

PN ACC-941

FE 157

EAST

Environmental Audits for Sustainable Tourism

Environmental Management Audit

Coral Seas Garden Hotel

Negril, Jamaica, W.I

Final Report

EAST Report No 97-234

January 1998

Prepared for
EAST Project
c/o Jamaica Hotel and Tourist Association
2 Ardenne Road
Kingston
Jamaica W I

By
Hagler Bailly Services, Inc
1530 Wilson Boulevard
Arlington, Virginia 22209
U S A

A project funded by the U S Agency for International Development

Table of Contents

Executive Summary	1
Summary of Implementation Costs and Paybacks	2
Summary of Initiatives Already Underway	4
1 Introduction	5
1 1 EAST Project	5
1 2 Audit Team	5
1 3 Audit Protocol	5
2 Background Information	6
2 1 Description of the Property	6
2 2 Occupancy Data	6
2 3 Water Consumption and Wastewater Generation	7
2 3 1 Current water use at Coral Seas	7
2 3 2 Impact of water conservation at Coral Seas	8
2 4 Electricity Consumption	10
3 Guidelines for the Development of an Environmental Management System	11
3 1 Environmental Management System (EMS) Overview	11
3 2 Motivation	12
3 2 1 Appoint the environmental program's "Champion"	12
3 2 2 Create a "Green Team"	12
3 2 3 Develop and environmental policy for Coral Seas	13
3 2 4 Motivate the staff	14
3 2 5 Participate in external activities	15
3 3 Planning Action	15
3 3 1 Select and assess the program's focus areas	15
3 3 2 Prepare a plan	17
3 3 3 Set targets	17
3 4 Taking Action	18
3 4 1 Prepare personal action plans	18
3 4 2 Provide support and training	18
3 4 3 Publish results	18
3 4 4 Show leadership	19
3 5 Reviewing Progress	19
3 5 1 Monitor progress	19
3 5 2 Conduct and annual review	20

4 Recommendations for Improving the Property's Environmental Performance 21

Table 1 Recommendations for Improving the Property's Environmental Performance 22

5 Detailed Analysis of Selected Recommendations 38

Summary

Project 1	Install flow aerators on all faucets	38
Project 2	Install low-flow shower heads	41
Project 3	Install flow diverters in toilet tanks	43
Project 4	Install displacement devices and adjust the water level in the toilets' water tanks	45
Project 5	Replace existing conventional toilets with water-saving toilets	47
Project 6	Use rainwater for laundry or other operations	50
Project 7	Reduce the time of operation of the pool filter pump	53
Project 8	Upgrade to energy efficient lighting	54
Project 9	Implement a property-wide waste management program	58
Project 10	Implement a towel reuse program	63
Project 11	Improve on the hotel's composting program	65

Appendix I Hotel Environmental Policy

Appendix II Summary of Coral Seas' environmental aspects, impacts and EMS objectives

Appendix III Action Plan Form

Appendix IV Personal Action Plan Form

Appendix V Sample Water and Electricity Monitoring Forms

Appendix VI Flow Diverters Technical Information

Appendix VII Monthly Occupancy Calculation Form

Executive Summary

What is an environmental management system?

- ▶ An environmental management system (EMS) is a management tool through which a property can evaluate and improve its environmental performance, and establish, achieve and sustain its own environmental performance objectives

Why should Coral Seas develop an EMS?

- ▶ An EMS will help Coral Seas sustain the social and physical environment on which it depends for its survival. Tourists visit Negril to savor the beauty of its reefs, beaches and nature and to experience the warmth and kindness of its people. The day Negril loses these valuable attributes will mark the end of its tourism industry.
- ▶ Hotel guests are increasingly taking an interest in the environment. A recent poll conducted by *Conde Nast Traveler* revealed that
 - 91% of the respondents were concerned about the environmental conditions at the destination to which they are making travel plans,
 - 50% claimed that the environment had become a factor in their travel planning over the last ten years,
 - 25% have changed travel plans because of what they perceived to be an environmental issue at their chosen destination

The “green” image created and sustained through an effective EMS will therefore provide Coral Seas with an additional marketing tool

- ▶ Since many environmental measures are aimed at reducing the consumption of water, energy, chemicals and materials, an effective EMS will help the property save money and ensure the sustainability of the measures and actions that yield these savings

During the course of the audit, the EAST team reviewed Coral Seas’ water, energy, chemicals and materials consumption practices, evaluated its policies, procedures and management structure, identified ways to improve its environmental performance and develop an effective EMS. As illustrated in the following section, the audit revealed that Coral Seas could greatly benefit by becoming a more environmentally friendly property.

Summary of Implementation Costs and Paybacks

The following table summarizes the costs and benefits of 11 of the more than 50 recommendations presented in this report. The detailed analysis of these 11 recommendations, or projects, is presented in Section 5 of this report.

Project no and description	Environmental benefits	Financial savings	Implementation cost	Payback period
1) Install flow aerators on all faucets	<ul style="list-style-type: none"> Reduces water consumption and wastewater generation Improves the operation of septic tanks and tile fields Saves energy 	1,470 J\$/year for each typical faucet	60 J\$ per aerator	2 to 4 weeks
2) Install low-flow shower heads	<ul style="list-style-type: none"> Reduces water consumption and wastewater generation Improves the operation of septic tanks and tile fields Saves energy 	3,810 J\$/year for each low-flow shower head	300 to 850 J\$ per low-flow shower head	< 3 months
3) Install flow diverters in toilet tanks	<ul style="list-style-type: none"> Reduces water consumption and wastewater generation Improves the operation of septic tanks and tile fields 	3,900 J\$/year for 60% of the property's toilets	2,000 J\$	6 months
4) Install displacement devices in toilet tanks	<ul style="list-style-type: none"> Reduces water consumption and wastewater generation Improves the operation of septic tanks and tile fields 	3,900 J\$/year for 60% of the property's toilets	800 J\$	< 3 months
5) Replace existing toilets with water-saving models	<ul style="list-style-type: none"> Reduces water consumption and wastewater generation Improves the operation of septic tanks and tile fields 	710 J\$/year for guest bathrooms	1,000 J\$ per guest bathroom	1.4 years
		3,690 J\$/year for public restrooms	4,000 J\$ per public restroom	13 months
6) Use rainwater for laundry operations	<ul style="list-style-type: none"> Reduces the use of NWC water Reduces the use of the water softening system and laundry chemicals 	17,500 J\$/year for the laundry's rain catchment	unknown but probably moderate	probably < 1 year

7)	Reduce the time of operation of the pool filter pump	<ul style="list-style-type: none"> • Reduces electricity consumption • Extends the service life of the pump 	10,200 J\$/year	0 to 1,800 J\$	0 to 2 months
8)	Upgrade to energy efficient lighting	<ul style="list-style-type: none"> • Reduces electricity consumption 	see table in Project 8	478 J\$ per energy-efficient bulb	typically 6 to 12 months
9)	Implement a waste management program	<ul style="list-style-type: none"> • Reduces the volume of waste generated by the property • Reduces the negative impact of the waste generated by the property 	unknown	moderate	probably <1 year
10)	Implement a linen and towel reuse program	<ul style="list-style-type: none"> • Reduces water consumption and wastewater generation • Reduces energy consumption • Reduces chemicals consumption 	can reduce laundry costs by up to 20%	negligible	immediate
11)	Improve the hotel's composting program	<ul style="list-style-type: none"> • Provides the property with a free source of fertilizer and soil conditioner 	unknown	low to moderate	probably <1 year

Summary of Initiatives Already Underway

To its credit, Coral Seas has already implemented a variety of environmental initiatives. Some of the initiatives identified by the audit team are listed below.

- ▶ The hotel is currently recycling its cooking oil and grease. The kitchen staff should make sure that the lid to the barrel is always properly closed to prevent contaminating the grease with rainwater and foreign objects -- contaminated grease cannot be recycled.
- ▶ The hotel is composting much of its yard waste on the property and at another site. Coral Seas should however ensure that no trash (e.g., plastic bags, chemical containers) is discarded on the compost pile.
- ▶ Juices for the bar are being purchased in bulk, this reduces costs and the amount of waste produced.
- ▶ The hotel has purchased liquid soap dispensers for the public bathrooms. Dispensers will be more sanitary than the bars now being used and will save money versus the bars. In the meantime, the hotel should reuse bars of soap from the guest rooms instead of putting new bars in the public bathrooms.
- ▶ The housekeeping staff changes the guest room sheets every other day. This practice saves money by reducing the consumption of water, energy, detergent and other laundry chemicals.
- ▶ The hotel only provides guests with washcloths upon request, a practice that saves money by reducing the laundry's workload. However, the audit team found that sometimes housekeepers only leave bath towels in the room (no hand towels or washcloths), thus forcing guests to use bath towels for a purpose that could be served by a smaller towel or a washcloth.
- The guest room letter posted in all rooms encourages guests to turn off lights and air conditioning when leaving their rooms. This message is likely read by most guests but might be more effective if it were on a sign near the door (conveying only that message) to remind the guests as they leave the room.
- ▶ The purchasing manager is very cost-conscious and tries to control whenever possible the frequent purchasing of disposable items.
- ▶ The hotel uses clippings from plants in an on-site nursery that supplies all of its needs.

I. Introduction

1.1 EAST Project

The Environmental Audits for Sustainable Tourism (EAST) Project is an activity funded by the U S Agency for International Development (USAID) that is designed to assist the tourism and hospitality industry implement effective environmental management systems (EMS)

The specific objectives of this project are (1) to develop greater awareness and understanding of the benefits of environmental management systems and audits among hoteliers, restaurateurs, allied tourism businesses, as well as in the manufacturing industry, (2) to train Jamaican consultants on EMS auditing techniques, (3) to assist a select, representative number of tourism establishments in carrying out environmental audits, and (4) to help finance, on a cost-sharing basis, specific audit recommendations in the participating establishments to demonstrate the financial benefit of the systematic application of environmentally friendly practices and, thereby, encourage others in the tourism industry to do likewise EAST is being implemented by Hagler Bailly Services (USA) under the direction of USAID/Jamaica and the Jamaica Hotel and Tourist Association

1.2 Audit Team

The audit of the Coral Seas Hotel was conducted by an interdisciplinary team in August 1997 The team members included Hugh Cresser, EAST Project Coordinator, Patricio Gonzalez Morel, Environmental Engineer, Hagler Bailly (USA), Cara Holley Montrief, Hotel Environmental Consultant, Lloyd Marsh, Senior Energy Engineer, Metrocad (Jamaica)

The EMS audit consisted of a detailed analysis of all departments and key service areas designed to identify the environmental aspects and impacts of the property's activities, and to formulate recommendations on how to improve the property's environmental performance and its environmental management system (EMS)

1.3 Audit Protocol

The audit protocols used by the audit team covered the following issues

- ▶ ISO 14 000 EMS gap analysis
- ▶ Water use and wastewater generation
- ▶ Energy use and efficiency
- ▶ Solid waste generation and handling
- ▶ Chemicals use and management
- ▶ Hotel procedures and operations

2. Background Information

2.1. Description of the Property

Coral Seas is a 26-room compact property located on the garden side of Norman Manley Boulevard in Negril, Jamaica. This property is owned by Mr. Ricky Jackson and managed by Ms. Marie Gibbs.

The guest facilities offered at Coral Seas include

- ▶ suites and standard rooms equipped with kitchenettes,
- ▶ air-conditioned and non-air-conditioned rooms,
- ▶ a pool,
- ▶ a restaurant and a pool bar

2.2. Occupancy Data

The occupancy information given by Coral Seas to the audit team covers the 12-month period from November 1996 to October 1997. This data is summarized in the following table and is used as the basis for the calculations presented in this report.

Month	Occupancy (room nights, RN)	Guest Nights (GN)
November 1996	525	998
December	584	1 030
January 1997	526	967
February	526	927
March	646	1 857
April	185	368
May	151	266
June	168	288
July	170	293
August	595	1 231
September	219	390
October	310	575
Annual total	4 605	9 190

This data yields the following occupancy criteria for Coral Seas:

Average occupancy = 384 RN/month
 = 766 GN/month

Note: The hotel does not currently track its monthly or yearly occupancy percentage. A form to be used for this purpose has been included as Appendix VII.

2.3 Water Consumption and Wastewater Generation

2.3.1 Current water use and wastewater generation at Coral Seas

- All of the water consumed by Coral Seas is purchased from the National Water Commission
- The bulk of the property's effluent is disposed to an on-site wastewater system composed of 3 septic tanks and 2 tile fields. The gray water generated by the kitchen is discharged untreated to the morass.

The water consumption information collected from Coral Seas' NWC water bills is presented in the following table and graph. This data is used as the basis for the calculations presented in this report.

NWC water consumption figures					
Month	Water use Imp gal/month	Water cost JS/month	Unit cost JS/1,000 IG	GN/month	IG/GN
September 1996	133,000	25,908	194.8	-	-
October	170,000	33,203	195.3	-	-
November	145,000	28,354	195.5	998	145.3
December	180,000	35,227	195.7	1,030	174.8
January 1997	175,000	34,314	196.1	967	181.0
February	166,000	32,768	197.4	927	179.1
March	170,000	33,746	198.5	1,857	91.5
April	152,000	30,385	199.9	368	413.0
May	94,000	18,877	200.8	266	353.4
June	109,000	21,882	200.8	288	378.5
July	159,000	31,948	200.9	293	542.7
August	153,000	30,877	201.8	1,231	124.3
Annual total	1,806,000	357,489			
Nov-Aug total	1,503,000	298,378		8,225	

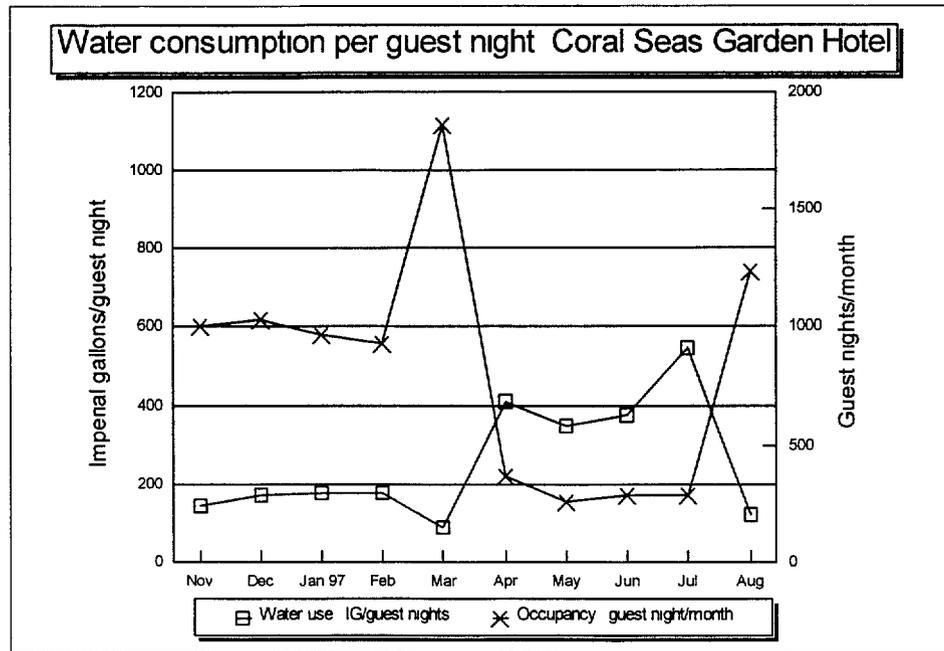
Note IG = imperial gallons
GN = guest night

Based on this data the average water figures for Coral Seas are

Current water cost = 202 JS/1,000 IG

Average water use = (1,806,000 IG/year) / (12 months/year)
= 150,500 IG/month
= 30,400 JS/month

Av. water use per GN = (1,503,000 IG/10 months) / (8,225 GN/9 months)
= 183 IG/guest night



As shown in the graph, Coral Seas' water consumption index (i.e., the consumption of water per guest night) varies widely throughout the 10 month period covered by the overlapping water use and occupancy data. In fact, the water consumption index for July (543 IG/GN) is almost 6 times greater than that for March (91.5 IG/GN). Although the water consumption index is expected to vary with time because of changes in weather, occupancy rates and guest type (e.g., large influx of college students for spring break), the 590% variation seen at Coral Seas is excessively high.

