

## ***Chapter 5: WASTE MANAGEMENT:***

### **5.1 Liquid Waste Management**

As with all coastal developments, the proper treatment of waste water is of paramount importance. Poor management of liquid waste could rapidly deteriorate the surrounding environs posing unwarranted health risks and not to mention costly rehabilitation works. In addition, the success of this venture depends significantly on a healthy marine ecosystem, which is the justification for site location of the project that provides for some of the best scuba and snorkeling environments.

#### **5.1.1 Effluent Characteristics**

Two categories of effluents will be generated by this proposed development:

- Gray water – this includes liquid waste from showers and wash water and kitchen wastewater
- Sewage waste

It is estimated that the average water consumption per person per day is 70 gallons. Of this, approximately 70% becomes liquid waste. The total water consumption for the proposed development is estimated at 65,000 gallons per day of which 46,000 gallons will require treatment daily. The majority of this waste water composition will be gray water.

#### **5.1.2 Description of Wastewater**

Wastewater characteristics can have large variations depending on factors such as: potable water consumption, the type of system of storage and the existence of individual systems of sewage discharge amongst other. Apart from these factors, it is important to recognize hourly, daily and weekly variations as it relates to concentration.

For example, in a community where water use is very low, the concentration of Biological Oxygen Demand (BOD<sub>5</sub>) in domestic wastewater can be above 850 mg/l. On the other hand, in a system where there is a large use of water, BOD<sub>5</sub> can be as low as 100 mg/l. However, due to the large number of variables and the wide range of values it does not merit in this document, a discussion on concentration data.

**The important characteristics of residential wastewater are:**

BOD<sub>5</sub>, which is determined by the taking of water samples for which during five days is incubated to determine the quantity of oxygen consumed. This test is an indirect measurement of the quantity of organic material present in the wastewater.

Solids in wastewater are found in suspension in a colloidal state and as dissolved. The suspended solid parameter is a value for estimating the quantity of sediments that can accumulate in a system. The volatile component of the suspended solids can be used to estimate the quantity of active organic material.

Chemical Oxygen Demand (COD) is a measurement of the quantity of oxygen required in the chemical oxidation of organic matter. This parameter is used for the characterization of residual waters with presence of industrial discharges. The relationship between BOD<sub>5</sub>/COD in either raw or treated wastewater is values used for compliance monitoring.

In raw wastewater nitrogen is normally present in the form of organic nitrogen and usually as ammonia. The importance of this parameter is to determine the properties of biodegradable waste.

Total coliforms, fecal coliforms and protozoa are indispensable in the characterization of wastewater and are normally used in the design of a system.

In identifying any wastewater treatment system, it is paramount that the organic loads be determined from the inception and ensures that the system is design to reduce such loads, including those parameters above described.

The organic load of a system for the treatment of wastewater is generally expressed in kg/BOD/day or kg Suspended Solids (SS)/day. For the purpose of this project, organic loads are expressed in Kg/BOD/day.

For consistency purposes it is estimated that 140 persons will inhabit the development and the total daily water consumption is in the range of 11,200 gallons/day maximum. Of this some 70% is converted to waste which is approximately 7,840 gallons of wastewater that will require treatment.

It is critical to first determine the daily BOD produce per person per day. For this development daily BOD loads is calculated at 250 mg/l which is based on a 62 g/person.day.

### **5.1.3 Waste Water Treatment Options**

Cognizant of freshwater restrictions due to the location of the project and the need to protect the sensitive surrounding environment, Big Cat project has eliminated all other options of wastewater treatment other than a centralized aerated wastewater treatment plant. The plant of choice is the Integrated Membrane Activated Sludge (IMAS) wastewater treatment plant Equipped with a constructed wetland to further reduce nitrates and phosphates from entering the surrounding water body. As mentioned, these wetlands will be lined to prevent percolation of treated effluent into ground water. The wetland area will be vegetated with plant species of high transpiration rate to absorb much of the nutrients that remain in the already treated effluent.

Furthermore, Big Cat shall always be investigating in newer technologies of wastewater treatment and will always seek to use the most environmentally friendly technology that are efficient and have reduce cost of operation.

