Water Reuse at Petit St. Vincent Grenadines, West Indies

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Project Location

Project Setting

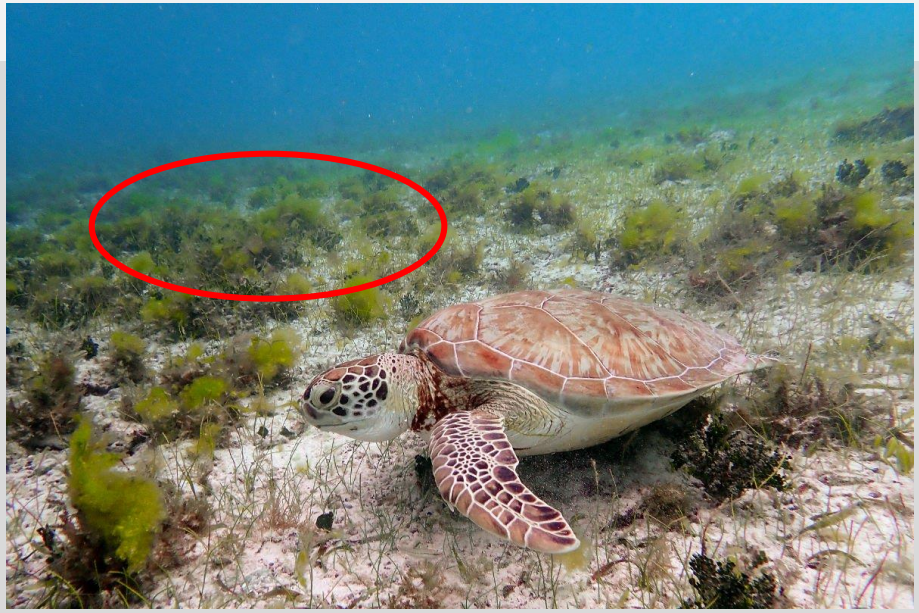
- Grenadines - 9 islands with permanent settlements: Bequia, Mustique, Canouan, Mayreau, Union I., Petit Martinique and Carriacou, Palm I, and Petit St. Vincent.
- The islands range from rocky volcanic headlands to tiny cays that barely rise above sea level.
- The entire area is noted for its beautiful scenery, spectacular beaches and diverse marine habitats that include coral reefs, mangroves and seabird colonies.
- The area supports the most extensive coral reefs and related habitats in the Windward Islands (the Grenadines Bank constitutes approximately 11% of the coral reef area of the Lesser Antilles).
- The diverse marine habitats associated with coral reefs are home to rich marine biodiversity which is the basis of much of the tourism activity.

Petit St. Vicent

- Petit St. Vicinity is one of the oldest resorts in the West Indes (~50 years old).
- Private resort established by a U.S. Family and originally built using local sourced materials
- Island population includes approximately 130 staff and 44 to 66 guests
- Two restaurants (one public and one for the guests)
- Staff and guest housing
- Spa
- Central Laundry
- Dive Center