Coral Seas should therefore try to define and control the factors responsible for the large fluctuations in the amount of water consumed per guest night.

2.3.2 Impact of water conservation at Coral Seas

Because of the high cost of water, it is in this property's best interest to engage in an aggressive water conservation program. The comparison made in the following table between Coral Seas and a water efficient hotel (as defined by the International Hotels Environmental Initiative) shows that this property could achieve significant savings through water conservation.

Average water consumption for hotels		Savings if Coral Seas achieved the water consumption of a water efficient property	
Location	Water use	Water savings	JS savings
Water efficient hotel	96 IG/guest night	800 000 IG/year	162 000 JS/year
Coral Seas	183 IG/guest night		

- Notes • The savings presented in this table are based on the total annual occupancy figure calculated in Section 2.2 of this report (that is, 9,190 guest nights per year)
- The International Hotels Environmental Initiative uses the following figures to rate the relative water efficiency of hotels

Property size (with gardens and laundry)	Water efficiency rating - water use figures are in IG/guest night				
	Good	Fair	Poor	Very poor	Coral Seas
4 - 50 rooms	< 96	96 - 111	111 - 128	> 128	183

Besides the direct financial benefits, a reduction in water consumption will also reduce the flow processed through the property's on-site wastewater treatment system and, thereby, improve its performance. Currently, each of the property's septic tanks must be pumped every 6 months.

Furthermore, after the completion of Negril's new sewer and wastewater treatment plant in mid-1999, the cost of the NWC water is expected to increase by a factor of two.

The reader should therefore keep in mind that the water conservation measures proposed in this report will have, in the near future, an even greater impact on reducing Coral Seas' utility costs.

2.4 Electricity Consumption

The electricity consumption information collected by the audit team from Coral Seas' JPSCO bills is presented in the following table and graph

Month	kWh/month	JS/month	JS/kWh	GN/month	kWh/GN
September 1996	14,480	66,969	4.62	missing	-
October	14,480	66,494	4.59	missing	-
November	12,720	58,466	4.60	998	12.7
December	10,960	50,436	4.60	1,030	10.6
January 1997	missing	-	-	967	-
February	missing	-	-	927	-
March	13,960	64,076	4.59	1,857	7.5
April	13,040	59,978	4.60	368	35.4
May	12,720	58,642	4.61	266	47.8
June	11,600	53,639	4.62	288	40.3
July	12,840	59,453	4.63	293	43.8
9 month total	116,800	538,153			
7 month total	87,840	404,690		5,100	

Note The audit team was unfortunately unable to collect energy consumption figures for a continuous 12 month period

Based on this data, the electricity consumption figures for Coral Seas are

$$\begin{aligned} \text{Average energy consumption} &= (116,800 \text{ kWh/year}) / (9 \text{ months/year}) \\ &= 12,980 \text{ kWh/month} \end{aligned}$$

$$\begin{aligned} \text{Average energy use per GN} &= (87,840 \text{ kWh/year}) / (5,100 \text{ guest nights/year}) \\ &= 17.2 \text{ kWh/GN} \end{aligned}$$

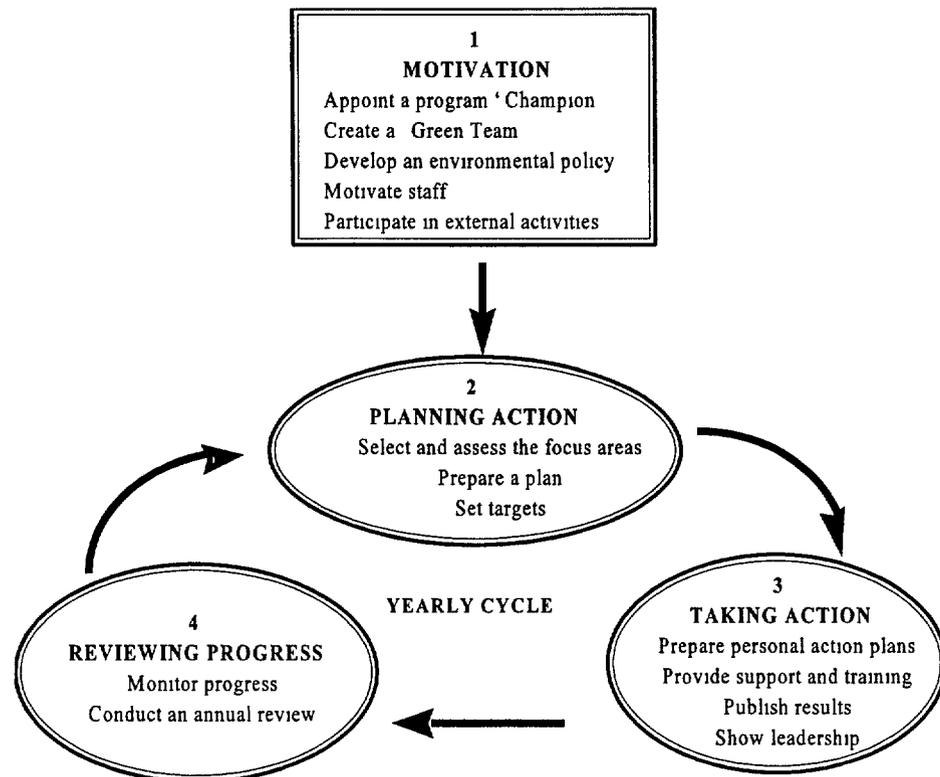
As shown in the table Coral Seas' electricity consumption index (i.e. the consumption of electricity per guest night) varies widely throughout the year. In fact, the electricity consumption index for May (47.8 kWh/GN) is 6 times greater than that of March (7.5 kWh/GN), the peak occupancy month. Although the electricity consumption index is expected to vary with time because of changes in weather, occupancy rates and guest type and because of the existence of power loads that are not affected by occupancy (e.g., pool pumps, public area lighting), the 640% variation seen at Coral Seas is excessively high.

Coral Seas should therefore try to define and control the factors responsible for the large fluctuations in the amount of electricity consumed per guest night throughout the year.

3. Guidelines for the Development of an Environmental Management System

3.1 Environmental Management System (EMS) Overview

Becoming an environmentally friendly property is not a challenge that can be met overnight. It is a long-term commitment and a continuous process of improvement which should be integrated in the daily operations at a pace which is right for each property. The key phases in the creation and development of an effective environmental management system are illustrated below.



Note This EMS cycle is based on the approach developed by the International Hotels Environmental Initiative

The four phases are

- **Motivation** -- in which you begin to integrate the initiative in your property by appointing a Champion to coordinate the program, creating a Green Team to assist in the implementation and monitoring of the program, developing a policy which defines the property's environmental objectives, and by motivating the staff to participate and contribute to the program.
- **Planning action** -- in which you select and conduct a detailed review of the property's priority areas, identify measures to be taken, prepare an action plan and set a timetable.

for the implementation of the program

- ▶ **Making it happen** -- in which staff commitment is gained for the action plan, responsibilities are allocated, and the plan is implemented
- ▶ **Reviewing process** -- in which progress is monitored against set targets and objectives, an annual review of overall progress is conducted to assess the successes and failures, and priorities are set for the coming year

As shown above, phases 2, 3 and 4 form a yearly environmental management cycle. Each year the property will go back through this cycle again, using the review of the previous year's successes and failures to improve the effectiveness of its EMS and revise, if necessary, its environmental policy.

3.2 Motivation

3.2.1 Appoint the environmental program's "Champion"

Once the hotel is ready to move ahead with its environmental program, Coral Seas will need to appoint a "Champion" who will have the responsibility for coordinating and implementing the environmental program. This person must have a good operational knowledge of the hotel, the respect of other employees, a commitment to the project, and the full support of the property's owners and top management. The Champion will keep the environmental program on line, ensure good business and environmental results are achieved, and ensure the participation or cooperation of all staff members.

3.2.2 Create a "Green Team"

The creation of a "Green Team" is crucial to ensure the introduction and the implementation of environmental policies. The functions of the Green Team include:

- ▶ assist the program Champion in the day-to-day management, supervision and troubleshooting of the environmental program
- ▶ keep the property's staff motivated and dedicated to the principles of the environmental program
- develop new ideas and strategies for improving the program
- act as the principal link between the property and local community groups or environmental organizations

To be most effective, the Green Team must be composed of highly motivated individuals selected from each of the property's departments and representing all levels of employee hierarchy -- from executive-level to line-level employees. The actual size of the Green Team will depend on the requirements of Coral Seas' environmental program, however, when assembling the team, keep in mind that as the group gets larger, the team as a whole becomes less focused and less productive.

The employees selected for the Green Team must have the motivation and character needed to insure the success and the dissemination of the program. Criteria for the selection of team members may include

- ▶ recommendations by managers or supervisors,
- ▶ nomination by fellow employees, or
- ▶ a simple application process which requires the candidates to explain their expected contribution to the environmental program and their reasons for wanting to join the team

Note Coral Seas should create more personalized names for the “Champion” and “Green Team” to reflect the property’s “personality.” In this report, the terms “Program Champion” and “Green Team” are used as generic names to represent two key components of an effective EMS

3.2.3 Develop an environmental policy for Coral Seas

An environmental policy is an important tool for communicating, both internally to employees and externally to guests, that the property is serious about its role in preserving and protecting the environment. The policy should therefore embody the property’s commitment to the environment and define the goals it wishes to achieve.

The formulation of the environmental policy should be a concerted effort, involving management, the program Champion, the Green Team and all interested staff members. This combined effort will insure that the environmental policy is understood and respected by all employees, and will provide the staff with a sense of ownership over the property’s environmental program.

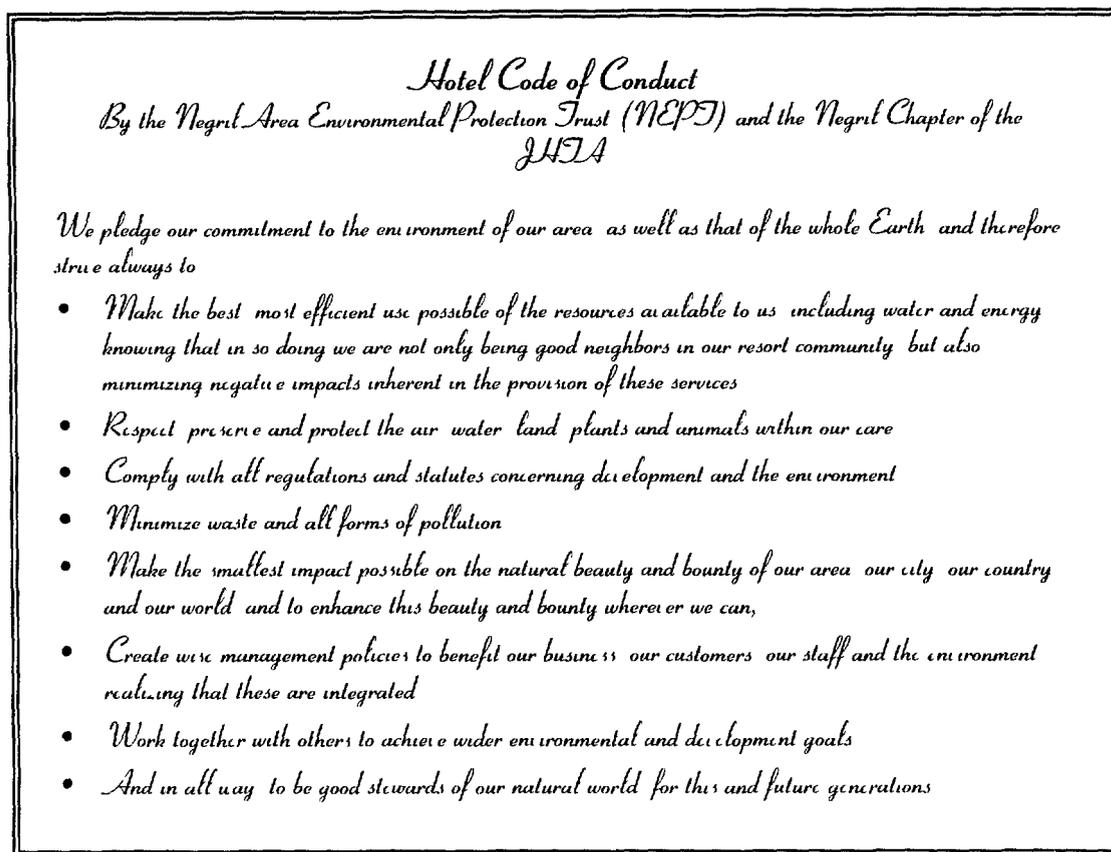
The breadth of the environmental policy adopted by the hotel will define the complexity and magnitude of the environmental management system that will be needed to put the policy’s words into actions. The property is therefore advised to develop a first policy that is appropriate to the nature and scale of its environmental impact, but not overly ambitious. The first environmental policy should include manageable commitments which bring obvious benefits to the property or help remedy its most significant environmental impacts. Examples of commitments appropriate for a first environmental policy include

- ▶ safeguarding natural resources by achieving a more efficient use of water, energy, chemicals and materials
- ▶ preventing pollution by reducing the amount of waste generated by the property
- ▶ complying with all applicable environmental regulations

After mastering the basic principles and operations of its EMS, Coral Seas should broaden the scope of its environmental policy and review its objectives and targets. Examples of complete and comprehensive environmental policies are given below and in Appendix I.

The environmental policy must be clearly communicated and explained to all current employees and all new hires. It should be discussed in staff meetings, included in employee handbooks and posted on the staff notice board. Once the property has put into practice the

key elements of its EMS and achieved the first noticeable results, management should place a framed copy of the environmental policy in the hotel lobby, in full view to all guests and visitors



3.2.4 Motivate the staff

The hotel does not currently have regular staff meetings. Monthly, or at least quarterly, meetings of all employees are important to establishing communication between management and employees and to building staff morale. More frequent meetings of department heads will build teamwork among departments and keep everyone apprised of important issues in the hotel. It is important that the hotel begin holding meetings of staff and department heads as soon as possible. These meetings do not have to be lengthy -- in fact they will typically be more effective if a brief agenda is set beforehand.