As the efficiency of treatment depends on the load and volumes of wastewater, the system of choice is designed to treat up to 15,000 gallons of wastewater daily. This system is capable of reducing BOD5 to 10 mg/l. Thus, this system is capable of reducing organic loads well within those prescribe by local regulations. In addition, treated waste water will be stored in above ground roto-plast containers and chlorinated and left to settle and allow for the evaporation of excess chlorine. Two such storage containers for chlorination will be provided for. The treated and disinfected water will be used for irrigation.

In addition, the system is so efficient it is also capable of reducing COD by 90% and Suspended Solids by 90%. The added benefit of this system is that it requires minimal energy for functioning and does not produce bad odors and is 30 times faster than a septic tank or any other anaerobic system.

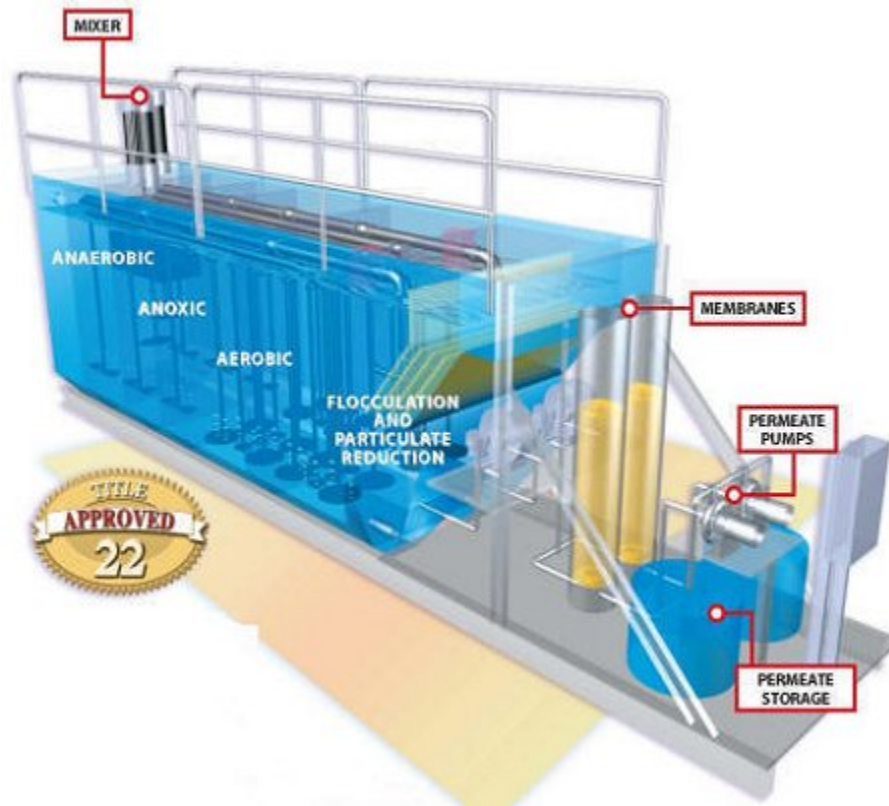
*What makes this system superior to any in its class?*

#### COST EFFECTIVE MEMBRANE QUALITY EFFLUENT

- 50% Lower Operating Costs
- No Membrane Air Scour or Air-Lift
- Competitive Footprint & Capital Cost
- No Ultra-Fine Screening Required
- Significantly Lower Process Air Requirement
- No MLSS Recirculation Pumping

How do we do it? By creating a low membrane fouling environment. Prior to the membrane, the wastewater treatment biological and particle reduction unit processes are not only designed for optimal efficiency and economy, they are also engineered to create the low membrane fouling environment that results in substantial cost savings.

The treatment entails several processes. These are Screening and Grit removal, Primary Clarification, Aeration, Secondary Clarification, Filtration and Disinfection.



## 5.2 SOLID WASTE MANAGEMENT

The project upon completion and for consistency will have a total of 14 persons on site at any given time. The estimated waste generated per person per day is approximately 2.05 kg/person/day. The waste from a tourism development in a large part is primarily domestic waste consisting mainly of organic and inorganic waste.