Project Background

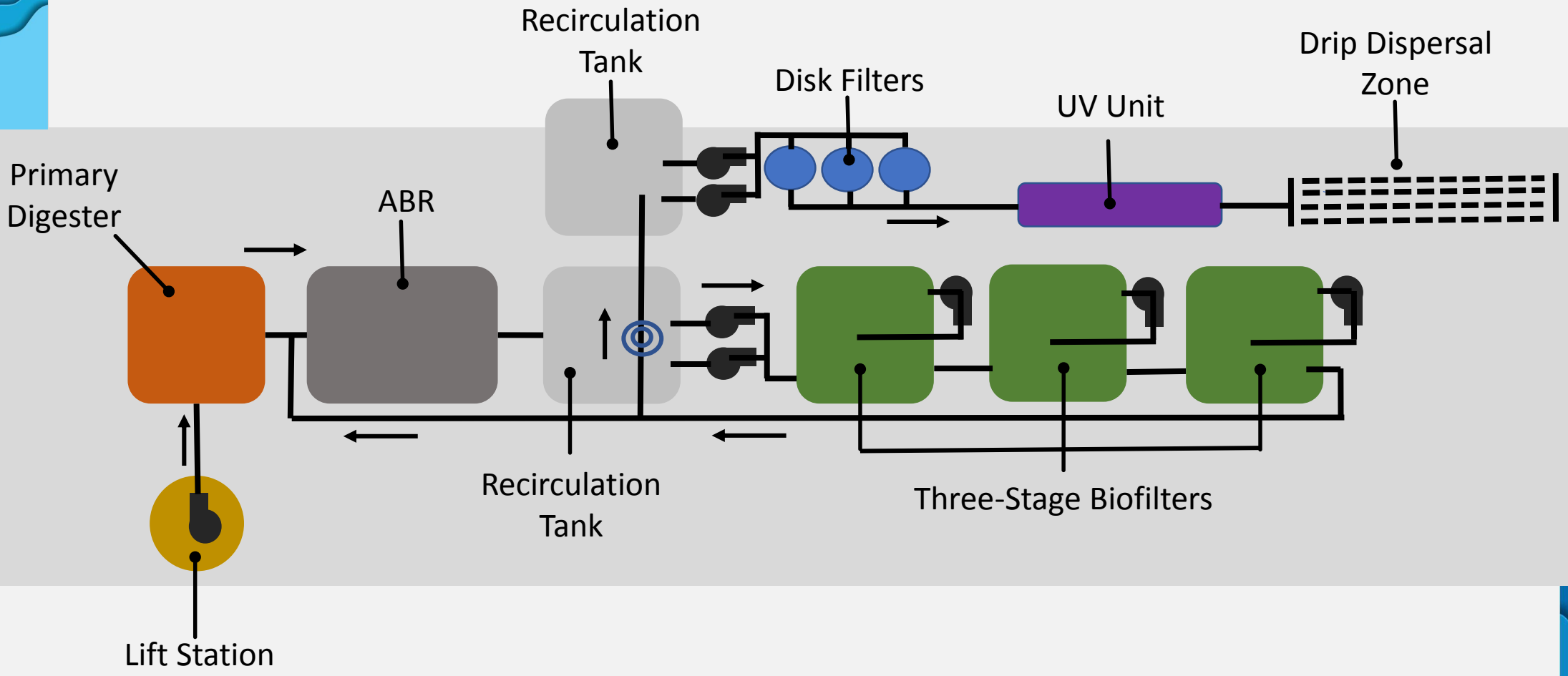
- Jean-Michel Cousteau was asked to set up a dive center on PSV (Ocean Futures Society)
- JMC identified that the reefs in the vicinity of the resort were being impacted by nutrients from the discharge of partially treated wastewater – JMC recommended FCE/AQL to design and install a new wastewater system at the resort
- Resort has installed a FAST treatment system that was not working effectively
- FCE/AQL was retained by PSV to design and install a wastewater treatment and recycling system to eliminate the discharge to reuse the water for beneficial reuse on the island
- August – October 2018 AQL installed the wastewater treatment and reuse system on the island.