Management should use these staff meetings to inform all employees of the environmental program's objectives and to call for their ideas and support. Involving the staff not only helps gain their commitment to the initiative but it also allows the program to benefit from their creativity and experience. Line-level employees often know best how to reduce waste and improve efficiency and how to carry out specific programs and actions in the most practical manner. The Champion and the Green Team should, therefore, strive to gain the support and collaboration of their colleagues at all levels and in all the departments of this property.

In most cases, staff will not effectively practice environmentally-conscious behavior unless they are given proper training and motivated through an appropriate incentives program. For example, employees will engage more willingly in good housekeeping practices once they are clearly instructed on what must be done, informed of the benefits of these practices, and encouraged and rewarded by management. Since staff participation in the environmental program can generally save the property a lot of money, management should take the time to devise an appropriate and effective incentive program.

Incentives can include monetary rewards such as sharing with the staff part of the water and energy savings achieved through the environmental program, or giving bonuses to particularly deserving employees. Incentives can also include non-monetary rewards such as extra paid vacation days, parties and gifts (e.g., t-shirts with the hotel's "green team" logo, gift certificates).

3.2.5 Participate in external activities

Coral Seas' management and staff should get involved in local and national initiatives, attend events, subscribe to environmental publications, discuss environmental issues with colleagues in the industry, and promote "networking" of good ideas through the Negril Chapter of the JHTA. Participation in external activities will help the property gain a deeper understanding of the issues, learn of how others are tackling their environmental problems and enhance the property's reputation in the industry.

An effective and productive way for Coral Seas to further enhance its environmental program is by developing strong community relationships. By actively participating in local civic and environmental activities, Coral Seas will highlight its leadership role and bolster the motivation of its employees by allowing them to positively affect the community in which they live and by providing them an alternate means for professional growth.

3.3 Planning action

3.3.1 Select and assess the program's focus areas

The Green Team, under the leadership of the Program Champion, must review the property's activities in order to determine which areas, departments or issues should be targeted first by the environmental management program. This review process is generally conducted by

- 1) identifying the environmental aspects of the property's activities -- an environmental aspect is an element of a property's activity which interacts in a beneficial or detrimental manner with the environment
- 2) evaluating these environmental aspects in order to determine which of these have a significant negative impact on the environment
- 3) highlighting the areas of significant negative environmental impact that can be affected through the property's environmental program

The environmental aspects of the various activities carried out in hotels can generally be classified in at least one of the following categories

- water use,
- energy use,
- solid waste generation,
- generation of water pollutants,
- use of hazardous products,
- generation of air emissions, and
- damage to the eco-system

A description of the environmental impacts and the types of activities associated with Coral Seas' principal environmental aspects is given in Appendix II

The identification of environmental aspects and impacts provides the property with a sense of its current environmental performance and enables the property to establish the environmental targets and objectives of its future EMS activities. The background information and the recommendations given in this report should help Coral Seas identify its principal priority areas.

After selecting the priority areas for the environmental program, the Green Team will have to conduct a detailed review of each priority area. The purpose of this review process is

- 1) To assess current performance in each particular priority area. Current performance can be best evaluated by calculating environmental performance indicators from the property's energy, water and solid waste bills, chemicals and materials purchase records, and hotel occupancy records. Examples of the type of indicators which can be used by Coral Seas to gauge its current environmental performance include

- gallons of water consumed by the property per guest night
- kWh consumed by the property per guest night
- number of tanker loads pumped from the septic tank per 1,000 guest nights
- gallons of water consumed per pound of material processed through the laundry
- pounds of laundry (or number of wash loads) processed per guest night
- pounds of laundry chemicals used per guest night
- pounds (or volume) of solid waste hauled out of the property per guest night
- pounds of materials (glass, paper, plastic, metals) recycled per guest night
- pounds of a specific chemical product used per guest night

This initial assessment is very important since it provides the benchmark against which progress will be measured in a particular focus area (e.g., the laundry room) or in the property as a whole.

- 2) To identify improvement options. The Green Team will need to identify what is already being achieved in order to gain an idea of where improvements can be made without sacrificing other operational criteria. This is where discussion with key staff in each area is not only very useful (they often understand best where and how improvements can be made) but also essential if they are to be committed to the process.

The findings and conclusions of this preliminary review process should be recorded so that they may be used, at the end of the yearly EMS cycle, to evaluate the results and achievements of the environmental program

3 3 2 Prepare a plan

The preparation of the action plan involves four important steps

- decide which of the actions identified by the review should be pursued first,
- define the steps to implement each action,
- allocate responsibility for these steps,
- set target dates for action

The action plan should prioritize

- actions needed to meet environmental laws and standards,
- good management practices which are simple and will bring a combination of environmental and business benefits,
- investment measures which have a rapid payback

The action plan forms given in Appendix III illustrate the outputs of this task

The task of working up the plan of action may involve testing the performance, cost and operational implications of an option. It may be wise to try out an idea before fully implementing it.

The audit team recommends that the hotel begin with back-of-house environmental improvements first. Since Coral Seas has not yet begun a comprehensive environmental effort, it would not be wise to start its program with an initiative such as a Linens and Towels Reuse Program, which solicits guest participation. These types of programs are best implemented (the guests are more likely to willingly participate) when the guest can see that the hotel has made some efforts toward conservation.

3 3 3 Set targets

The purpose of setting targets is to provide clear benchmarks against which to measure the success of the program. However, since changing environmental practice takes time and effort, the Green Team should carefully evaluate the program's targets. It is often better to set targets which are achievable and which can provide real satisfaction once achieved, than to set over-ambitious targets which only lead to failure and staff demoralization.

The targets established by the Green Team for the property's environmental program can either be based on environmental performance indicators or on specific actions that must be completed by a given date.

Examples of indicator-based targets include

- Reduce the amount of water consumed by the property per guest night in 1998 by 10% with respect to the 1997 figure
- Reduce the mass of solid waste hauled out of the property per guest night in 1998 by 20% with respect to the 1997 figure
- Before the end of 1998, achieve a water use ratio of 2.1 IG per pound of laundry processed

Examples of action-based targets include

- Start a composting program for all garden waste by March 1998
- Develop a check list for a guest room preventive maintenance program by January 1998 and begin the program by February 1998

3.4 Taking action

3.4.1 Prepare personal action plans

Coral Seas' employees must clearly understand that responsibility for minimizing the waste of energy, conserving water, recycling materials, and other tasks defined by the property's environmental program is part of their job. They must be aware that they will be recognized if they carry out these responsibilities successfully, and noticed if they do not. The key to achieving this objective is to translate the overall action plan into personal action plans which detail the specific and general actions expected of specific employees.

An example of a personal action plan is provided in Appendix IV

3.4.2 Provide support and training

The key to success for any environmental program is education. Employees must learn how to perform their daily tasks in a manner that will maximize conservation, and understand why Coral Seas is undertaking this effort and the positive effects this effort will have on them, their families and the local community. This understanding will provide a sense of ownership in the environmental effort that will contribute to its long-term success.

The objectives of the training program are simple: to ensure that all employees understand the property's important environmental issues and have acquired the skills to perform their work in an environmentally responsible manner. Employees need to realize that resources are limited and that proper waste disposal in an island environment is critical. For instance, the audit team has found that employees at many hotels in Jamaica do not realize that fresh water is scarce or expensive because there is so much water everywhere you look in Jamaica. The hotel needs to educate its employees on these types of issues in order to gain their participation.

3.4.3 Publish results

Employees want to know the results of their endeavors. Management and the Green Team should therefore regularly post the results of monitoring on the staff notice board, congratulate success, and rewarding individuals or departments that have done particularly well.

Many hotels put up energy and water consumption monitoring results on their staff notice boards. The results for the current month are displayed in a simple graphic format and compared with the previous month and the same month in the previous year. Staff take a great interest and pride in these results.

Coral Seas may also decide to publicize the results of its environmental program in promotional literature.

3.4.4 Show leadership

Achieving staff commitment is an ongoing task -- if enthusiasm is to be maintained, staff need to be constantly reminded of the objectives and targets which have been set. Management and the Green Team must demonstrate its continued commitment and leadership, notice when action is being taken and when lapses occur, and continually refresh enthusiasm in the challenge of transforming Coral Seas in an environmentally friendly property. Like customer care, good environmental management practices must become part of the management culture.

3.5 Reviewing progress

3.5.1 Monitor progress

The saying, "you can't manage what you don't measure," applies as much to environmental management as to other areas. Coral Seas needs to establish good monitoring procedures to insure that the program is working and achieving its objectives. Monitoring should be sufficiently frequent to enable corrective action to be taken if there is a significant change in the average daily consumption or a large deviation from targeted performance. Ideally, water and electricity meters should be checked on a daily basis. This activity need not take a member of staff more than 30 minutes per week.

Examples of water and energy monitoring forms are provided in Appendix V
--

Especially in the early days when progress will be patchy and difficulties will arise, the Green Team should frequently hold short meetings with relevant individuals to review the progress made and to help sort out problems as they arise.

Effective utilities metering will pay back very rapidly. Some hotels have installed separate utility metering for different parts of the hotel. This enables them to better identify where energy or water wastage is occurring. Typically the cost of installing new meters will be met from utility cost savings in the first year.

3 5 2 Conduct an annual review

Once a year Coral Seas will need to step back to check the progress in its environmental performance. This review might best be undertaken by the Champion and may take the form of a short report attaching completed targeting and monitoring forms of the initiatives undertaken. Alternatively, management may prefer to use independent consultants if it feels that Coral Seas does not have the resources or expertise in house to perform this task. The review should cover the property's environmental management capabilities as well as the progress made with specific environmental actions. It should entail

- A general review of the property's environmental performance to assess what progress has been made, and to help re-prioritize action
- A summary of measured achievements against set targets and objectives
- Discussions with relevant staff to identify the difficulties that have arisen, and the successes, and their recommendations for future action

This review process is invaluable. It will highlight problem areas as well as help identify the most appropriate environmental management approach for Coral Seas. Management and the Green Team can then begin to plan for the coming year -- but this time on the basis of the experience acquired over the past year.

4. Recommendations for Improving the Property's Environmental Performance

Table 1 provides a summary of the recommendations proposed by the audit team to help the property address many of its activities that have a negative impact on the environment. It is important to note, however, that this list only contains the recommendations identified during the course of a three day audit, these recommendations should therefore be viewed as only a the first phase of the property's continuous EMS process

The recommended actions listed in Table 1 are classified by department or area of activity (e.g., maintenance department, housekeeping department, guest rooms, gift shop) and by the environmental aspect category addressed by each recommendation (e.g., water use, energy use, solid waste generation). Table 1 also provides an evaluation of the environmental impact, the implementation cost and the cost effectiveness of each recommended action. The ratings used to qualify the recommendations are defined as follows:

Criteria	Rating	Description of rating
Environmental benefit of the action	High (H)	Significant reduction of the property's impact on the environment (e.g., a large reduction in the toxicity or volume of generated waste, a significant improvement in the use of water, energy, chemicals or other products)
	Moderate (M)	Moderate reduction of the property's impact on the environment
	Low (L)	Low or insignificant reduction of the property's impact on the environment
Cost to implement the action	High	Cost > 1 750 J\$ per room (> 50 US\$ per room)
	Moderate	Cost = 350 to 1 750 J\$ per room (10 - 50 US\$ per room)
	Low	Cost < 350 J\$ per room (< 10 US\$ per room)
Cost effectiveness of the action	High	Payback < 2 months
	Moderate	Payback = 2 months to 1 year
	Low	Payback > 1 year

The property's management and staff can use the ratings to select the recommendations that should be implemented first and to identify the recommendations that yield the greatest benefits -- that is, High environmental benefit, Low implementation cost and High cost effectiveness.

The high priority actions are highlighted with the ☉ symbol. These actions are those which either have an immediate payback (cost effectiveness = H) or have a high environmental benefit combined with a moderate payback (cost effectiveness = M).

