and design and construction management. Business development activities include client contact, strategic planning, proposal preparation, project cost determination, presentations, contract negotiations and representing the firm at industrial, municipal and professional conferences. Specialist in wastewater treatment, air pollution and landfill design. Project activities have included:

RECENT EXPERIENCE

- Lee County, Florida - Annual Bondholders Report.
- Sarasota County, Florida – Design of four pumping stations that comprise the Longwood-Meadowood wastewater transmission system to the County's Bee Ridge Regional Wastewater Treatment Facility.
- Lee County, Florida – Ballard Road Pumping Station 11M Retrofit and slip-lining of 7,500 feet of 42 inch diameter gravity sewer interceptor.
- Sarasota County, Florida – General Reuse Permit for the South County area of Sarasota County.
- Sarasota County, Florida – Preliminary Engineering and development of a Wastewater Master Plan for the North County area.
- Sarasota County, Florida - Expansion of the Central County Regional Wastewater Treatment Plant from 2 to 4 MGD and add biological nitrogen removal. Also evaluated future requirements to expand the facility to 8 MGD.
- Sarasota County, Florida - Reclaimed water reuse master plan for the Venice Gardens Area of South Sarasota County.
- City of Punta Gorda, Florida - Evaluation of emergency water supply for the City of Punta Gorda.

- City of Bedford, Bedford, Virginia - Evaluation and implementation of a pretreatment program for the City's POTW.

- City of Danville, Danville, Virginia - Computer modeling of VOC emissions from the City's 24 MGD pure oxygen WWTP to determine the need to file for a Title V air Permit. Also performed odor evaluation of facility's lime stablized sludge.

- City of Bedford, Bedford, Virginia - Wastewater Treatment Plant evaluation that included ammonia source wastewater, pilot plant simulation of activated sludge and biotower system, and an expansion study to determine solutions to allow the POTW to meet the requirements of its new VPDES permit.

- City of Bedford, Bedford, Virginia - Comprehensive sludge generation and disposal study.

- Augusta County Service Authority, Verona, Virginia - Performed systems integration and construction management of a 110 site SCADA system for the Authority using Wonderware as the systems software control. Also evaluated point-to-point, multiple address and frequency hopping (spread spectrum) radio systems.

- Town of Culpeper, Culpeper, Virginia - Sewer capacity study using computer models to evaluate and determine capacity of existing wastewater collection system and improvements needed to allow additional sewer flow.

- Hickson DanChem Corporation, Danville, Virginia - Performed characterization of organic and inorganic process waste streams for the OCPSF specialty chemical manufacturer. Also designed system to separate organic OCPSF flows from inorganic flows. Currently evaluating treatment technologies to determine the most cost effective pretreatment system for the specialty chemical manufacturer.

- City of South Boston, Virginia - Performed a needs study to determine the optimum method to upgrade and expand the City's wastewater treatment plant to meet its new NPDES permit. Also designed an upgrade of the facility to comply with a Consent Order to provide an upgrade of the chlorination/dechlorination system and replace the existing mechanical aerators with fine bubble diffused aeration.

- SEACO, Inc., Ridgeway, Virginia and Lenoir, North Carolina - Currently performing a treatability study to determine the optimum pretreatment system to reduce organics from urea based formaldehyde and polyvinyl acrylic adhesives. The evaluation will also determine the optimum system needed to provide water reuse.

- Mitsubishi Kasei Virginia, Chesapeake, Virginia - Performed evaluations to prepare air permit and pretreatment permit for their organic coating facility located in

Chesapeake, Virginia. Air permit evaluated both Catalytic and fume incineration of the coating facility's solvent air emissions.

- City of Bedford, Virginia - Currently performing a treatability study to determine the source and method to reduce influent ammonia concentrations to less than 1.3 mg/l and evaluating and preparing sludge management plan for the City's water and wastewater treatment plants. Also assisting City with establishing a pretreatment system.

- Warner Lambert, Inc., Fajardo, Puerto Rico - Performed treatability study and prepared engineering study to modify current pretreatment system to meet stringent limits from the Puerto Rico Aqueduct and Sewer Authority. Evaluated Reverse Osmosis, activated sludge, reactivator clarification, pH adjustment, Chemical addition for metals removal and carbon adsorption for color and MBAS removal.

