

Rose Hall Sewage Treatment Facility Public Consultation

1.0 Purpose

This document incorporates a report on the public consultation requested for the proposed Rose Hall Sewage Treatment Facility, which was held on June 30th at the Wexford Court Hotel, in Montego Bay.

An application for the Sewage Treatment Facility was submitted by the Rose Hall Utility Company to the National Environment and Planning Agency (NEPA) in January 2004. NEPA conducted an Environmental Screening of the project and based on the results of this Environmental Screening, NEPA requested the Rose Hall Utility Company, by letter of March 8, 2004 (Appendix I), to conduct a Public Presentation of the project and to submit a report on this presentation to them.

2.0 Background

The development of Rose Hall Estate, east of Montego Bay in the Parish of St. James, was started several years ago and has included the completion of Spring Farm (housing) Estate, the Holiday Inn Hotel, the restoration of the Rose Hall Great House, The Palms (condominium), the Wyndham Hotel and the Wyndham Golf Course, Rose Hall Beach Club, the Highlands Housing Estate, Ritz Carlton Hotel and the White Witch Golf Course. Rose Hall Developments Ltd. entered into an agreement with the Government of Jamaica to implement a phased development plan with specific benchmarks.

The company produced a Master Plan which includes residential units, recreational areas (including two golf courses), green areas and commercial uses.

A Strategic Environmental Assessment of the Rose Hall Developments Ltd. Master Plan was requested by NEPA. This was conducted by Environmental Solutions Ltd and submitted to NEPA in May 2004.

During the operation of the various components of the proposed development, sewage will be treated through a new facility to be established by the Rose Hall Utility Company. The treated effluent from the wastewater treatment facility would be pumped into an irrigation distribution system for beneficial reuse and sale to customers as irrigation water. It is estimated that the daily average flow from the existing hotels, resorts, and commercial establishments would be 350,000 gallons per day with a potential future flow of 1,000,000 gallons per day.

The wastewater treatment facility would be an extended aeration system which has benefits of ease of operation and maintenance, more capable handling of spikes in flow and contents and less generation of solids. The company would build operate and maintain a wastewater collection forcemain which would extend along the eight mile stretch of coastal highway (Appendix IV). A Public Hearing for this facility was held on Wednesday June 30, 2004 at the Wexford Court Hotel in Montego Bay.

2.0 Information Dissemination

Information on the Public Consultation was disseminated by the following means:

2.1 Letters of Invitation

Individual letters of invitation were sent to several persons, agencies and organizations, and included stakeholders. A list of invitees and the letter of invitation are given in Appendix II.

2.2 Advertisements in the print and electronic media

Advertisements for the meeting included the following:

- ✓ The Sunday Gleaner June 27, 2004 and The Daily Gleaner Wednesday June 30. A sample of the newspaper advertisement is given in Appendix III)
- ✓ Posting on the website of NEPA

2.3 Distribution of Flyers

Flyers were prepared and distributed to several organizations, agencies and individuals including NEPA, local communities, St. James Parish Council and Montego Bay

Chamber of Commerce. The flyers were the same format as the newspaper advertisements.

3.0 The Public Consultation

3.1 Date, Venue and Programme

The Public Consultation was held on Wednesday June 30, 2004 from 5:30 - 7:30 p.m. at the Wexford Court Hotel in Montego Bay. The session was chaired by President of the Montego Bay Chamber of Commerce, Mr. Winston Dear. The agenda for the meeting is given in Appendix IV.

The meeting was fairly well attended with at least 50 persons. Registration sheets were provided and are given in Appendix V.

Presentations were given by Mrs. Eleanor Jones on the SEA of the Master Plan (Appendix VI) and by Mr. Tim Pringle of Jordan, Jones and Gouling Engineers, on the details of the Sewage Treatment Facility. Details on the engineering aspects of the treatment are given in Appendix VII.