Table I Recommendations for Improving the Property's Environmental Performance

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
MAINTENANCE DEPARTMENT			
General maintenance issues	Action's env impact = H	Cost = M/L	Cost effectiveness = H
<p>☉ Implement a program to regularly monitor the consumption of energy, water and chemicals and the amount of solid waste generated by the property. At the end of each month, the property should calculate how much electricity, LPG, water, and chemicals was consumed and how much garbage was produced per guest night (i.e. gallons of water/guest night, kWh/guest night, etc.) This data will help the property</p> <ul style="list-style-type: none"> • define its normal consumption patterns, • identify any unusual shifts in consumption which may indicate equipment problems (e.g., water leaks) or operational problems, • ensure that employees are complying with water, energy and materials conservation guidelines, • ensure the effectiveness of preventive maintenance operations, and, • evaluate the progress of the property's conservation and environmental efforts <p>Monitoring should be sufficiently frequent to enable the property to take corrective action if there is a significant change in consumption or a large deviation from targeted performance. Ideally, water and electricity meters should be checked on a daily basis. This activity need not take a member of staff more than 30 minutes per week. Sample monitoring forms are presented in Appendix V</p>			
General maintenance issues	Action's env impact = M	Cost = L / M	Cost effectiveness = N/A
<p>Formalize a preventive maintenance program. The preventive maintenance program should include written maintenance schedules and maintenance activities should be formally tracked in a preventive maintenance log book. A comprehensive preventive maintenance program ensures that equipment is running efficiently and safely and extends the useful life of the equipment.</p>			
General maintenance issues	Action's env impact = M	Cost = N/A	Cost effectiveness = H
<p>Establish a procedure for all staff to quickly report maintenance issues to the maintenance staff</p>			
Water use	Action's env impact = H	Cost = see specific actions	Cost effectiveness = see specific actions
<p>☉ Water consumption at Coral Seas (183 Imperial gallons per guest night) is greater than the industry average for a water efficient property (96 Imperial gallons per guest night). Given the high cost of NWC water (202 J\$/1 000 IG) it is in this property's best interest to engage in an aggressive water conservation program. By implementing water conservation measures, Coral Seas will also reduce the volume of effluent discharged to its on-site wastewater treatment systems, thereby improving the performance of its septic tanks and tile fields.</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊙ Promptly fix all leaks in faucets, toilets and pipes and ensure that all water-using fixtures are in proper working order. The audit team detected only one leak (behind the laundry washing machines) and one creeping toilet while inspecting the property, suggesting that Coral Seas provides effective and timely maintenance to its water-using fixtures. However, since even a single dripping tap can waste up to 10,000 IG/year (2,000 J\$/year) and an overflowing toilet can easily lose 53 000 IG/year (10,600 J\$/year), Coral Seas should persevere in its leak detection and maintenance efforts.</p> <p>Maintaining Coral Seas' water-using fixtures in proper working order requires an effective preventive maintenance program and the collaboration of all employees. All staff members -- and in particular housekeepers, kitchen and laundry workers -- should be trained to detect leaks and malfunctioning toilets (leaky flapper valves sticking flush mechanism overflowing toilet tanks), and to promptly report these problems to maintenance.</p> <p>Maintenance staff should have the training and the means to promptly answer the maintenance requests and to conduct a regular and effective preventive maintenance program. As part of the preventive maintenance program, maintenance staff should conduct the following operations:</p> <ul style="list-style-type: none"> • Replace missing or damaged faucet aerators • Ensure that there are no excessive leaks in the valves which divert water from the tub faucet to the shower head -- that is only a minimum amount of water should come out of the tub faucet while the valve is on the "shower" position • Ensure that there are no excessive leaks around the packing of tub and sink faucets • Periodically clean the carbonate deposits from shower heads. Clogged shower head may encourage guests to take baths rather than showers -- an average bath consumes 4 times more water than a shower • Ensure that tub and sink stoppers seal properly. Repair or replace leaking stoppers • Check for broken flush lever mechanisms. A damaged or jammed flush mechanism can waste more than 5 IG/minutes (7 200 IG/day) until it is detected and corrected • Check for damaged and leaking toilet flapper valves • Remove scale deposits in toilet tanks that obstruct the flapper valve • Adjust the water level in toilet tanks to the minimum level required for proper operation. An excessively high water level in the toilet tank can waste up to 0.5 IG/flush. Letting the water level rise above the top of the tank overflow pipe can result in a constant loss of more than 0.5 IG/min <p>The cost of these maintenance operations is generally minimal.</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>☉ Install faucet aerators wherever possible Many of Coral Seas' faucets are not equipped with flow aerators (e.g., kitchen, laundry guest bathrooms, and guest room kitchenettes) The absence of these low-cost water-saving devices contributes to the excessive consumption of water at Coral Seas</p> <p>The use of flow aerators is particularly important in areas where taps are used frequently or left running for long periods of time</p> <p>This recommendation is detailed in Project 1</p>			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>☉ In addition to flow aerators the output of faucets can be further controlled by adjusting the shut-off valves located on the pipes that bring water to the faucets In many cases these valves are wide open and thus subject the faucets to the full pressure carried by the water distribution system These valves should be adjusted to lower the water pressure acting on the faucets and reduce their maximum flow output</p> <p>Coral Seas should use this technique to limit the output of its older faucets which cannot accommodate flow aerators and cannot be economically replaced by new faucets</p>			
Water use	Action's env impact = M	Cost = L/M	Cost effectiveness = M
<p>Continue the installation of low flow shower heads Since the low flow shower heads installed by Coral Seas use less than 1.0 IG/min as compared to more than 2.5 IG/min for standard shower heads the installation of these devices is a very cost effective water and energy conservation measure At the time of the audit, Coral Seas had already purchased and installed several such low-flow shower heads</p> <p>This recommendation is detailed in Project 2</p>			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
<ul style="list-style-type: none"> ☉ Ensure that all guest bathroom sinks are equipped with stoppers which seal properly The lack of properly fitting stoppers forces guests to use running faucets when shaving washing clothes etc None of the 8 guest bathrooms and kitchenette sinks inspected had stoppers ☉ Ensure that if the tubs are equipped with stoppers these do not leak Poorly fitting or leaking stoppers lead guests to use more water whenever they take baths ☉ Since baths consume on average 4 times more water than showers Coral Seas may want to discourage guests from taking baths In such a case Coral Seas should remove all tub stoppers or dismantle all tub stopper mechanisms 			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = M
<p>Install flow diverters in the water tanks of all possible conventional toilets (i.e., toilets which are equipped with large water tanks and therefore use between 3.3 to 4.2 IG per flush). Flow diverters fit at the end of the hose which feeds water to the toilet bowl's refill pipe, and they divert to the water tank part of the flow that would otherwise drain to the toilet bowl.</p> <p>This simple device can therefore be used to</p> <ol style="list-style-type: none"> 1) regulate the amount of water sent to refill the toilet bowl, 2) set a suitable water level in the toilet bowl (very often the water level in the toilet bowl is unnecessarily high), and 3) avoid overfilling the toilet bowl (once the water reaches the maximum allowable level in the bowl, all additional water added to the bowl is automatically discharged from the toilet) <p>Flow diverters can be easily installed on most conventional toilets and can save from 0.4 to 0.8 IG per flush.</p> <p>This recommendation is detailed in Project 3</p>			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = M
<p>Install displacement devices in the water tanks of conventional toilets (3.3 to 4.2 IG/flush). The use of these devices can reduce by approximately 0.4 IG the amount of water used for each flush. This water conservation measure requires only a minimum investment since toilet dams are generally home-made (plastic bottles filled with pebbles and water).</p> <p>This recommendation is detailed in Project 4</p>			
Water use	Action's env impact = M	Cost = M	Cost effectiveness = M
<ul style="list-style-type: none"> • Establish a policy to replace any damaged or unusable guest bathroom toilet with a water-saving toilet (i.e. a toilet that uses 1.3 IG/flush) • Replace conventional toilets with 1.3 IG/flush toilets in frequently used public or employee restrooms <p>This recommendation is detailed in Project 5</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Water use	Action's env impact = H	Cost = M	Cost effectiveness = M
<p>⊗ Consider collecting and using rainwater for the laundry or other operations</p> <p>Since rainwater is virtually free, plentiful during at least 6 months of the year, and relatively clean, it is an ideal source of laundry water. Collected rain water contains little dissolved iron which stains linens and towels. It is also naturally soft and should therefore minimize the use of this property's water softening system.</p> <p>This recommendation is detailed in Project 6</p>			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊗ Replace the float valve which limits the maximum allowable height of water in the storage tank. Currently, the filling of the storage tank is controlled manually by the property's staff. This practice is rather wasteful since the storage tank can easily overflow if the water inlet is not shut off in a timely fashion. Based on the wetness of the surrounding ground, it would appear that the storage tank overflows much too often.</p> <p>⊗ Repair the leaking pipes at the outlet of the storage tank.</p> <p>⊗ Repair the broken mosquito netting which covers the water storage tank. An open storage tank greatly increases the risks of contaminating the property's potable water supply.</p> <p>⊗ Consider increasing the size of the pressure tank or decreasing the output of the pump. The existing pump/pressure tank configuration is poorly sized and forces the pump to cycle (on/off) much too frequently. This excessive cycling will shorten the service life of the pump.</p>			
Energy use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊗ The swimming pool's filtration system is equipped with a 1.5 HP (1.1 kW) pump. The pool keeper occasionally turns the pump off during nighttime (from 10 PM to 8 AM) but normally this pump operates 24 hours per day.</p> <p>Experience shows that in most cases pool water quality can be maintained by running the filter pumps for only 12 to 16 hours per day. Coral Seas should therefore make it a regular habit to shut off its filter pump at night in order to save energy and to increase the service life of the pump.</p> <p>This recommendation is detailed in Project 7</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Energy use	Action's env impact = M	Cost = M	Cost effectiveness = M
<ul style="list-style-type: none"> ▶ The hotel should consider the use of key switches in guest rooms to control the use of lighting, air conditioning, and appliances when the guest is not in the room. This type of system is very popular in Europe, where most of the Coral Seas' clientele is from. ▶ Air-conditioners, generally the largest single users of energy in guest rooms, can also be easily controlled with occupancy sensors. Coral Seas is encouraged to consider the use of occupancy sensor since, in the particular case of this property, this control measure could offer a faster payback period than the use of key switches. 			
Energy use lighting	Action's env impact = M	Cost = M	Cost effectiveness = M
<p>There is a large number of incandescent bulbs used around the property. Wherever possible, Coral Seas should consider retrofitting existing lights with energy efficient fixtures (e.g. compact fluorescent bulbs) -- priority should be given to replacing the incandescent bulbs that have a medium to high wattage (60 W or higher) or that burn for long periods of time (> 8 hours per day).</p> <p>This recommendation is detailed in Project 8</p>			
Energy use lighting	Action's env impact = M	Cost = L	Cost effectiveness = H
<ul style="list-style-type: none"> ⊗ Establish a program to regularly clean all guest room light bulbs to ensure they perform at maximum efficiency. The audit team found many dirty bulbs in the guest rooms and guest baths. <p>Dusty or dirty bulbs give 1/3 less light and therefore waste approximately 1/3 of the energy consumed. For example, a dirty 60 W bulb produces no more light than a clean 40 W bulb and therefore wastes 16 kWh of energy (75 J\$) over its service life.</p>			
Energy use air-conditioning	Action's env impact = M	Cost = L	Cost effectiveness = M/H
<ul style="list-style-type: none"> ⊗ The louvered windows and the large gaps under the entrance doors result in a significant heat gain in the guest rooms which adds to the load and energy consumption of the air conditioning units. This property should therefore install durable weather stripping on the louvered windows and at the base of the entrance doors of its air-conditioned guest rooms. 			
Energy use air-conditioning	Action's env impact = M	Cost = L	Cost effectiveness = H
<ul style="list-style-type: none"> ⊗ The maintenance staff should ensure that the exhaust vanes of all a/c units are closed. An open exhaust vane lets fresh outside air enter the room and thus forces the a/c unit to work harder. Since all Coral Seas guest rooms receive plenty of fresh air through improperly sealing louvers and doors, the additional fresh air supplied by the exhaust vane is not necessary and wasteful. 			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Energy use hot water supply	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>☉ The hot water supplied by most water heaters at Coral Seas is excessively hot. Coral Seas should therefore ensure that all water heater thermostats are set to the "energy efficiency" range indicated on the thermostats.</p> <p>High water heater temperatures increase heat/energy losses from the surface of the water tanks and hot water pipes, and increase the risk of scalding guests and employees. In many parts of the US, setting water heaters higher than 120°F is prohibited by law.</p>			
Solid waste generation	Action's env impact = H	Cost = M	Cost effectiveness = M
<p>☉ Coral Seas should implement a hotel-wide recycling program to segregate glass, plastics, metal, cardboard, paper, and green waste from its general waste stream.</p> <p>This recommendation is detailed in Project 9</p>			
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
<p>The hotel should install trash cans around the property to make it easier for guests and employees to throw items away.</p> <p>The audit team noted considerable trash on the grass around the hotel, in the bushes, and over the fence on the adjacent lot. Emptying these trash cans on a regular basis should be a lot easier than constantly collecting trash around the property and periodically hauling large amounts of garbage from the adjacent lot.</p>			
Use of hazardous chemicals	Action's env impact = H	Cost = L	Cost effectiveness = H
<p>☉ Avoid the use of drain cleaning chemicals whenever possible. Drain cleaning chemicals are toxic, hazardous, and expensive; they should therefore be used sparingly and only as a last resource. Furthermore, when discharged to an on-site wastewater disposal system, these chemicals harm the bacteria which decompose and purify the waste in septic tanks and tile fields. The destruction of these beneficial bacteria increases the rate at which solids accumulate in septic tanks, increases the possibility of clogging the tile fields, and increases the mass of pollutants which reach the ground water table.</p> <p>The maintenance staff should first try to clear clogged drains with a plunger or snake before using chemicals. Snakes are long, highly flexible metal wires or coils which are very effective in cleaning and unclogging drains; they can be operated manually or powered through a drill-like device. The cost of these tools range from 20 US\$ for a manual snake to 250 US\$ for a top-of-the-line power-driven snake.</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Damage to the ecosystem	Action's env impact = H	Cost = L	Cost effectiveness = H
<p>⊗ The audit team found that a considerable amount of trash is dumped on the empty lot adjacent to the hotel. Although the hotel staff indicated that most of this trash is placed there by the guests, this seems to be unlikely since most of the trash is either wrapped in plastic bags or consists of old chemical or paint containers.</p> <p>The hotel staff should be instructed that it is not acceptable to dispose of trash in this way, since the practice is both harmful to the environment and unattractive. In addition, the grounds staff stated that the hotel pays for the lot to be cleaned several times per year. This cost could be greatly reduced by informing staff that this practice will not be tolerated.</p>			
Damage to the ecosystem	Action's env impact = H	Cost = L	Cost effectiveness = N/A
<p>⊗ Currently, Coral Seas discards in the morass the waste that is removed from the kitchen's grease trap. Since the disposal of solid waste and sludge in bodies of water (i.e., the morass) is prohibited by Jamaica's Natural Resources Conservation Authority Act, Coral Seas should put an end to this practice.</p> <p>This waste (i.e., the layer of grease skimmed from the trap and the solids collected from the bottom of the trap) should be placed in a plastic bag and thrown out along with the property's solid waste. Alternatively, Coral Seas could discard only the grease and dispose of the solids in its compost pile.</p> <p>⊗ Coral Seas should also stop discharging the untreated effluent from its kitchen in the morass. The discharge of sewage and noxious effluents in bodies of water is also prohibited by Jamaica's Natural Resources Conservation Authority Act.</p> <p>⊗ During the cleaning operations, the groundsman pours powdered bleach into the grease trap to neutralize odors and to kill the harmful bacteria present in the waste. Since bleach harms the fauna and flora in the morass, kills the beneficial bacteria which degrade waste in septic tanks and tile fields, and does not kill all of the harmful bacteria in the waste, Coral Seas should discontinue this practice immediately. The odor problem can be greatly minimized by 1) cleaning the grease trap more frequently, and 2) placing the collected waste in a closed plastic bag.</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
FRONT OFFICE			
Solid waste generation	Action's env impact = M	Cost = M	Cost effectiveness = M
	Consider converting to a computerized reservation and accounting system This conversion will reduce paper waste and provide Coral Seas with more reliable cost-tracking system		
PURCHASING			
Solid waste generation	Action's env impact = H	Cost = L	Cost effectiveness = N/A
	<p>☉ Purchase as many recycled paper products as possible (office paper, toilet paper, facial tissues, paper towels, etc) Most paper products manufacturers have environmentally-friendly alternatives which contain a minimum of 20% POST CONSUMER waste The price and quality of recycled paper products are often comparable to those of virgin paper products The use of these products also helps to convey the hotel's concern for the environment to its guests</p>		
Solid waste generation	Action s env impact = M	Cost = L	Cost effectiveness = H
	<p>☉ The hotel uses too many plastic bags the three Coral Seas properties use approximately 1 000 large plastic garbage bags per month resulting in an expenditure of 120,000 JS/year</p> <p>Since these bags are mainly used to collect garbage yard waste, and laundry, Coral Seas could drastically reduce its consumption of plastic bags by controlling the habits of its employees and replacing disposable bags with durable and reusable canvas bags These alternatives will be discussed later in the report but the purchasing manager should tightly control the purchase and use of these bags</p>		
Solid waste generation	Action s env impact = M	Cost = L	Cost effectiveness =H
	<p>☉ All housekeeping cleaning products are purchased in individual and disposable bottles The purchasing manager should look into the possibility of purchasing these items in bulk concentrated form instead Concentrated products are less expensive due to lower packaging cost and they can be used by the housekeepers in re-fillable pump bottles Switching over to bulk concentrated products will therefore save money and reduce the amount of packaging waste generated by the hotel</p>		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Use of hazardous chemicals	Action's env impact = M	Cost = L	Cost effectiveness = H
	<ul style="list-style-type: none"> <li data-bbox="302 363 1461 541">⊗ The hotel needs to reduce its use of toxic chemicals (e g , housekeeping cleaners, drain clearing chemicals, bleach) These chemicals harm the beneficial bacteria which purify the waste in septic tanks and tile fields, and may be largely responsible for the property's need to use expensive enzyme treatments to re-introduce bacteria to the system These enzyme treatments are estimated to cost 3,000 J\$ per month and could be reduced if the property used fewer hazardous chemicals <li data-bbox="302 583 1461 751">⊗ If the enzyme treatments are continued the purchasing manager should check with the supplier to find out how the enzymes should be stored Generally, enzyme treatments should be kept at temperatures less than 120 degrees Fahrenheit and this temperature is likely exceeded in the chemical storage room High temperatures degrade and reduce the effectiveness of these products 		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
GUEST ROOMS AND HOUSEKEEPING			
General housekeeping issues	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊗ Create a checklist, or personal action plan, for housekeepers to ensure they are aware of and comply with the conservation measures adopted by Coral Seas. Examples of items that should be included in this checklist include</p> <ul style="list-style-type: none"> • Turn the a/c off (or lower the a/c setting) when entering the room • Make sure the a/c units are not obstructed by curtains and furniture • Before leaving the guest room, turn off all lights, televisions and radios, ensure that faucets and toilets are not running, close all louvers and windows (if the a/c is left on or if the room is cool) • Check for and report malfunctioning equipment and fixtures. Pay particular attention to water leaks in toilets, faucets and shower heads, excessively high flows from faucets or shower heads, sticking toilet flush handles, sink and bathtub stoppers which don't work or don't fit properly, damaged windows or louvers, scalding hot water, malfunctioning air conditioners • Do not replace the trash can liners (plastic bags) unless these are soiled or otherwise unacceptable for further use • Collect and separate all recyclable items left in guest rooms • Remove used soaps and amenities only at checkout • Etc <p>A sample of a "Personal action plan" for housekeepers is provided in Appendix IV</p>			
Water use / energy use / generation of water pollutants	Action's env impact = H	Cost = L	Cost effectiveness = H
<p>⊗ Let guests decide if they want to replace their towels every day. International and Jamaican (JHTA) experience has revealed that this measure can reduce the laundry load by up to 20%. By reducing the amount of material processed through the laundry, Coral Seas will be able to lower its water, chemicals and energy consumption and costs. The hotel will also be able to reduce the volume of wastewater processed through its septic system.</p> <p>This recommendation is detailed in Project 10</p>			
Water use / energy use / generation of water pollutants	Action's env impact = H	Cost = Nil	Cost effectiveness = H
<p>⊗ Currently, the hotel washes its guest bedspreads after every checkout. This practice</p> <ol style="list-style-type: none"> 1) increases the property's consumption of water, energy and detergent 2) increases the laundry's workload 3) shortens the service life of laundry equipment, and 4) increases the wear and tear on the bedspreads, forcing Coral Seas to replace them more frequently <p>Since many hotels wash their bedspreads only once per month, and more often only if needed, Coral Seas should consider modifying its current practices.</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Energy use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊗ Many guests leave the air conditioner running and lights on after leaving their rooms Coral Seas should place a tactful note in the rooms to encourage guests to turn off air conditioners and lights whenever they leave their rooms for extended periods</p> <p>Other action that can be taken by Coral Seas to reduce the energy consumed by its a/c units include</p> <ul style="list-style-type: none"> • When entering a guest room, ask the housekeepers to turn the a/c units off or, if this is unacceptable to the guests to adjust the a/c thermostat to a "low cool" setting (or the lowest possible setting) • Unless special ventilation is required, ask housekeepers to keep the doors of air-conditioned guest rooms closed this will keep the room cooler and prevent insects (especially mosquitoes) from entering the room If the door must be left open during guest room preparation, ask housekeepers to turn off the a/c units The audit team observed that many housekeepers left guest room doors open for extended periods while cleaning despite the fact that the air conditioner was on • Investigate the possibility to control the operation of the a/c units with infrared sensors and magnetic door switches 			
Energy use	Action's env impact = M	Cost = Nil	Cost effectiveness = H
<p>Housekeepers should close the curtains during the day in air-conditioned rooms This will keep the rooms cooler thus reducing the need for air-conditioning when the guests return</p>			
Solid waste generation	Action's env impact = M	Cost = Nil	Cost effectiveness = H
<p>⊗ Several housekeepers told the auditors that they change the guest bathroom soaps every day whether they have been fully used or not They should instead leave the used soap in the bathroom and provide a fresh bar just in case the guest needs it</p> <p>Replacing bars of soap every day costs the hotel approximately 27 300 J\$ per year about twice what it should be spending</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = H
	<p>⊗ Coral Seas should reduce the number of plastic bags currently used by the housekeeping staff. The housekeepers use too many large plastic bags to collect dirty laundry and trash from the guest rooms</p> <ul style="list-style-type: none"> • Housekeepers should be given reusable cloth or canvass bags to collect dirty linens from guest rooms. These bags can either be purchased or made from old sheets or table cloths • Whenever possible, housekeeper should empty the contents of guest room trash cans into a larger collection bag or reusable container, rather than automatically removing and replacing the trash can liners. The plastic trash can liners should be replaced only when damaged, soiled or no longer fit for reuse • If the trash can liners are removed, these should be tied close and not placed into a larger plastic bag 		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = H
	<p>⊗ The use of aerosol air fresheners should be avoided. Many Jamaican hotels used liquid air fresheners in a pump bottle with much success. These products are less expensive since they can be purchased in bulk, and will reduce the amount of waste produced by this property</p>		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = H
	<p>⊗ Currently, partially-used rolls of toilet paper are removed from guest rooms and thrown away. These rolls should be left in the guest bathrooms until they are almost empty and then should be removed for use in the employee bathroom. Guests do not necessarily need a fresh roll of toilet paper at check-in</p>		
Damage to the ecosystem	Action's env impact = M	Cost = L	Cost effectiveness = M/H
	<p>⊗ Housekeepers use an excessive amount of chlorine bleach for cleaning guest rooms. When discharged to an on-site wastewater disposal system, this chemical harms the bacteria which decompose and purify the waste in septic tanks and tile fields. The destruction of these beneficial bacteria increases the rate at which solids accumulate in septic tanks, increase the possibility of clogging the tile fields, and increases the mass of pollutants which reach the ground water table</p> <p>Coral Seas should try to identify less harmful cleaning products or minimize the amount of bleach used by housekeepers</p>		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
LAUNDRY			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊗ The laundry often washes loads that are not full. This practice should be discouraged, since it wastes water, energy and chemicals. The hotel should have enough turns of towels and sheets to allow the laundry to leave partial loads to be washed the next day.</p>			
Energy use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊗ The laundry staff should sort laundry by type (i.e. sheets, tablecloths, towels) and determine the optimal drying time for each type of laundry. The audit team found that laundry is often mixed and that the dryers are generally set for a one-hour drying time regardless of the type of load. One load was found with 25 minutes of drying time remaining and all but three pieces already completely dry.</p> <p>Segregating types of laundry will allow for a more even drying and shorter drying times for thinner linens.</p>			
Energy use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊗ The door on one dryer does not close fully and its seal is broken, allowing heat to escape when the dryer is operating. This should be fixed as soon as possible. The laundry staff should be trained to notify the maintenance department whenever there is a problem with the dryers to prevent wasted energy.</p>			
Energy Use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>⊗ Dryer loads are not always full. If the washers and dryers are not appropriately sized for one load to be moved directly from the washer to the dryer (that is, if they don't have the same capacity), the laundry staff should be aware of each dryer's capacity and divide the laundry accordingly. It wastes energy to dry less than a full load.</p>			
Damage to the ecosystem	Action's env impact = M	Cost = L	Cost effectiveness = M
<p>The laundry uses too many detergents and other chemicals in each load of wash. According to the laundry staff, a powder detergent, a fabric softener, a general purpose degreaser, and a rust and stain remover are used in every load.</p> <p>The laundry staff should identify effective and biodegradable products and reduce the number of chemicals used. For instance, heavily-stained items could be separated and pre-washed, thus eliminating the need to add a stain remover in every load. This will save the hotel money and reduce the amount of harmful chemicals going into the septic system.</p>			