- City of Radford and Pulaski County, Virginia - Land application of alum sludge at the New River Valley Airport. Prepared separate permits to land apply alum sludge from the entities respective water treatment plants. Supervised all engineering and geological tasks required to prepare and submit permits including an operations plan for the land application site.

- City of Radford, Virginia - Prepared a new NPDES permit application for the City's water treatment plant.

- Quadrex Corporation, Floyd, Virginia - Assisted Quadrex Corporation with preparation and submission of an air permit for their Ethylene Glycol recycling facility. Prepared and implemented a baseline air sampling program to determine if their facility was in violation of Title I of the Clean Air Act. The baseline air sampling program was performed at selected locations along the facility's property line.

- Corning Incorporated, Blacksburg, Virginia - Assisted Corning with determining their current emissions from their kilns, impact of emissions concerning the Clean Air Act and determining alternatives to use waste heat from their stacks inside their facility. This included waste heat boilers and air to air heat exchangers.

- Louisiana Pacific (LP), Chetwynd, British Columbia - Assisted LP with pretreatment of mill effluent prior to going to freeze crystallization for treatment and reuse in the chemical/mechanical/thermal pulping mill. Developed alternatives to reduce hardness, color, and removal of charged long chain fatty acids that caused plating problems in the freeze system and black liquor concentrate evaporators.

- Australian Paper Manufacturers (APM), Gallup, New Mexico - Assisted APM with determining biological treatment system, filtration and systems to further reduce waste loadings from a recycle paper mill. The final system allows APM to reuse mill effluent in the paper recycle facility.

- Somerset Fiber, Cowpens, South Carolina - Assisted Somerset Fiber with evaluating and designing an interim and long term wastewater treatment system to allow Somerset Fiber to meet its pretreatment permit requirements. Tasks included operating bench scale bioreactors and defining process improvements needed to allow reuse of mill effluent.

SOLID WASTE

Directed staff that designed the following landfills:

- Roanoke County, Smith Gap Regional Landfill, Roanoke County, Virginia
- Roanoke Valley Regional Solid Waste Management Board Landfill, Roanoke County, Virginia
- Ingles Mountain Landfill, Southern Expansion, New River Resource Authority, Radford, Virginia
- Matson Properties Regional Landfill, New River Resource Authority, Radford, Virginia
- CaseLin Systems, Medical Waste Incinerator, Bland County, Virginia
- Page County Regional Landfill, Page County, Virginia
- Design of a full service environmental laboratory for Pasco County, Florida
- Septage and sewer rate charge evaluation for the Tampa Sewer Department
- Evaluated means to treat septage and grease trap waste at the City of Tampa's Hookers Point wastewater treatment plant. Other tasks included evaluation of the current user charge formula of the City's sewer department
- Preliminary design of the Central Transfer Station for Seminole County, Florida, consisting of the preliminary design of a 3,000 ton/day, open top, solid waste transfer station; performed sizing of the facility, evaluating building materials, evaluation of environmental factors such as odor, noise levels, dust and aesthetics, construction cost, outline of contract documents, and basis of design memorandum
- Evaluation of iron removal from landfill leachate for Boone, North Carolina
- Evaluation of leachate from industrial landfill, PPG Industries, Lexington, North Carolina

Directed staff that prepared quarterly and annual ground water reports and site characterization studies for the following clients:

- Pneumo Abex Corporation - Industrial and RCRA Landfills
- Georgia Pacific - Industrial landfill siting, fuel oil leak and Part A and Part B for new landfill
- Tarmac Lonestar (Roanoke Cement) - Annual ground water report
- New River Resource Authority - Permitting for Ingles Mountain Debris and Sanitary Landfills and annual ground water reports
- Patrick County, Virginia - Ground water monitoring
- Bath County, Virginia - Ground water monitoring

- Roanoke County, Virginia - Ground water monitoring
- Roanoke Valley Regional Solid Waste Management Board, Roanoke County, Virginia - Ground water monitoring
- Clifton Forge, Virginia (UST Project) - Site characterization report
- Scott County, Virginia - Ground water monitoring
- Boones Mill Gasoline Spill - Site characterization report for gasoline spill from tanker truck wreck
- Roanoke Gas - Site characterization report for diesel fuel leak
- W. W. Boxley (Blue Ridge Quarry and Asphalt) - Site characterization report for MEK, TCE, Carbon Tetrachloride, gasoline, diesel fuel and fuel oil contamination

AIR POLLUTION

Initiated an air pollution group that prepared modeling protocols and directed a staff that performs sampling and analysis of air emissions for all types of industries using Screen, ISCST or Complex I air dispersion models developed by EPA and investigate sick building syndrome. Projects include:

- CaseLin Medical Incinerator, Bland County, Virginia - Directed dispersion modeling to obtain an air permit for an 80 ton/day commercial medical waste incinerator.