3.2 Question and Answer Session

The main issues raised in the Question and Answer Session are presented below:

Omar Dixon, Assistant Secretary of White House Fishing Co-operative	Q	When will the project (sewage plant) be started and finished
Tim Pringle, Jordan, Jones, Gouling	A.	Construction will start by the end of 2004, coinciding with completion of Iberostar.
	Q	Would it be suitable to construct the plant during hurricane season, i.e. will ponds flood?
Eleanor Jones, Environmental Solutions Ltd.	A	Seasons will be considered, silt screens for run off and retention ponds to reduce impact on coastal zone have been recommended. Collection point on highway will be built before the plant. Coincide pipe - laying with construction of NCHIP.
	Q	Will trees be removed for pipe- laying
Pringle & Jones	A	Trees may be removed as it is a major construction, but few if any will be removed as pipes are laid along the road. Also, only small diameter trees will be removed. Recommendations are that larger ones will be flagged and a penalty

		imposed for clearance.
Andrew Ross, Mobay Marine Park	Q	Is there a contingency plan for dams overflowing?
Pringle	A	There is an overflow system already in place
	Q	What is the retention time in lake?
Pringle	A	Depends on how many customers come on line
	Q	Time retention of plant?
Pringle	A	24 hours
	Q	Will identification occur?
	A	Yes
	Q	Will the water held in the pond be gray water? Will it affect the grass on the golf course? (sediments)
Pringle	A	Won't have harmful effects on the golf course.
	Q	Will it smell?
Pringle	A	Yes, but this type of plant doesn't have much problem.
	Q	Tile Fields and septic systems in residential areas?
Jones	A	Sewage plant will not take waste from residential areas, these have waste accepted by discrete units.
	Q	Why won't they be involved in the system
Jones	A	The design preceded the development of the sewage plant and topography of the area would be a major challenge for central collection.
	Q	Will existing pipes be used?
Pringle	A	Majority will be new pipes for mains.
	Q	What was previous permit gotten for?
Jones	A	Parcel O.
	Q	Will new golf courses be built?
Jones	A	Yes
	Q	What is the likely source of pollution in coastal water?

Jones	A	Gullies and rivers, possible golf course fertilizer. Treated water from sewage plant used for irrigation, should reduce coastal pollution, and may reduce fertilizer use on golf course.
	Q	Will there really be less artificial fertilizer application?
Stanley Nansen, Rose Hall Developments	A	Yes, that is a reality
Winston Dear	A	Other hotels have inefficient plants to treat sewage, so this plant will help.
	Q	Are you missing the eco zones if trees only associated with gullies
Jones	A	All other areas between will remain forested as will slopes south of the golf course and development.
Bobby Miller, Bio-GT Sanitation Soc. Ltd.	Q	Will plants be able to accommodate septage from haulage contractors and organic waste?
Pringle	A	Not right now, there are limitations to the chemistry of pretreatment.
	Q	Will 1-million gal capacity accommodate all Rose Hall?
Pringle	A	Currently yes, and it has additional capacity. Plant can also be expanded
Noel Whyte, N.O. Whyte & Associates Ltd.		Treatment plant has many positives- good because of central collection, treatment and reuse of sewage. Other small plants at hotels now old and inefficient.
Whyte	Q	What time span for bridges?
Stanley Consultants Ltd.	A	There are no bridges on highway, only culverts.
Kerry Thomas, West Indies Home Contractors	Q	Pretreatment required at hotel. Will housing scheme near Rhyne Park be able to use the sewage treatment plant?
Pringle	A	There would have to be pretreatment also restrictions- no grease, petroleum, gas. Matter can be discussed.
	Q	How will hotels comply with the restrictions?
Pringle	A	Wet well present, and grease traps cleared often.