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
KITCHEN			
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
	The kitchen staff currently uses a great deal of aluminum foil and plastic wrap. The hotel should purchase sealable, reusable plastic containers (e.g., Tupperware) to reduce the use of disposable plastic wrap for food storage. The hotel staff should be instructed to minimize the disposable wraps.		
RESTAURANT AND BAR			
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = H
	<ul style="list-style-type: none"> ⊗ Purchase sealable, reusable plastic containers (e.g., Tupperware) to reduce the use of disposable plastic wrap for food storage. The hotel staff should be instructed to minimize the use of plastic wrap and aluminum foil. 		
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = H
	<ul style="list-style-type: none"> ⊗ Do not give straws out automatically with drinks. Place straw dispensers on the bar or ask guests if they need a straw before serving the drinks. Also, replace plastic straws with paper straws. 		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = H
	<ul style="list-style-type: none"> ⊗ The hotel uses a variety of disposable plastic cups, plastic and paper plates, paper towels, and plastic utensils. Since disposable tableware items are not cheap and eventually end up as solid waste, their use should be discouraged and tightly controlled. ⊗ Coral Seas should purchase more glasses for its bar. Currently, the bartender begins using disposable cups whenever the bar runs out of clean glasses. 		
Solid waste generation	Action's env impact = L	Cost = unknown	Cost effectiveness = unknown
	The hotel should consider offering some of its more popular beers and drinks on tap instead of in bottles.		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
GARDENS			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = M
The grounds staff should spread mulch under the plants around the property This will help retain the moisture in the ground, allowing less frequent watering of the plants			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
<p>☉ All hoses should be equipped with spray nozzles to prevent water flow when it is not needed The audit team noted several hoses running unnecessarily, one for over an hour, especially when sidewalks are being cleaned</p>			
Water use	Action's env impact = M	Cost = Nil	Cost effectiveness = H
<p>☉ Currently the lawns are generally watered in the middle of the afternoon with the use of sprinklers Instead the hotel should water its gardens in the evening or in the early morning in order to reduce the amount of water lost to evaporation In addition, the hotel should ensure that the sprinklers are placed in such a way that the sidewalks are not being watered along with the grass and plants</p>			
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = H
Discontinue the practice of using disposable plastic bags to collect yard waste The hotel should instead use a wheelbarrow a yard cart or sturdy and reusable canvas bags for this purpose			
Solid waste generation	Action's env impact = H	Cost = L	Cost effectiveness = M
<p>☉ The hotel should keep its compost pile free of non-biodegradable items (e.g. general trash, plastic bottles, bags and containers) or send all yard waste to its off-site compost heap This compost should be processed appropriately and used as fertilizer and mulch on the property</p> <p>This recommendation is detailed in Project 11</p>			

5 Detailed Analysis of Selected Recommendations

Project I: Install flow aerators on all faucets

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 7,300 IG/year, corresponding to savings of 1,470 J\$/year for each flow aerator installed on a typical faucet
- ▶ Saves energy and money by reducing the use of hot water from faucets
- ▶ Reduces the volume of wastewater discharged to the property's septic tanks and tile fields, thereby improving the performance of the on-site wastewater disposal systems
- The payback period of this water conservation measure is typically 2 to 4 weeks

Current situation

Most faucets in guest rooms (bathrooms and kitchenettes), back-of-house areas (laundry room, kitchen, bar), and public areas (public restrooms) are not equipped with flow aerators. In fact, only 2 of the 12 faucets inspected in guest rooms and public restrooms were equipped with these water-saving devices.

Some of the maximum flows measured by the audit team in guest rooms and back-of-house areas are listed below.

Location	Maximum flow	Aerator
Room 101 bathroom sink	0.8 IG/min	yes (rated at 1.7 IG/min max)
Room 102 bathroom sink	2.5 IG/min	no
Room 205 bathroom sink	3.3 IG/min	no
Room 102 kitchenette sink	3.3 IG/min	no
Room 109B kitchenette sink	3.3 IG/min	no
Kitchen sink	2.7 IG/min	no
Laundry hot water faucet	1.7 IG/min	no
Laundry cold water faucet	2.9 IG/min	no

Recommendations

Install flow aerators on all faucets which can be equipped with these inexpensive water saving devices. Flow aerators screw directly at the end of faucets and reduce their output.

without affecting the “feel” of the flow

The maximum flow output of standard aerator models ranges from 1.3 to 2.1 IG/min. 1.3 or 1.7 IG/min aerators are generally used for bathroom faucets, while 2.1 IG/min models are generally installed on kitchen or bar faucets. In most instances, the actual output of an aerator is well below its rated maximum output (this is evident in the output of the aerator in room 101).

The use of flow aerators is particularly important on faucets that are used frequently (e.g., public and employee restrooms), are left running for long periods of time (e.g., kitchen, bar and laundry room), or have exceedingly high outputs. Flow aerators also save energy by reducing the amount of hot water drawn from faucets.

Input, assumptions and calculations

a) Calculation of the savings achieved by installing a flow aerator on a typical faucet

- ▶ Assume the typical faucet is operated for 10 minutes per day
- ▶ Assume the flow of the typical faucet with no aerator is 3.0 IG/min. By installing an aerator, this flow can be reduced to less than 1.0 IG/min
- The cost of water is 202 J\$/1,000 IG

The savings achieved by installing an aerator on a single faucet are

$$\begin{aligned}
 \text{Water savings} &= (10 \text{ min/day/faucet}) \times (3.0 \text{ IG/min} - 1.0 \text{ IG/min}) \times (365 \text{ days/year}) \\
 &= 7,300 \text{ IG/faucet/year} \\
 &= (7,300 \text{ IG/faucet/year}) \times (202 \text{ J\$/1,000 IG}) \\
 &= 1,470 \text{ J\$/faucet/year}
 \end{aligned}$$

b) Calculation of the implementation cost and payback period

- ▶ The cost of a faucet aerator ranges from 30 to 60 J\$. Therefore the cost effectiveness of this measure is

$$\text{Implementation cost} = 60 \text{ J\$/faucet}$$

$$\begin{aligned}
 \text{Payback period} &= (\text{implementation cost}) / (\text{annual savings}) \\
 &= (60 \text{ J\$/faucet}) / (1,470 \text{ J\$/faucet/year}) \\
 &= 2 \text{ weeks}
 \end{aligned}$$

Comments

- ▶ The savings achieved with flow aerators can justify, in certain cases, the cost of purchasing new fixtures to replace old fashioned faucets which cannot be equipped with aerators. The following table illustrates this point by presenting the savings resulting from the purchase of aerators and new fixtures for faucets that are operated from 5 to 60 minutes each day

Faucet use (min/day)	Water savings (IG/year)	Water savings (J\$/year)	Payback period for a 60 J\$ aerator	Payback period for a 3,000 J\$ faucet
5	3,650	735	1 month	4 years
10	7,300	1,470	2 weeks	2 years
20	14,600	2,940	1 week	1 year
40	29,200	5,880	< 4 days	6 months
60	43,800	8,820	< 3 days	4 months

- Note
- The savings presented in this table are based on the same flow assumptions used in the preceding calculations -- that is, initial flow of 3.0 IG/min reduced to 1.0 IG/min with the use of an aerator or with a new fixture equipped with an aerator. The cost of a new faucet is estimated at 3,000 J\$
 - In areas where hot water is drawn from the faucets, the installation of a flow aerator will also save energy by reducing the consumption of hot water

Project 2: Install low-flow shower heads

Summary of results and benefits

- ▶ Installing a low-flow shower head in a guest bathroom reduces water consumption by 5,300 IG/year and electricity consumption by 590 kWh/year, and saves the property 3,810 J\$/year in water and electricity
- ▶ Reduces the volume of wastewater discharged to the property's septic tanks and tile fields, thereby improving the performance of the on-site wastewater disposal systems
- ▶ The payback period for this water and energy conservation measure is typically less than 3 months

Current situation

- ▶ Coral Seas has installed low-flow shower heads in some guest bathrooms, but 60% of the guest bathrooms inspected by the audit team still have old shower head models which do not use water efficiently
- ▶ The showers in the two employee bathrooms located by the laundry room have no shower heads at all
- ▶ The maximum output of some of Coral Seas' shower heads is summarized in the following table

Location	Maximum flow (IG/min)	Type of shower head
Room 109B	1.0	low-flow
Room 205	0.8	low-flow
Room 305	1.7 to 4.2	not low-flow
Room 102	2.3	not low-flow
Male employee bathroom	2.5	no shower head
Female employee bathroom	2.1	no shower head

Note The output of the shower head in room 305 varied widely throughout the day according to the pressure available in the water distribution system

Recommendations Install low-flow shower heads in all guest and employee bathrooms. The low-flow shower heads installed at Coral Seas use less than 1.0 IG/min and provide a shower that feels good. These fixtures therefore save a significant amount of water and energy (by reducing the amount of hot water consumed in a shower) as compared to Coral Seas' older shower heads.