- Unimed Medical Waste Incinerator, Richmond, Virginia - Directed dispersion modeling to obtain an air permit for a commercial medical waste incinerator.

- Magnox Incorporated, Pulaski, Virginia - Directed compliance air sampling, air sampling to determine baghouse efficiency, evaluation of air pollution control equipment, dispersion modeling, negotiations with State concerning consent order and preparation and submission of an air permit application.

- Wolverine, Blacksburg, Virginia - Directed indoor air sampling efforts to determine if organic vapors were causing medical vapors in the manufacturing area.

- Poly-Scientific, Blacksburg, Virginia - Directed indoor air sampling efforts to evaluate employee complaints concerning odor problems.

- Corning Glass, Blacksburg, Virginia - Directed efforts to characterize dust particles from baghouses and perform air sampling of baghouses.

- Intermet Foundry, Radford, Virginia - Ongoing project that is concerned with assisting Intermet with obtaining an air permit. This is a potential PSD permit situation.

- Mohawk Tire and Rubber, Roanoke, Virginia - Assisted with air sampling of hot rubber lines to determine concentrations of VOCs emitted from these lines. Potential PSD project.

- Acadia Polymers, Roanoke, Virginia - directed air sampling of air pollution control equipment.

PRIOR EXPERIENCE

JULY 1990 - APRIL 1996: VICE PRESIDENT AND DIRECTOR OF ENGINEERING, OLVER INCORPORATED, CONSULTING ENGINEERS, BLACKSBURG, VIRGINIA.

1989 - 1990: PROJECT MANAGER, HAVENS AND EMERSON, TAMPA, FLORIDA.

1988 - 1989: PROJECT MANAGER, KNEPPER AND WILLARD, INC., TAMPA, FLORIDA.

1986 - 1988: PROJECT ENGINEER, BLACK AND VEATCH, INC., TAMPA, FLORIDA, AND ASHBORO, NORTH CAROLINA.

1978 - 1986: PROJECT ENGINEER, HDR, INC., CHARLOTTE, NORTH CAROLINA.

PROFESSIONAL REGISTRATION:

Professional License, Commonwealth of Virginia
Professional License, State of Florida
Professional License, State of North Carolina
Professional License, State of South Carolina
Professional License, State of Tennessee

PROFESSIONAL AFFILIATIONS:

American Academy of Environmental Engineers (AAEE), Diplomate
American Water Works Association (AWWA), Member
Water Environment Federation (WEF), Member
Southeastern Deslating Association (SEDA), Member

PUBLICATIONS:

"Corrosion Control Studies for Water Distribution Systems", presented at the Annual Meeting of the North Carolina AWWA/WPCA at Pinehurst, North Carolina, November, 1987.

"Direct Discharge of Water Plant Sludge", presented at the North Carolina AWWA/WPCA Annual Meeting, Charlotte, North Carolina, November 1985.

"I/A Case History: Pilot Mountain Water Pollution Control Facilities", presented at the Triangle Conference, Duke University, Durham, North Carolina, June, 1982.

"Vacuum Assisted Sludge Dewatering", presented at the University of Florida, June, 1981.

"Secondary Fiber Removal from Recycled Paper Mill Waste", TAPPI Conference, New Orleans, Louisiana, 1986.

"Case History: Using Membrane Technology to Achieve NPDES Permit Limits for a Mixed Bag Pharmaceutical Plant in Puerto Rico", Presented at the American Desalting Association's Biennial Conference at Palm Beach, Florida, September, 1994.

"Biological Nutrient Removal in Florida: Case Histories", Presented at Biological Wastewater Treatment Fundamentals and Modeling Symposium, hosted by VPI & SU at Roanoke, Virginia, September 29 through October 2, 1996.