Mark Riley, NWC	Q	Nutrient retainment in soil and levels of nutrients in run-off from irrigation will need to be assessed. Has consideration been given to effects of structure of plant and sea spray affecting it? How will plant be affected from the ocean being so close?
Pringle	A	We will look at sea sprays, probably need buffer zone (100-200 ft.) around plant, erosion control and silt fencing during construction.
Andrew Ross	Q	All water will go to holding lakes and will treated water have a smell?
Pringle	A	Yes, initially to one lake, then very little smell
Troy Jumpp, White House White Sands	Q	What acreage of trees will be removed and how big is the plant?
Pringle	A	Plant is 1 ¹ / ₂ acres; plant has lot of benefits, outweighing other negative issues.
	Q	Risky to do construction this time of year. During construction of golf course, dams overflowed to sea. What impacts will be caused by nutrient leaching to sea?
Pringle	A	Sewage will be treated to higher level, treated in central area, will be better treatment than presently in lagoons.
Omar Dixon, White House Fish Co-operation	Q	What about monthly monitoring, because no one monitors the UDC ponds at Rose Hall?
Dear	A	That one will be abandoned, NWA will monitor the new one
Pringle		Plants typically monitored once a day- flow, BOD, COD- it is standard practice.
		Rose Hall Utilities would not put harmful sewage on their golf course, so would monitor effluent.
Desmond Clarke, St, James Health Dept.		All plants are monitored and must meet standards by NEPA and Ministry of Health. Health dept. monitors and checks on monitors. (Comment)
Andrew Ross, Mobay Marine Park	Q	In case of emergency, will there be pipe or culvert/ ditch to sea.
Pringle	A	We haven't taken this into consideration but these plants are reliable.
Patroy Forbes NEPA	A	Condition of NEPA sewage permit- must have stand by generator and stand by pump.

**APPENDIX I
LETTER OF INVITATION
AND LIST OF INVITEES**



INVITATION TO PUBLIC MEETING

Rose Hall Sewage Treatment Facility

In keeping with the requirements of the National Environment & Planning Agency (NEPA), Environmental Solutions Limited (ESL) will be making a presentation on the Environmental Considerations of the Rose Hall Sewage Treatment Facility.

The presentation will be held at Wexford Court Hotel, Gloucester Avenue, Montego Bay on Wednesday, June 30, 2004 between 5.30 and 7.30 p.m.

You are cordially invited to participate in the discussion following the presentation.

We do hope you will be able to attend.

Yours truly,

ENVIRONMENTAL SOLUTIONS LIMITED

A handwritten signature in blue ink, appearing to read "Eleanor B. Jones", is written over a light gray rectangular background.

Eleanor B. Jones

INVITATION LIST

Ms. Wendy Lee Northern Jamaica Conservation Association P.O.Box 212, Runaway Bay St. Ann	Tel./Fax 973-4305 Email: NJCA@anngel.com.jm
Ms. Jill Williams Montego Marine Park	940-0659
St. James Parish Council	952-4066
President, Jamaica Hotel & Tourism Association, Montego Bay Chapter	952-0816
President Montego Bay Chamber of Commerce and Industry	952-2784
Manager Ritz Carlton Hotel	953-8981
Community Associations - Mount Zion - Ironshore - Spot Valley (Note: ask Mr. Campbell for names and numbers of associations)	Sent batch of notices to Mr. Nansen
Manager Wyndham Rose Hall Hotel	953-2617
Urban Development Corporation Kingston	
National Works Agency	940-7973
Northern Coastal Highway - Stanley Consultants	973-9380
Manager – JPSCo.	940-4454
Manager – NWC	
Manager – C&W Ja. Ltd.	
Manager Sea Castles	
Half Moon Hotel	953-2222

Sangsters Airport Airports Authority	
Iberostar	
Holiday Inn /Sunsree Resort	953-9480
Mr. F. McKnight North Coast Times	
Gleaner Western Bureau	
Radio Jamaica	952-8093
Jamaica Information Service	
N. O. White & Associates Ltd. Shop 19, Montego Freeport Shopping Centre Montego Bay St. James	684-9548

APPENDIX II
GLEANER ADVERTISEMENT AND FLYER

**NOTIFICAT
ION OF
PUBLIC
MEETING**

**APPENDIX IV
AGENDA**

ROSE HALL SEWAGE TREATMENT FACILITY

PUBLIC HEARING

Wednesday, June 30, 2004

AGENDA

Moderator: Winston Dear, President, Montego Bay Chamber of Commerce and Industry

- 1. Rose Hall Developments – Environmental Considerations - Eleanor Jones, Managing Director, Environmental Solutions Limited.**
- 2. Rose Hall Sewage Treatment Facility – Rose Hall Utility Co. Ltd.**
- 3. Questions from the Floor**
- 4. Closing Remarks – Moderator**

**APPENDIX V
SIGN IN SHEETS**

GUEST BOOK

PUBLIC HEARING

**ROSE HALL SEWAGE TREATMENT
FACILITY**

HELD ON JUNE 30, 2004 AT 5.30 P.M.