Input, assumptions and calculations

- a) Calculation of the water and energy savings achieved for each low-flow shower head

installed in a guest bathroom

- ▶ Assume two 5-minute showers per guest night
- ▶ Assume a piped water temperature of 70°F (21°C) and a shower water temperature of 105°F (41°C)
- ▶ Coral Seas' low-flow shower heads consume no more than 1.0 IG/min while the older shower heads consume on average 2.5 IG/min
- ▶ The cost of water is 202 J\$/1,000 IG
- ▶ The property has 26 guest rooms and an occupancy of 9,190 guest nights per year. This corresponds to an average of 353 GN/year/room
- ▶ The electricity consumed by Coral Seas' electric water heaters costs 4.64 J\$/kWh and yields 860 kcal/kWh. The electric water heaters have an assumed efficiency of 95%

Given this information, the savings achieved by installing a low-flow shower head are

$$\begin{aligned}
 \text{Water savings} &= (2 \times 5 \text{ min/GN}) \times (2.5 \text{ IG/min} - 1.0 \text{ IG/min}) \\
 &= 15 \text{ IG/GN} \\
 &= (15 \text{ IG/GN}) \times (353 \text{ GN/year/room}) \\
 &= 5,300 \text{ IG/year/room} \text{ or } 24,100 \text{ liters/year/room} \\
 &= (5,300 \text{ IG/year/room}) \times (202 \text{ J}/1,000 \text{ IG}) \\
 &= 1,070 \text{ J}/\text{year/room}
 \end{aligned}$$

$$\begin{aligned}
 \text{Energy savings} &= (24,100 \text{ lit/year/room}) \times (1 \text{ kcal/lit}/^\circ\text{C}) \times (41^\circ\text{C} - 21^\circ\text{C}) \times (1/0.95) \\
 &= 507,000 \text{ kcal/year/room} \\
 &= [(507,000 \text{ kcal/year/room}) / (860 \text{ kcal/kWh})] \times (4.64 \text{ J}/\text{kWh}) \\
 &= (590 \text{ kWh/year/room}) \times (4.64 \text{ J}/\text{kWh}) \\
 &= 2,740 \text{ J}/\text{year/room}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total savings} &= \text{water savings} + \text{energy savings} \\
 &= 3,810 \text{ J}/\text{year/room}
 \end{aligned}$$

b) Calculation of the implementation cost and payback period

- The cost of a low-flow shower head ranges from 300 to 850 J\$ but the following calculations will use a conservative cost of 850 J\$/unit. Therefore the cost effectiveness of this water and energy conservation measure is

$$\text{Implementation cost} = 850 \text{ J}/\text{shower head}$$

$$\begin{aligned}
 \text{Payback period} &= (850 \text{ J}/\text{shower head}) / (3,810 \text{ J}/\text{year/shower head}) \\
 &< 3 \text{ months}
 \end{aligned}$$

Comments If Coral Seas is not satisfied with the performance of its recently purchased low-flow shower heads, the property is strongly encouraged to identify, test, and purchase low-flow shower heads that have a proven performance record in Negril.

Project 3: Install flow diverters in toilet tanks

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 19,300 IG/year if flow diverters are installed in 60% of the property's toilets
- ▶ Saves the property 3,900 J\$/year in reduced water bills
- ▶ Reduces the volume of wastewater discharged to the property's septic tanks and tile fields, thereby improving the performance of the on-site wastewater disposal systems
- ▶ The payback period for this recommendation is less than 6 months

Current situation

- ▶ All of Coral Seas' bathrooms and restrooms are equipped with conventional toilets which consume from 3.3 to 4.2 IG per flush. None of the toilets inspected had any type of water conservation device in place
- ▶ Since toilets account for up to 40% of water consumption in an average residence, this property should be concerned about optimizing water use in toilets

Recommendations

Whenever possible, install a flow diverter on the hose which feeds water to the toilet bowl refill pipe of conventional toilets. By diverting back into the water tank part of the flow that normally drains to the toilet bowl, this simple device can be used to set a suitable water level in the toilet bowl and avoid the waste of water resulting from overflowing the toilet bowl. In most cases, flow diverters do not affect the performance of the toilet because they do not reduce the water level in the toilet tank or the amount of water used to flush the waste from the bowl. Flow diverters can be easily installed on most conventional toilets and can save from 0.4 to 0.8 IG per flush.

Flow diverters are used in many US hotels which are not equipped with water-saving toilets.

Product information on flow diverters is included in Appendix VI.

Input, assumptions and calculations

- a) Calculation of the savings resulting from the use of flow diverters
 - ▶ There are 26 toilets in guest rooms, 4 in public restrooms and 2 in employee restrooms
 - ▶ Assume 4 flushes per guest night in guest bathrooms and 20 flushes/day/toilet in public and employee restrooms
 - ▶ Assume flow diverters reduce by 0.4 IG the amount of water used to refill the bowl after each flush
 - ▶ Assume flow diverters can be installed in 60% of all toilets
 - ▶ The cost of water is 202 J\$/1,000 IG

- ▶ The hotel has an occupancy of 9,190 guest nights per year

Given the preceding information, the savings achieved by using flow diverters in the property's toilets are

$$\begin{aligned}\text{Water savings} &= 60\% \times [(4 \text{ flushes/GN}) \times (0.4 \text{ IG/flush}) \times (9,190 \text{ GN/year}) \\ &\quad + (20 \text{ flushes/day/toilet}) \times (6 \text{ toilets}) \times (0.4 \text{ IG/flush}) \times (365 \text{ days/year})] \\ &= 19,300 \text{ IG/year} \\ &= (19,300 \text{ IG/year}) \times (202 \text{ J\$/1,000 IG}) \\ &= 3,900 \text{ J\$/year}\end{aligned}$$

b) Calculation of the implementation cost and payback period

- ▶ Since flow diverters cost approximately 100 J\$/unit, the cost effectiveness of this measure is

$$\begin{aligned}\text{No. of diverters purchased} &= 60\% \times (26 + 6) \\ &= 20 \text{ units}\end{aligned}$$

$$\begin{aligned}\text{Total implementation cost} &= (100 \text{ J\$/unit}) \times (20 \text{ units}) \\ &= 2,000 \text{ J\$}\end{aligned}$$

$$\begin{aligned}\text{Payback period} &= (2,000 \text{ J\$}) / (3,900 \text{ J\$/year}) \\ &= 6 \text{ months}\end{aligned}$$

Comments

- ▶ Possible supply sources for flow diverters include

Mr. John Albino
AquaSaver Sales Inc
5062 South 108th Street #291
Omaha NE 68137
Tel (402) 895-4073

The flow diverters (AquaSaver™) supplied by AquaSaver Sales cost 2.50 USD/unit. Shipping 50 - 100 flow diverters from the US to Jamaica costs approximately 10 USD.

Project 4: Install displacement devices and adjust the water level in the toilets' water tanks

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 19,300 IG/year if displacement devices are installed in 60% of the property's toilets
- ▶ Saves the property 3,900 J\$/year in reduced water bills
- ▶ Reduces the volume of wastewater discharged to the property's septic tanks and tile fields, thereby improving the performance of the on-site wastewater disposal systems
- ▶ The payback period for this recommendation is less than 3 months

Current situation

- ▶ All Coral Seas bathrooms and restrooms are equipped with conventional toilets which consume between 3.3 and 4.2 IG per flush. None of the toilets inspected had any type of water conservation device in place.
- ▶ A total of 13 toilets were inspected during the course of the audit. In 7 of these (54%), the water depth in the toilets' water tanks was higher than necessary (the recommended water level is often indicated by a mark drawn inside the water tank). In one particular case, the water level rose 2' above the recommended water mark, implying that this toilet would use in every flush 0.75 IG of water more than required by the manufacturer.

Recommendations

- ▶ Whenever possible, equip all conventional toilets with displacement devices which reduce the amount of water used in each flush. Displacement devices include home-made plastic bottles filled with pebbles and water, flexible panels and filled bags. These devices are placed in the storage tank of conventional toilets to reduce the volume but not the height of the stored water. The displacement device must be compatible with the existing toilet and not interfere with the flush mechanism.
- ▶ Adjust all float valves to achieve a consistent and reasonable water depth in all toilet water tanks. Periodically check the toilet tanks to ensure that the water depth is at the predetermined height and never reaches the top of the overflow pipe.

Input, assumptions and calculations

a) Calculation of the savings resulting from the use of displacement devices

- ▶ There are approximately 26 toilets in guest rooms, 4 in public restrooms and 2 in employee restrooms
- ▶ Assume 4 flushes per guest night in guest bathrooms, and 20 flushes/day/toilet in public and employee restrooms
- ▶ Assume the displacement devices reduce by 0.4 IG the amount of water used in each flush. Reported water savings range from 0.4 to 0.8 IG per flush
- ▶ Assume displacement devices can be installed in 60% of all toilets
- ▶ The cost of water is 202 J\$/1,000 IG
- ▶ The hotel has an occupancy of 9,190 guest nights per year

The savings achieved by installing displacement devices in all guest room toilets are

$$\begin{aligned}
 \text{Water savings} &= 60\% \times [(4 \text{ flushes/GN}) \times (0.4 \text{ IG/flush}) \times (9,190 \text{ GN/year}) \\
 &\quad + (20 \text{ flushes/day/toilet}) \times (6 \text{ toilets}) \times (0.4 \text{ IG/flush}) \times (365 \text{ days/year})] \\
 &= 19,300 \text{ IG/year} \\
 &= (19,300 \text{ IG/year}) \times (202 \text{ J\$/1,000 IG}) \\
 &= 3,900 \text{ J\$/year}
 \end{aligned}$$

b) Calculation of the implementation cost and payback period

- ▶ The cost of a commercial displacement device is approximately 170 J\$. Coral Seas could however produce home-made displacement devices at a minimum cost (e.g., a recycled plastic bottle filled with pebbles and water). The following calculations assume a cost of 40 J\$ for a home-made displacement device

The cost effectiveness of this water conservation measure is

$$\begin{aligned}
 \text{No. of displacement devices} &= 60\% \times (26 + 6) \\
 &= 20
 \end{aligned}$$

$$\begin{aligned}
 \text{Total implementation cost} &= (40 \text{ J\$/toilet}) \times (20 \text{ toilets}) \\
 &= 800 \text{ J\$}
 \end{aligned}$$

$$\begin{aligned}
 \text{Payback period} &= (800 \text{ J\$}) / (3,900 \text{ J\$/year}) \\
 &< 3 \text{ months}
 \end{aligned}$$

Comments

- Coral Seas should test the effectiveness of the displacement units in a few toilets before implementing this water conservation measure throughout the property

Project 5: Replace existing conventional toilets with water-saving toilets

Summary of results and benefits

- ▶ Replacing a damaged guest bathroom toilet with a water-saving model lowers water consumption and wastewater generation by 3,530 IG/year and saves 710 J\$/year. The payback period for this water conservation measure is 1.4 years.
- ▶ Installing a water-saving toilet in a frequently used public or employee restroom reduces water consumption and wastewater generation by 18,250 IG/year and saves 3,690 J\$/year. The payback period for this water conservation measure is 13 months.
- ▶ Reduces the volume of wastewater discharged to the property's septic tanks and tile fields, thereby improving the performance of the on-site wastewater disposal systems.

Current situation All of this property's toilets consume from 3.3 to 4.2 IG per flush.

Recommendations

- ▶ For guest bathrooms, establish a policy to replace any damaged or unusable toilet with a water-saving model which uses 1.3 IG/flush (1.6 US gallon/flush).
- ▶ For all frequently used public or employee restrooms, replace conventional toilets with 1.3 IG/flush toilets.

Input, assumptions and calculations

a) Calculation of the savings achieved by installing a water-saving toilet in a guest bathroom.

- ▶ Assume 4 flushes per guest night.
- ▶ Water-saving toilets use 1.3 IG/flush while the existing toilets use on average 3.8 IG/flush.
- ▶ The cost of water is 202 J\$/1,000 IG.
- ▶ The property has 26 guest rooms and an occupancy of 9,190 guest nights per year. This corresponds to an average of 353 GN/year/room.