The impacts associated with solid waste is that if not management properly can attract feral animals. In this project these animals include the salt water crocodile and birds. These unwanted attractions could pose significant unwarranted health risks. Hence, the Big Cat project, after analyzing its available option for solid waste management has

chose two options. These include composting in an earth tub and transportation to mainland for subsequent disposal of all inorganic waste. The transportation of solid waste, whilst it has a significant cost associate therewith, is the most environmentally sound approach at managing solid waste from this project.

The waste management programme for the Big Cat project has taken into the consideration the recommendations made by the Belize Fisheries Department and the Wildlife Conservation Society. The programme entails the following:

- Waste Reduction – the basic principle here is to reduce over consumption of products particularly those that generate hard to recycle waste such as polyethylene packaging.
- Reuse – here waste generation is avoided or decreased when packaging and products that have fulfilled their primary function are used again by findi a new secondary use for them.
- Recycle – here a product that has already fulfilled its purpose is used as a raw material for the same or new goods.

## 5.2.1 The Earth Tub

### *Commercial Duty Compost System*



The Earth Tub is designed specifically for on-site composting of food-wastes. The Earth Tub is a fully enclosed composting vessel featuring power mixing, compost aeration, and biofiltration of all process air. This self-contained unit is ideal for composting at schools, universities, restaurants, hospitals and supermarkets.

### *The Earth Tub Process*

#### **Loading**

Organic materials such as food scraps, manure or yard waste are loaded through the large hatchway in the cover. Periodically, dry materials such as wood chips, shredded paper or shavings can be added to insure that porosity and moisture levels are ideal for composting.



### **Mixing**

Turn on the auger motor and rotate the cover to shred and mix the new organic material into the active compost. Two revolutions of the rotating cover are required to mix the outside and center of the Earth Tub. The auger will shred and mix a ton or more of compost in 10-15 minutes. During active composting, the Earth Tub should be mixed at least two times per week.

### **Aerobics and odor control**

Maintaining aerobic conditions and controlling temperature are essential for composting and odor control. The aeration system draws air through the compost and forces the exhaust air through our biofiltration air purification system to remove odors. Liquids are collected and disposed to a sanitary sewer or holding tank. The overall cleanliness of the in-vessel design allows the Earth Tub to be placed in commercial settings close to where waste is generated.

### **Waste reduction**

Heat generated in the Earth Tub rapidly breaks down the food scraps. The volume reduction is typically 70% or higher. After 3--4 weeks of active composting, open the discharge doors and the auger pushes the compost out as it rotates past the discharge door. The compost can be cured for 20-40 days for

further stabilization.

### Key features

- Easy to operate
- Rapid process reduces volume quickly
- Heavy-duty plastic construction
- Minimal need for bulking agent
- Short time required for mixing/loading
- Temperature controlled system
- Insulated for cold weather operation
- Thorough compost mixing
- Biofilter odor control system

### Specifications

Tub Vessel Height	48"
Overall Height	68"
Overall Diameter	90"
Foam Insulation	R-12
Shipping Weight	450 lbs
Volume	3 cubic yards
Mixing Auger	12" Diameter Stainless Steel
Auger Motor	3 Ph 2.5 hp 230/460V
Aeration Blower	80 CFM 100 watt
Power Usage	~1080 KWH per year
Liquid Drain	1" drain on biofilter
Processing Capacity	40-200 ppd*
* Pounds per day of biomass per Earth Tub.	

## **5.2.3 Solid Waste Treatment Impacts and Mitigation**

### **Physical Impacts**

Direct physical impacts from onsite composting of organic wastes concern the additional land conversion requirements for the development of composting sites. This impact is unavoidable and can only be mitigated by non-composting. However, in this project, the earth tub is commercial and thus this will not be of concern.

Storage facility for subsequent transportation to the mainland may pose some aesthetic impact and can only be mitigated by non-development.

### **Biological Impacts/Water Resource Impacts**

Direct negative water resource impacts from onsite temporary storage of solid waste concern the potential for seepage of nitrogen and other nutrients into ground or coastal waters.

Potential indirect and residual negative water resource impacts are nil. Seepage impacts may be partially and wholly mitigated by:

- Having all wasted baged stored within a containment area to avoid any leachate.