AT

**WEXFORD COURT HOTEL
GLOUCESTER AVENUE
MONTEGO BAY**

NAME	COMPANY/AFFILIATE & ADDRESS	CONTACT INFORMATION	COMMENTS/ FOLLOW UP
DESMOND CLARKE	ST. JAMES HEALTH DEPARTMENT	979 7820-4	fax 979 7802
CONRAD SPENNER	WYNDHAM ROSE HALL RESORT	953-2650	
Nilevil Hensling	Wynndham Rose Hall	953-2650	
RICHARD WHITE	NO. WHITE AND ASSOCIATES	884-9545	
ROBERT MILLER	BIO-GT SANITATION SOC. LTD.	952 3107	EMAIL - 706willis@home.com Fax 876-9178057
TIM PRINCE	JORDAN, JONES CONSULTING	845-946	TPAryle@JJC.COM Fax 876-966-1099
KERRY THOMAS	WEST FRIES HOME CALL. WITH CON	953-605	Kerry@witcon.com
WINSTON DEAR	Montego Bay Chamber of Commerce & Industry	368-909	WINDEAR@cajama.com
OMAR DIXON	ASS. SEC. WHITE HOUSE FISH COOP	979 8852	
TROY JUMPP	White House White Sands	358-6415	
Charl JUMPP	Fish FOLKS Co-op water	840-5698	
Andrew ROSS	Montego Bay Marine Park	363-8850	
Athena Williams	Montego Bay Marine Park	458-8734	
W. S. NYROP	Stanley Consultants Inc.	973-2407	
K. KUTSEY	Stanley Consultants Inc.	973-2577	
S. GREEN	NGPA	754 7540	
Pedry Foster	NEPA	754-7540	pfoster@nepa.gov.jm

APPENDIX VI

**STRATEGIC ENVIRONMENTAL ASSESSMENT
POWERPOINT PRESENTATION**

**APPENDIX VII
SEWAGE TREATMENT PLANT**

PRELIMINARY ENGINEERING REPORT

**ROLLINS JAMAICA, LTD
WASTEWATER COLLECTION, TREATMENT & IRRIGATION
DISTRIBUTION SYSTEMS
ROSE HALL, JAMAICA**

INTRODUCTION

Rollins Jamaica, LTD is looking to construct and operate a wastewater collection, treatment & irrigation distribution system in Rose Hall, Jamaica (Figure 1). The following report gives a basic outline description of the three major components to the total system. Each of the three sections will contain estimated construction costs, operation and maintenance costs. A final section will provide an analysis of the costs versus the potential revenue from the collection and treatment of the wastewater and distribution of beneficial reuse water for irrigation.

The Rose Hall Plantation is located on the north coast of Jamaica between Montego Bay and Falmouth. Rose Hall includes an eight-mile stretch of beachfront on the Caribbean Sea along the Coastal Highway and rises into the adjacent hills. Currently, several hotels and resorts are located on the shore including the Ritz Carlton, Holiday Inn, Half Moon Hotel, Wyndham Hotel, and Sea Castle. The Wyndham Golf Course, Ritz Carlton Golf Courses and the Half Moon Golf course are located within Rose Hall. The community of Lillipun lies in the eastern end of the eight-mile stretch. The beachfront has a number of developable sites for future hotels, resorts, and commercial property.

Many of the existing hotel and resort properties have individual package wastewater treatment systems. These systems are in need of repair and/or expansion.

Rollins Jamaica, LTD has developed a water supply and distribution utility from various wells located in the hills above the coast. The water from the wells is stored in storage tanks and reservoirs also built by Rollins Jamaica, LTD.