Given the preceding information, the savings achieved by replacing an existing guest room toilet with a 1.3 IG/flush toilet are:

$$\begin{aligned}\text{Water savings} &= (4 \text{ flushes/GN}) \times (3.8 \text{ IG/flush} - 1.3 \text{ IG/flush}) \times (353 \text{ GN/year/room}) \\ &= 3,530 \text{ IG/year/room} \\ &= (3,530 \text{ IG/year/room}) \times (202 \text{ J}/1,000 \text{ IG}) \\ &= 710 \text{ J}/\text{year/room}\end{aligned}$$

b) Calculation of the implementation cost and payback for replacing a guest bathroom's damaged 3 3 IG/flush toilet with a 1 3 IG/flush toilet

- ▶ Cost of a conventional toilet = 3,000 J\$
- ▶ Average cost of a 1 3 IG/flush toilet = 4,000 J\$

The cost effectiveness of replacing a damaged guest bathroom toilet with a water-saving model rather than a conventional model is calculated as follows

$$\begin{aligned}\text{Implementation cost} &= (4,000 \text{ J\$/room} - 3,000 \text{ J\$/room}) \\ &= 1,000 \text{ J\$/room}\end{aligned}$$

$$\begin{aligned}\text{Payback period} &= (1,000 \text{ J\$/room}) / (710 \text{ J\$/room/year}) \\ &= 1.4 \text{ years}\end{aligned}$$

- ▶ The preceding analysis shows that it is economically beneficial to replace any damaged 3 3 IG/flush toilet with a water-saving model even in low use areas, such as guest bathrooms. After the completion of Negril's sewer system, the payback period for this recommendation will be reduced to 8.5 months

c) Calculation of the savings achieved by replacing a conventional public or employee restroom toilet with a 1 3 IG/flush toilet

- ▶ Assume that on average a public or employee restroom toilet is flushed 20 times per day
- ▶ Water-saving toilets use 1 3 IG/flush while the existing toilets use on average 3 8 IG/flush
- The cost of water is 202 J\$/1,000 IG

The savings achieved by replacing a conventional public or employee restroom toilet with a 1 3 IG/flush model are

$$\begin{aligned}\text{Water savings} &= (20 \text{ flushes/day/toilet}) \times (3.8 \text{ IG/flush} - 1.3 \text{ IG/flush}) \times 365 \text{ days/year} \\ &= 18,250 \text{ IG/year/toilet} \\ &= 3,690 \text{ J\$/year/toilet}\end{aligned}$$

d) Calculation of the implementation cost and payback for replacing an operational conventional public or employee restroom toilet with a 1.3 IG/flush model

- ▶ Average cost of a 1.3 IG/flush toilet = 4,000 J\$
- ▶ These calculations assume the replaced conventional toilet has no economic value

The cost effectiveness of this water conservation measure is

Implementation cost = 4,000 J\$/toilet

Payback period = (4,000 J\$/toilet) / (3,690 J\$/year/toilet)
= 13 months

- ▶ The preceding analysis shows that it is economically beneficial to replace all frequently used public restroom toilets with new water-saving units, even if the existing toilets are still in good conditions. After the completion of Negril's sewer system, the payback period for this recommendation will be reduced to 6.5 months.

Comments

In order to minimize the clogging problems associated with some water-saving toilet models, the property is strongly encouraged to identify and purchase water-saving toilets that have a proven performance record. Many Negril hotels have been using water-saving toilets for a number of years -- most of these toilets are reported to perform very well.

The purchase of low-cost water-saving toilets of uncertain performance may end up costing the property dearly and causing much aggravation. The property is also encouraged to purchase and test a few water-saving units before implementing this recommendation throughout the property.

Project 6: Use rainwater for laundry or other operations

Summary of results and benefits

- ▶ A 4,000 ft² rain catchment will reduce the purchase of NWC water by 86,800 IG/year and save the property 17,500 J\$/year
- ▶ The use of rainwater for laundry operations should reduce the property's consumption of rust removing chemicals and minimize the use of the ion exchange softener
- ▶ Collecting rainwater from Coral Seas' impervious surfaces will reduce the ponding of water on the hotel's grounds and improve the performance of the tile fields during the rainy season

Current situation

- ▶ On average, the Negril area receives 57 inches of rainfall per year, therefore, each ft² of rain catchment surface could theoretically collect 29 4 Imperial gallons of water per year At the present time, Coral Seas does not collect any rainwater
- ▶ Coral Seas' laundry processes the laundry of two other Coral Seas properties
- ▶ The laundry water is softened using an ion exchange softener The ion exchange resin is regenerated once per day, and the spent regeneration brine is discharged on the ground by the laundry room

Recommendations

Consider collecting and reusing the rainwater that falls on the property's rooftops The collected rainwater could then be used for laundry room operations and for irrigation

Since rainwater is virtually free, plentiful during at least 6 months of the year and relatively clean, it is an ideal source of laundry water Collected rainwater contains little dissolved iron which stains white linens and towels it is also naturally soft and should therefore greatly reduce the use of the ion exchange softener

Since times of peak rainwater supply always coincide with times of minimum irrigation the use of collected rainwater for grounds irrigation is a less attractive alternative

Input, assumptions and calculations

- a) Calculation of the savings resulting from using collected rainwater in laundry room operations

- ▶ The amount of laundry water used to process Coral Seas laundry can be estimated as follows

- Industry surveys show that towel/linen use in hotels ranges from 4 to 6 lb per guest night and, according to commercial laundry equipment manufacturers, institutional washing machines use from 1.7 to 2.1 IG per pound of linen laundered. It is therefore assumed that a beach property such as Coral Seas uses an average of 9.5 IG of laundry water per guest night (i.e., 5 lb/GN x 1.9 IG/lb of laundry)
- It is assumed that linens and towels account for 75% of the total laundry load

$$\begin{aligned} \text{Laundry water consumption} &= (9.5 \text{ IG/GN}) \times (9,190 \text{ GN/year}) / (0.75) \\ &= 116,000 \text{ IG/year} \\ &= 9,670 \text{ IG/month} \end{aligned}$$

Note: The laundry water needs are expected to drop significantly after the 3 Coral Seas properties implement some of the recommendations made in this report.

- ▶ The cost of NWC water is 202 J\$/1,000 IG
- ▶ Assume that Coral Seas can collect rainwater over a 4,000 ft² area (the roofs surrounding the pool already cover approximately 2,200 ft²)
- ▶ Assume that 80% of the rain which falls on the catchment area is collected and stored (i.e., 20% loss)
- ▶ Due to a lack of information, these calculations will not take into account the savings resulting from reducing the consumption of rust removing and minimizing the operation of the ion exchange softener
- ▶ The precipitation data for Negril is given in the following table

Month	1997 precipitation		30 year mean precipitation	
	mm	IG/ft ²	mm	IG/ft ²
Jan	58	1.19	97	1.99
Feb	134	2.74	44	0.90
Mar	15	0.31	57	1.16
Apr	67	1.37	92	1.88
May	212	4.34	164	3.35
Jun	170	3.48	158	3.23
Jul	149	3.05	160	3.26
Aug	157	3.22	175	3.57
Sep	119	2.43	155	3.16
Oct			180	3.80
Nov			80	1.64
Dec			71	1.45
Annual total			1,433 mm	29.4 IG/ft

Based on this information, the average monthly precipitation is 3.40 IG/ft² from May to October and 1.50 IG/ft² from November to April.

Collected rainwater (May - Oct)	= 80 % x (3.40 IG/ft ² /month) x 4,000 ft ² = 10,900 IG/month > 100% of the water needs for Coral Seas' laundry
Collected rainwater (Nov - Apr)	= 80 % x (1.50 IG/ft ² /month) x 4,000 ft ² = 4,800 IG/month = 50 % of the water needs for Coral Seas' laundry
Total laundry water savings	= [(9,670 IG/mo) + (4,800 IG/mo)] x 6 mo/yr = 86,800 IG/year = 17,500 J\$/year

b) Implementation cost and payback period

- ▶ No information is available at the present time on the cost of a rain collection and storage system. The property should contact a local contractor to obtain a cost estimate for this system.

Project 7: Reduce the time of operation of the pool filter pump

Summary of results and benefits

- ▶ Reduces Coral Seas' energy consumption by 2,190 kWh/year, resulting in savings of 10,200 J\$/year
- ▶ Extends the service life of the pool filter pump
- ▶ The payback period for this recommendation is 2 months

Current situation The swimming pool's filtration system is equipped with a 1.5 HP (1.1 kW) pump. The pool keeper occasionally turns the pump off during nighttime (from 10 PM to 8 AM), but normally this pump operates 24 hours per day.

Recommendations Experience shows that, in most cases, pool water quality can be maintained by running the filter pumps for only 12 to 16 hours per day. Coral Seas should therefore make it a regular habit to shut off its filter pump at night in order to save energy and to increase the service life of the pump. The pump can either be shut off manually or Coral Seas may decide to purchase an automatic timer for its pool filter system.

Input, assumptions and calculations

- ▶ Assume that now the pump is turned off only once every 4 days
 - ▶ Assume that the pool pump can be turned off every day from 10 PM to 8 AM
 - ▶ The pump's estimated power draw is 0.8 kW
 - ▶ The cost of energy is 4.64 J\$/kWh
- a) Calculation of the savings resulting from regularly turning off the pump during nighttime

$$\begin{aligned}
 \text{Energy savings} &= 10 \text{ hr/day} \times 0.8 \text{ kW} \times (75\% \times 365 \text{ days/year}) \\
 &= 2,190 \text{ kWh/year} \\
 &= 10,200 \text{ J$/year}
 \end{aligned}$$

- b) Calculation of the implementation cost and payback period

- If Coral Seas decides to manually control the operation of the pool pumps, the implementation cost of this recommendation would be nil.
- A timer costs less than 1,800 J\$. Therefore, if Coral Seas decides to purchase an automatic timer for its pool, the corresponding implementation cost and payback period are

$$\text{Total implementation cost} = 1,800 \text{ J\$}$$

$$\begin{aligned}
 \text{Payback period} &= 1,800 \text{ J\$} / (10,200 \text{ J\$/year}) \\
 &= 2 \text{ months}
 \end{aligned}$$

Project 8: Upgrade to energy efficient lighting

Summary of results and benefits

- ▶ Reduces Coral Seas' energy consumption and saves money Savings and payback periods vary depending on bulb wattage and hours of operation
- ▶ Typical payback periods range from 6 months to 1 year

Current situation

Most lights in guest rooms, gardens and public areas use inefficient incandescent bulbs

Recommendations

Wherever possible, replace incandescent bulbs with CF bulbs Although is almost always economically beneficial to use CF bulbs instead of incandescent bulbs, this property should first focus on replacing the incandescent bulbs that have a medium to high wattage (60 W to 100 W) and those that burn for extended periods of time (> 8 hours per day) -- these fixtures offer the greatest potential savings and shortest payback periods

Compact fluorescent bulbs consume less energy than incandescent light to produce the same amount of light, CF bulbs also last 10 times longer than incandescent bulbs Therefore, although CF bulbs cost more than incandescent bulbs, they save electricity and money The following table shows the equivalence, in terms of light output, between CF and incandescent bulbs

Compact fluorescent		Incandescent
9 Watt bulb	replaces a ↻	25 Watt bulb
11 Watt bulb	replaces a ↻	40 Watt bulb
15 Watt bulb	replaces a ◡	60 Watt bulb
20 Watt bulb	replaces a ◡	75 Watt bulb
27 Watt bulb	replaces a ◡	100 Watt bulb

Input, assumptions and calculations

- a) Sample calculation of the savings achieved by replacing a single 75 Watt incandescent bulb which burns for 12 hours per day with a 20 Watt compact fluorescent bulb

- The cost of energy is 4.64 J\$/kWh
- The characteristics of the incandescent and CF bulbs are as follows

Cost of a 75 W incandescent bulb	= 22 J\$/bulb
Service life of an incandescent bulb	= 800 hours/bulb
Cost of a 20 W compact fluorescent bulb	= 500 J\$/bulb
Service life of a compact fluorescent bulb	= 10,000 hours/bulb

a 1) Operating cost of a single lamp equipped with a 75 W incandescent bulb

Hours of operation	= 12 hr/day/lamp x 365 days/year = 4,380 hr/year/lamp
Energy cost	= 75 W x (4,380 hr/year/lamp) x (4.64 J\$/kWh) = (328 kWh/year/lamp) x (4.64 J\$/kWh) = 1,520 J\$/year/lamp
Cost to replace burnt bulbs	= [(4,380 hr/year/lamp) / (800 hr/bulb)] x (22 J\$/bulb) = (5.48 bulbs/year/lamp) x (22 J\$/bulb) = 120 J\$/year/lamp
Total operating cost	= energy cost + cost to replace burnt bulbs = 1,640 J\$/year/lamp

a 2) Operating cost of a single lamp equipped with a 20 W compact fluorescent bulb

Hours of operation	= 4,380 hr/year/lamp (same as above)
Energy cost	= 20 W x (4,380 hr/year/lamp) x (4.64 J\$/kWh) = (87.6 kWh/year/lamp) x (4.64 J\$/kWh) = 406 J\$/year/lamp
Cost to replace burnt bulbs	= [(4,380 hr/year/lamp) / (10,000 hr/bulb)] x 500 J\$/bulb = (0.438 bulb/year/lamp) x 500 J\$/bulb = 214 J\$/year/lamp
Total operating cost	= energy cost + cost to replace burnt bulbs = 620 J\$/year/lamp

a 3) Savings and payback period for replacing a single 75 Watt incandescent bulb with a 20 Watt compact fluorescent bulb

Total savings = (total operating cost for inc) - (total operating cost for CF)
 = 1,640 J\$/year/lamp - 620 J\$/year/lamp
 = 1,020 J\$/year/lamp

Implementation cost = cost of a CF bulb - cost of an incandescent bulb
 = 500 J\$/bulb - 22 J\$/bulb
 = 478 J\$/bulb

Payback period = (implementation cost) / (savings for 1 lamp)
 = (478 J\$/bulb) / (1,020 J\$/year/bulb)
 = 0 47 years

b) The same approach can be use to calculate savings and payback for other bulb outputs and operating hours These results are summarized in the following tables

Financial savings achieved by replacing an incandescent bulb with a CF bulb					
Incandescent bulb	CF replacement bulb	hours of operation of the bulbs (hours/day)			
		6 hours/day	8 hours/day	10 hours/day	12 hours/day
40 W	11 W	245 J\$/year	327 J\$/year	409 J\$/year	491 J\$/year
60 W	15 W	408 J\$/year	544 J\$/year	680 J\$/year	816 J\$/year
75 W	20 W	510 J\$/year	679 J\$/year	849 J\$/year	1,019 J\$/year
100 W	27 W	693 J\$/year	923 J\$/year	1,154 J\$/year	1,385 J\$/year

Payback period for replacing an incandescent bulb with a CF bulb					
Incandescent bulb	CF replacement bulb	hours of operation of the bulbs (hours/day)			
		6 hours/day	8 hours/day	10 hours/day	12 hours/day
40 W	11 W	2 0 years	1 5 year	1 2 year	1 0 year
60 W	15 W	1 2 years	0 88 year	0 70 year	0 59 year
75 W	20 W	0 94 year	0 70 year	0 56 year	0 47 year
100 W	27 W	0 69 year	0 52 year	0 41 year	0 35 year

Some of the specific locations where CS could replace incandescent bulbs with compact fluorescent bulbs are listed in the following table

Location	Existing bulb type and wattage	Quantity of bulbs	Hours of operation	Wattage of replacement CF bulbs	Financial savings per bulb	Total annual savings
Ice-making house	Inc 100 W	1	12	27	1 385	1 385
Restaurant roof	Inc 75 W	4	12	20	1,019	4,076
Restaurant roof	Inc 60 W	2	12	15	816	1,632
Employee bathroom	Inc 60 W	2	12	15	816	1 632
Restaurant back	Inc 100 W	2	12	27	1 385	2,770
Food store	Inc 75 W	1	12	20	1,019	1 019
Main store	Inc 60 W	1	12	15	816	816
Main store	Inc 40 W	1	12	11	491	491
Pathway	Inc 100 W	12	12	27	1,385	16,620
Entrance	Inc 100 W	2	12	27	1 385	2 770
Staff quarters	Inc 60 W	6	6	15	816	4,896
Block patio	Inc 100 W	20	12	27	1 385	27,700
Total annual savings						65 800

Comments

Before purchasing CF bulbs

- Find out from local hoteliers or other reliable sources which brands of CF bulbs have a good track record in Negril
- If you suspect that theft of CF bulbs will be a problem on your property purchase CF bulbs equipped with an anti-theft feature. This locking mechanism increases only slightly the cost of the compact fluorescent bulbs (approximately 40 J\$/bulb)

Project 9: Implement a property-wide waste management program

A waste management program will help Coral Seas reduce the amount of waste it produces, save materials, resources, energy and money, and reduce the property's impact on the environment by drastically reducing the amount of solid waste disposed in its dump or other locations. The principal elements of an effective waste management program include what is generally called the three R's: reduce, reuse and recycle. These three elements are detailed below.