Jean-Michel Cousteau Diving
CARIBBEAN

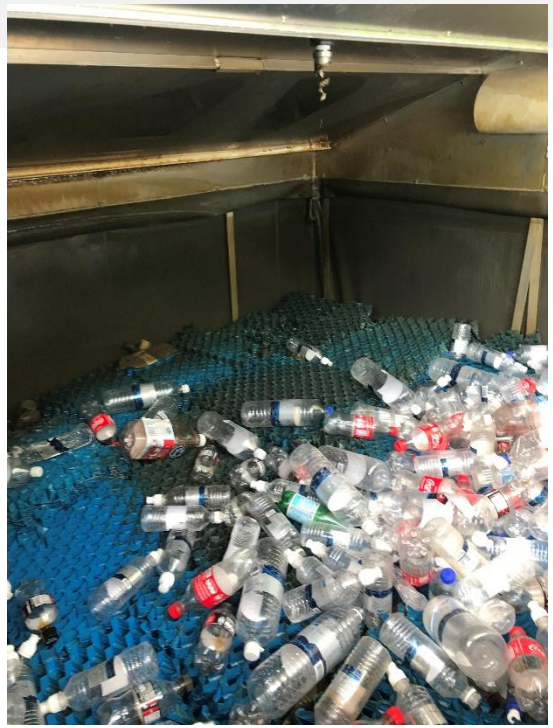
Design Criteria

- Treat all of the commercial and staff housing elements on the island
- Design Flow ~10,000 gallons per day
- Reduce BOD and TSS to less than 15 mg/L
- Reduce TN by 70%
- Reuse all treated water for irrigation – ornamental landscape and fruit trees



Treatment Train

1. Upflow Anaerobic Digester:
    1. Solids Removal
    2. Vertical Flow
    3. HRT – 8 to 12 hrs.
2. Anaerobic Baffled Reactor:
    1. Primary Treatment (Solids/BOD Removal):
    2. Vertical Flow with multiple compartments
    3. HRT 18 to 24 hrs.
3. Three-Stage Biofilters:
    1. Advanced Secondary Treatment (BOD/TSS/TN)
    2. HLR <300 gpd/sf; OLR <45 lbs. BOD/1000 of media
    3. Recirculation rate of 3:1
4. Disk Filters:
    1. Removal of residual TSS
    2. Redundant Filters (excess capacity) – ease of O&M
    3. 200 micron
5. UV Disinfection Unit:
    1. Pathogen Inactivation
    2. 40 mj/cm2
6. Drip Irrigation System
    1. 200 % Disposal Capacity
    2. Drip Emitter SAR – 0.7 gph @ 12” Spacing
    3. 150 maximum runs per line



1. Project Phases:
    1. Preliminary Planning - 2017
    2. Engineering Design Plans – Winter 2018
    3. Site Planning – Spring 2018
    4. Fabrication and Procurement – Spring 2018
    5. Construction Summer/Fall 2018

2. Owner Build and Operate
    1. AQL Procured All Equipment and Specialty Materials
    2. AQL Team with PSV Team Installed System

3. Total Costs ~$390,000
    1. Engineering and Planning ~$30,000
    2. Treatment Equipment ~$230,000
    3. Site Built Tanks and Foundations ~$50,000
    4. Installation Labor and Tools ~$50,000
    5. Shipping and Transport ~$30,000

1. Daily Activity (1 hour per day)
    1. Record Flow
    2. Visually Inspect System and Drip System Zones
2. Bi-Weekly (2 hours)
    1. Clean Disk Filters
    2. Clean Biotube filters
3. Quarterly (4 hours)
    1. Inspect and Clean Biofilter Spray Nozzles
    2. Inspect and measure sludge levels in tanks
4. Annual (labor 24 hours + Septage Truck)
    1. Desludge digester tanks
    2. Water Quality Testing
5. O&M Budget
    1. Monthly labor costs = 34 hrs @$35/hr = $1,190/month
    2. Quarterly labor costs = $560/qtr
    3. Annual Costs:
        1. Labor 24 hours @ $35 = $840/yr
        2. Septage Tank $3000/trip x 2 trips = $6,000
        3. Water Quality Testing = $1,500
    4. **Total Annual O&M Costs = $24,860**

- **Efficacy in design –** select systems to meet performance criteria
- **Ease of operation and serviceability -** keep the skill of the operator in mind
- **System redundancy & backup**
- Ongoing monitoring is **critical**
- **Expandability/adaptability –** consideration of changes – preserve space/land area for future needs