As an additional utility to the water utility, Rollins Jamaica, LTD plans on building a wastewater collection, treatment, and irrigation distribution system. The treated effluent from the wastewater treatment facility would be pumped into an irrigation distribution system for beneficial reuse and sale to customers as irrigation water. It is estimated that the daily average flow from the existing hotels, resorts, and commercial establishments would be 350,000 gallons per day with a potential future flow of 1,000,000 gallons per day. The Rollins Jamaica, LTD would build, operate, and maintain a wastewater collection forcemain. The forcemain would extend along the eight-mile stretch of Coastal Highway. The wastewater customers would pump wastewater from a pump station that would be owned and operated by the customer into the forcemain to the

proposed wastewater treatment facility. The wastewater treatment facility would be located near the middle of the development, along the Coastal Highway, across from existing wastewater treatment lagoons.

The wastewater treatment facility would be an extended aeration system. The benefits of an extended aeration system include: ease of operation and maintenance, more capable in handling spikes in flow and contents without upsetting the biological treatment process than other types of treatment systems, and less solids generated that require disposal.

The effluent from the treatment facility would be collected in a basin where it would be pumped into a pressure distribution system for beneficial reuse as irrigation water. Rollins Jamaica, LTD would sell the effluent to the various hotels, resorts, and commercial properties along the Coastal Highway. The excess irrigation water not consumed would be stored in a reservoir located on the adjacent hillside. The stored water would be repumped into the system during peak usage.

COLLECTION SYSTEM

Wastewater flows will be pumped into a pressurized force main. These flows will be monitored through the use of Mag Meter devices at each customer's discharge point. The wastewater collection system has been designed such that it is capable of handling flow simultaneously from all discharge points. The pump rate peaking factor will be based upon the size of each customer's wet well and its capacity to equalize flow. For the calculations, a peaking factor of 1.5 has been assumed. Discharge points will be from pumping stations, which will be later specified by Rollins Jamaica, LTD, and shall be purchased and maintained by each wastewater customer. These stations shall be submersible or suction lift package stations capable of operating within a hydraulic head range of 4.5 to 43 feet. The stations shall be duplex stations outfitted with level sensing alarms and incorporate an odor control system. The majority of each station shall be below ground with the exception of any necessary above ground appurtenances. It is recommended that these stations be supplied with an appropriate source of backup power in the event of a power loss. A typical layout of these stations can be viewed in Figure A.1 in Appendix A.

The collection system will consist of approximately 42,240 liner feet of 4-inch, 6-inch, and 8-inch PVC pipe. Construction costs assume that all road crossings will be bored with casing installed. All roads/driveways that are open cut shall be backfilled entirely with stone and returned to their previous state. Stream crossings are assumed to incorporate Best Management Practices (BMP) in order to minimize the effects of storm water runoff into streams. All installation shall be performed in accordance with local utility construction standards.

The table below outlines the estimated costs for construction of the collection system. All costs include materials and labor necessary for installation as well as all miscellaneous appurtenances. A more detailed cost summary can be viewed in the Table A.2 in Appendix A.

TABLE 1

ITEM	COST
4-inch PVC	\$130,459
6-inch PVC	\$540,446
8-inch PVC	\$305,250
TOTAL COST	\$976,155

All costs in US Dollars

IRRIGATION SYSTEM

Due to the high quality of treatment at the wastewater treatment facility, the treated effluent from the plant will be made available to surrounding facilities to provide irrigation. This will provide a beneficial system for the reuse of the water as well as an additional source of revenue for Rollins Jamaica, LTD.

The primary design of the irrigation system is to utilize the effluent discharge from the plant for irrigation. A 90 horsepower booster station located at the wastewater treatment facility will pump the effluent into the system. Effluent from the wastewater treatment facility, not immediately consumed for irrigation will be discharged and stored in two reservoirs, Stable Lake and Nursery Lake. During times of peak irrigation demand any necessary additional irrigation water will be supplied from a booster station located near Stable Lake or supplied by gravity from Nursery Lake.

Stable Lake is a man-made reservoir located approximately 3,000 feet south of the Coastal Highway. The lake is situated at an approximate elevation of 165 feet MSL and has a storage capacity of 25 million gallons. Water will be pumped to the top of an earthen dam and drawn off the bottom through a 10 horsepower booster station.

Nursery Lake is a man-made reservoir located approximately 5,500 feet south of the Coastal Highway. The lake is situated at an approximate elevation of 455 feet MSL and has a storage capacity of 33 million gallons. Water will be pumped into the lake and then supplied to the system through gravity feed.

The booster stations located at the Stable Lake and the wastewater treatment facility, as well as the hydraulic head produced at Nursery Lake, will be capable of maintaining an average minimum static pressure in the system of 45 psi. Construction of the waterline will consist of approximately 53,240 linear feet of 6-inch and 12-inch diameter PVC pipe as well as all necessary appurtances. Rollins Jamaica, LTD will provide the necessary taps to the irrigation main and set the necessary meters. It will be the responsibility of the irrigation customer to connect to the meter.

Construction costs assume that all road crossings will be bored with casing installed. All roads/driveways that are open cut shall be backfilled entirely with stone and returned to there previous state. Stream crossings are assumed to be done with Best Management Practices (BMP) in use to minimize the effects of storm water runoff into streams. All installation shall be performed in accordance with local utility construction standards.

The table below outlines the estimated costs for construction of the collection system. All costs include materials and labor necessary for installation as well as all miscellaneous appurtances. A more detailed cost summary can be viewed in the Table A.2 in Appendix A.

TABLE 2

ITEM	COST
6-inch PVC	\$677,180
12-inch PVC	\$780,487
90hp Duplex Booster Station w/ backup generator	\$214,000
10hp Duplex Booster Station w/ backup generator	\$53,500
TOTAL COST	\$1,725,167

All costs in US Dollars

WASTEWATER TREATMENT SYSTEM

The Plant is 1.0 million gallon per day (mgd) Extended Aeration Wastewater Treatment Plant. The proposed location of the Plant is south of the current wastewater lagoons located on the Coastal Highway (Figure 2). A Site Plan of the Plant is shown on Figure 2.

The Basis of Design for the Plant is based on the following criteria:

Influent Characteristics

- Average Design Plant Flow - 1.0 mgd
- Peak Flow - 2.5 mgd
- Influent BOD₅ - 280 mg/l
- Influent TSS - 250 mg/l
- Influent NH₃-N - 20 mg/l
- Influent Phosphorus - 8 mg/l
- Wastewater Temperature - 20°C

- Altitude - 100 feet
- Alpha Coefficient - 0.85
- Beta Coefficient - 1.0

Number of Reactors	-	2
Reactor Dissolved Oxygen	-	2.0 mg/l

Effluent Requirements

BOD ₅	-	30 mg/l
TSS	-	30 mg/l
NH ₃ -N	-	1 mg/l
Phosphorus	-	1 mg/l

Jamaica National Sewage Effluent Standards

BOD ₅	-	20mg/l
TSS	-	30 mg/l
Nitrates (as Nitrogen)	-	30 mg/l
Phosphates	-	10 mg/l
COD	-	100 mg/l
PH	-	6-9
Fecal Coliform	-	1000 MPN/100 ml
Residual Chlorine	-	1.5 mg/l

The eight major components of the Plant are described below:

- 1) Micro Strainer Screen – Untreated waste enters the Plant at the Micro Strainer Screen (Screen) where plastic, rags, paper, and other nuisance items are separated from the waste stream by the Screen (see Figure 2, #1). The Screen contains a screw conveyer that removes the nuisance solids from the wastewater to a separate discharge point for removal and disposal. The Screen has 1/4 –inch openings with a head loss of 6 inches at peak flow. The Screen is equipped with an emergency bypass.
- 2) Anaerobic Reactor – The wastewater enters the Anaerobic Reactor (Reactor) where phosphorus is removed. The phosphorus removed from the wastewater is incorporated into the sludge mass (see Figure 2, #2). Submersible mixers within the Reactor keep the wastewater mixed while maximizing anaerobic conditions. The reactor is divided into 3 chambers allowing for greater flexibility in series or parallel operation. The waste stream leaves the Reactor through slide gates and flows into the Oxidation Ditches. The Reactor has a hydraulic detention time of 1.5 hours at 1.0 mgd. The total volume of the Reactor is 62,000 gallons.
- 3) Oxidation Ditches – The waste stream enters the two-Oxidation Ditches (Ditches) where oxygen is added to the wastewater (see Figure 2, #3). Each Ditch contains two large rotors, which oxygenate the wastewater in each ditch, resulting in denitrification. Denitrification removes nitrogen from the wastewater. The Oxygen Ditches can be operated in parallel or series depending on the flow conditions.

A loading rate of 14.0 lbs of BOD₅/1,000 cubic feet at average design conditions was utilized to provide a hydraulic detention time of approximately 21.3 hours in each of the two Ditches. The average loading of 200 mg/l BOD₅ and 20 mg/l NH₃-N was selected for the design. To meet oxygen conditions requirements for a standard oxygen requirement of 103.2 lbs of oxygen per hour was selected for each reactor. This is based upon a BOD₅ removal of 1.5 lbs of O₂/lb BOD₅ and oxygen requirement for nitrification of 4.6 lb O₂/lbNH₃-N. The actual oxygen requirement was then converted to standard conditions. The total daily oxygen requirement is 4,955 lbs/day. Volume of each Ditch is 444,298 gallons.

- 4) Clarifiers – The waste stream enters the clarifiers where the solids are segregated and removed from clarified effluent (see Figure 2, #4). The decanted effluent leaves the Clarifiers and enters Pump Station #1. The decanted effluent is then pumped to the wet well adjacent to Pump Station #1. The pump station pumps the decanted effluent into the irrigation system for beneficial reuse. The volume of each Clarifier is 166,500 gallons.
- 5) Return Activated Sludge Pumps - The Return Activated Sludge (RAS) is pumped by the RAS pumps back into the Oxygen Ditches to ensure a viable biomass is maintained in each ditch (see Figure 2, #5). The Waster Activated Sludge (WAS) is sent to the Aerobic Digester.
- 6) Aerobic Digester – The WAS is pumped to Aerobic Digester (Digester) that provides sludge stabilization by aerobically treating the remaining degradable organic components of the wastewater (see Figure 2, #6). The Digester will also provide additional sludge thickening and allow for decanted water to be returned to the headworks of the Plant. After digestion, the sludge will go to the Sludge Drying Beds. The Digester has a volume of 64,575 gallons.
- 7) Sludge Drying Beds – The Sludge Drying Beds (Beds) allow the sludge from the Digester to be dried (see Figure 2, #7). The Beds contain an under drain, which captures water from the sludge and returns it to the headworks of the Plant. A concrete-retaining wall surrounds the Beds. Upon drying, the sludge will be land applied on Rose Hall Jamaica, LTD's land for agricultural beneficial reuse. After drying, the sludge is expected to meet US EPA's Class B for land application. The proposed sludge drying beds are 20 feet by 100 feet in area. There will be eight drying beds based on the volume of sludge generated each day from the Digester.
- 8) Ultraviolet Light Disinfection – The decanted effluent flows from the Clarifiers and goes through Ultraviolet (UV) lamps that disinfect the effluent prior to being pumped into the irrigation system. The UV lamps transfer electromagnetic energy from its arc lamps to an organism's genetic material (DNA and RNA). When UV light penetrates the cell wall of an organism, it destroys the cell's ability to reproduce. The design criteria for the UV systems are as follows: TSS –

30 mg/l, UV transmittance @ 253.7 nm is 56%, and 200 fecal coliform/100 ml sample. The one bank UV unit contains four lamps per lamp module and eight UV lamp modules.

- 9) Pump Station #1 – The clarified effluent from the Clarifiers are pumped to the irrigation system for beneficial reuse (see Figure 2, #8).

Additional technical information is contained in Appendix B.