A waste management program begins with a waste review, where the quantity and type of waste produced in the property are examined. Once this review is completed, the possibilities for the waste management program can be assessed by considering each kind of waste and deciding whether it is possible to avoid the generation or the disposal of this waste through the reduce, reuse, and recycling options. Whatever waste cannot be avoided through the reduce, reuse, and recycle components of Coral Seas' waste management program will have to be discarded. In most cases, however, an effective waste management program can have a significant impact in reducing the amount of waste generated by a property.

Reduce

Reduce the quantity and the impact of the waste produced by the property by avoiding natural wastage, by using more durable goods that will need to be disposed less frequently, by avoiding the purchase of excessively packaged goods, and by minimizing the use of hazardous materials or other products which have a significant impact on the environment. The reduce component of the waste management program is obviously the first option that should be considered by the property. By reducing the generation of wastes, Coral Seas will conserve resources, reduce its use of natural resources, and reduce the amount of materials its employees will need to handle and the volume of waste the property will need to dispose.

The bulk of the responsibility for the "reduce" element of the waste management program lies with the purchasing department, since the less material that is brought into the property, the less the property will have to discard (be it by disposal to a dump site, donation, or recycling). Employees who have the authority to decide what is discarded as waste also play an important role in reducing the property's waste output. The type of actions which can be taken by the property to reduce the production of waste and to lower the impact of the generated waste include:

- Avoid purchasing items (e.g. foods, chemicals, appliances, parts, maintenance items) that are excessively packaged. In North America, packaging alone can account for up to 40% of a hotel's waste stream.
- Purchase food items in bulk rather than in individually packaged portions (e.g. sugar, salt, pepper, jams/jellies, condiments, butter, cereals, syrup, cream, juice, etc.). Bulk items are less expensive and create less waste.
- Reduce or eliminate the use of disposable plates, place mats, wares, and cups. Inexpensive reusable plastic plates, tableware, and glassware can be used at guest and employee functions held outside.
- Use refillable containers for chemicals, cleaners and foods, reduce the use of aerosols, which are not refillable.

- Minimize the use of straws, and replace plastic straws with paper straws
- Do not automatically supply guests with new glasses or paper cups for each drink ordered at the bar, but offer to refill the glass if a guest orders the same beverage twice
- Eliminate the use of paper wrap or covers for guest room drinking glasses. Instead, store the drinking glasses upside-down
- Use cloth napkins rather than paper napkins and cloth rags for cleaning rather than paper towels
- Use cloth napkins instead of disposable doilies for buffet lines, platters, and in bread baskets
- Purchase durable coasters for use in the bar and restaurants instead of using paper napkins and replacing them with each drink
- Use cloth or canvas bags or a small basket to collect and return guest laundry, towels and linens
- Use cloth or canvas bags or a wheelbarrow or yard cart to collect garden waste rather than disposable plastic bags
- Install soap dispensers in guest bathrooms, public bathrooms, and employee locker rooms
- Purchase reusable plastic containers for food in the refrigerators and freezers. The hotel currently uses a great deal of plastic wrap for both of these purposes which wastes money and creates additional waste
- Avoid using laundry, kitchen, or housekeeping detergents which contain phosphates
- Minimize the purchase and keep track of the use of harsh or hazardous chemicals (e.g., drain cleaning agents, solvents, bleach)
- Purchase rechargeable or mercury-free batteries
- Reduce the number of garnishes purchased for drinks by saving them for several days before throwing them away. The bar staff currently throws leftovers away at the end of each day
- Coordinate the purchasing process to reduce the number of orders placed with each vendor. This will likely save money and will also reduce packaging
- Reduce the amount of paper used in the offices by discontinuing the practice of placing guest bills in envelopes (they can instead be stapled shut for privacy) and no longer using fax cover sheets

Reuse

Reuse items in their original form for the same or a different purpose rather than disposing of them. If an item cannot be reused by the property, Coral Seas should investigate the possibility of selling or donating them to employees, outsiders, charitable organizations, local schools and businesses. Examples of reuse actions are listed below.

- Reuse computer or other paper (i.e., printed on one side only) as scrap paper for taking notes and writing internal memos
- Give preference to vendors which supply their products in returnable/refillable containers. For example, one hotel in Negril indicated that Country Bucket will provide ice cream in 3-gallon reusable containers with a deposit of 200 J\$ each. This should save the hotel money and will reduce the amount of waste disposed of by the hotel. Someone on the staff should be made responsible for ensuring that containers that can be returned are returned. This is especially important when there is a rebate given for returned packaging
- Designate someone in each department to be responsible for returning packaging to the

supplier

- Only remove used soaps from guest rooms at checkout. Used soap bars can be flaked and used in certain laundry machines or used in a variety of cleaning operations around the property. Small pieces of soap which are not readily reusable can be collected, melted (with a small amount of water and low heat), and cast in a suitable mold (e.g., a rectangular box) to produce a large bar of soap that can be used for general cleaning operations.
- Give used amenities to any interested parties (e.g., charities, local schools, employees) rather than discarding them.
- Replace the trash can liners only when these are soiled or unsuitable for further use.
- Repair and reuse damaged furniture or donate it to interested parties (e.g., charities, schools, employees, businesses).
- Use a bucket to collect water from restaurant tables to use in watering plants.
- Offer all leftovers foods, including the soup of the day, to employees in the employee cafeteria. Food should only be disposed of when it can no longer be served to the staff.

Recycle

Many items that cannot be reused in their original form can be sold or given away to processors for recycling. Even if the hotel cannot make a profit from its recycling efforts, diverting items from the waste stream should allow the hotel to reduce the frequency of trash collection, which will save the hotel money. The type of products which can generally be recycled include:

- Green waste from kitchen and garden (this material can be composted on site or given to a local composting program)
- White paper and mixed paper
- Glass bottles and jars
- Plastic bottles and containers made of PET (typically used for soft-drink and water bottles) and HDPE (typically used for milk jugs and chemical containers)
- Aluminum cans and foil
- Steel cans or "tins"
- Steel scrap such as old pipes and appliances
- Other metals such as copper and brass
- Frying oil and grease
- Motor oil (from cars, motor boats and jet skis)

At the present time only one company (RYCO-JA, a recycler of waste oil and grease) collects recyclable materials in the Negril area. However, the EAST project, in collaboration with the Negril Chapter of the JHTA and the Negril Area Environmental Protection Trust (NEPT), will strive to organize a recycling project for the Negril area by acting as a link between the interested hotels and the recycling companies based on the island. Although EAST's survey of Jamaican recycling companies is not yet complete, the companies listed below have already been identified. At the conclusion of this survey, the EAST project will provide Coral Seas with an updated list of recycling companies, and details on the requirements related to the collection, sorting, quality, and packaging of the recyclable materials.

Glass Recycling

West Indies Glass Company Contact - Michael Austin, (809) 923-0787-9 Glass must be sorted into three color groups clear, brown, and green The company pays 300 J\$ per ton (2,000 lbs) and will provide free transportation to pick up the recyclables when there are five tons of any color glass available at any site Many of the glass bottles sold in Jamaica can be returned to the bottler for reuse, which should be the first priority However, if the hotel produces enough other glass that is suitable for recycling (drink bottles or food jars and containers), a glass recycling program should be implemented Recycling bins should be placed under the bars and in the kitchen to collect this glass separate from other recyclables The bins should be clearly labeled as to what color glass can be placed in them, and the signage should strongly discourage staff from contaminating the bin with other non-glass items A heavy plastic or cloth bag should be used inside of the bin so that the bag can easily be removed when the bin is full and the hotel will not have to worry about tearing if the glass breaks The West Indies Glass Company can help the hotel to estimate visually when five tons have been collected The hotel can then determine if it wants to deliver the glass itself or accumulate the glass in the loading dock area until there is enough to qualify for the free pickup

Plastics

Wysinco Environmentals, Ltd Contact- Mrs Pat Wright, (809) 943-9800 As of October 1997, this company only collects plastic (PET) bottles from schools and specific media-announced pickup points Therefore, they ask that plastic bottles be donated to a school in the community, which earns "points" for kilograms of plastic and trades them in for computers, videos, paint, tools, etc If the hotel wishes to drop off PET bottles at the Wysinco Recycling Plant (located at PO Box 367 White Marl, Spanish Town, St Catherine, Jamaica), the company will pay the hotel 8 J\$ per kilogram for them If the hotel produces a significant amount of plastic and wishes to begin collecting either for a local school or for profit, recycling bins should be placed in the areas where the majority of the plastic waste is produced (i.e. the kitchen) These bins should also be properly labeled so that the staff will know what can and cannot be placed in them Once enough plastic has been collected the hotel can either take it to a local school or transport it to Spanish Town

Plastic/Metal Drums

Kemcan Development Company Contact - Ms Usherwood, (809) 922-5270 At present, this company is only recycling plastic and metal drums, which it will pick up provided there are 30-50 drums Again, the hotel's first resort should be to return these drums to the supplier for reuse whenever possible However, any drums that cannot be returned should be collected in the loading dock area until there are enough to warrant a pickup

Paper

Nature's Handmade Paper Contact - Ms Gloria Dorman, (809) 993-8172 Nature's Handmade Paper is a small company set up with the assistance of the Peace Corps in 1986 This company is prepared to do a special project for the Negril hotels, whereby they will provide hotel stationery, guest cards, etc made out of the paper that the hotels recycle The

cost of the paper recycling is negotiable

JA Pottinger & Co , Ltd Contact - Mr Pottinger or Ms Nadine Higgins, (809) 926-8957
This company picks up paper products from hotels – provided there is one truck load full (50 large garbage bags) – and exports the paper for recycling. The price for this service is negotiable and the company is prepared to meet with EAST/ JHTA to discuss a program for the Negril area. Recycling bins for paper should be placed in the housekeeping area (to collect paper from guest rooms), at the front desk, and in offices at a minimum. Each desk in the office area should receive its own recycling bin. It is important, especially with paper, to collect the recyclables as close to their source as possible. Paper must be clean and dry to be recyclable. The hotel should first reuse paper whenever possible and then should collect the paper for recycling. If the bags of paper are exposed to the elements, it is important that plastic bags be used and that the bags be properly sealed to prevent the paper from getting wet. If the bags are to be stored in a weather-proof area, the hotel should talk to JA Pottinger & Co about using reusable cloth bags that are returned to the property for reuse after the recycler collects the paper.

Another paper recycling option is to sell it to companies needing packaging materials, such as Exotic Flowers of Montego Bay. If the hotel decides to pursue this option, it should purchase a shredder to ensure that confidential documents are not released from the property.

Metal/Aluminum

Contact Louis Daley for information regarding the recycling efforts organized by Mr McLaughlin in Mandeville.

Waste vegetable oil (frying oil) and grease

Recycling Corp of Jamaica (RYCO-JA) Contact - Mr Kevin Mullane, (809) 968-7002, (1-800) 991-7926. RYCO-JA collects used vegetable oils and grease from kitchens which is then recycled in the production of chicken feed. RYCO provides, free of charge, covered steel drums for the storage of the used oil and grease and collects the material from each participating property on a regular schedule. This recycling scheme benefits the hotel by reducing the discharge of oil and grease to the septic tank (thus reducing potential clogging problems in the tile field) and helps the country by reducing the amount of yellow grease imported into Jamaica for the production of animal feed. If the hotel chooses to recycle its cooking grease, it is important that the drum be kept covered (to prevent the rainwater dilution) and be kept free of contaminants, which will make the grease non-recyclable.

Other Waste Management Issues

The hotel should ensure that there are adequate trash receptacles and ash trays around the grounds and throughout the public areas so that guests can easily find one when they need it. The audit team found a great deal of waste and cigarette butts on the ground in these areas because there are not enough receptacles. Guests will usually make an effort to dispose of trash and cigarette butts properly if they can easily find a receptacle.

Project 10: Implement a towel reuse program

Coral Seas is already saving water, energy, and detergent by washing sheets every other day. Many hotels around the world have found success with a program in which the guest determines when towels are replaced. The audit team suggests that Coral Seas consider implementing a program of this type once other initiatives are underway. Guest reaction is typically more positive if they can see that the hotel is truly concerned with protecting the environment. They do not want to feel like they are making all of the sacrifices or that the hotel is simply trying to save money.

This towel reuse program informs the guest that the hotel is interested in protecting the environment by reducing the amount of water and chemicals that it uses. The guests are asked to leave their towels hanging up if they wish to use them again or put them on the floor if they would like to have them replaced.

If the hotel chooses to implement a similar guest-request program, a linens reuse program, this program typically operates in one of two ways:

- ▶ The guest is told that the hotel would like to save water by reducing the number of sheets washed each day. The guest is asked to leave a card on the door or on the bed indicating that it is not necessary to change the sheets that day. Otherwise, the guest's sheets are changed every day. This method works but gets fairly low guest participation, since even environmentally-concerned guests often forget to indicate that it is not necessary to change their sheets. In their rush to leave the room in the morning, they neglect to leave the card in the correct place.
- The guest is told that in an effort to save water, the hotel only changes sheets every two or three days (depending on the wording on the materials selected). If the guest would like to have the sheets changed more frequently, the materials ask that a card be placed on the door or on the bed to have them changed that day. This method puts the burden on the guest and therefore results in considerably higher participation. Hotels that have implemented this type of program in conjunction with towel reuse have found that their laundry costs are reduced by as much as 30% to 40%.

Once the hotel is ready to begin either program, it should purchase attractive, colorful in-room materials to communicate the program to the guest. These materials are available through a variety of sources, including the Caribbean Hotel Association. The CHA cards offer two key advantages over some of the other cards on the market:

- ▶ The design of the CHA materials will capture the guests' attention better than many other cards. It is important that the guests be clearly told about the program so that they feel that they have been given the opportunity to make a choice. The program is not designed to trick the guest into participating, but that is how they will feel if the program is not properly communicated.
- ▶ The CHA materials state that it is the hotel's policy to change sheets every three days unless the guest would like to have them changed more often. As indicated above, this is the verbiage that results in the greatest savings.

If this program is implemented, housekeepers need to be properly trained to carry it out effectively. Most hotels have found the greatest success with one of the following procedures:

- ▶ Designating certain days as sheet changing days. Under this format, all of the sheets in the hotel are changed on certain days of the week (for example Tuesdays and Fridays) instead of every three days. This method makes it easy for the hotel to increase housekeeping and laundry staff on those days if necessary and also gets the housekeepers in the habit of recognizing those days as sheet change days. On the other days, the housekeepers will only change sheets in checkout rooms and rooms where the guest has requested a change.
- ▶ Actually counting off every three days and posting a notice in the housekeeping area on the sheet changing days. This ensures that the sheets are changed on the exact schedule noted on the in-room materials and still makes it relatively easy for the housekeepers to know when to change the sheets. As mentioned in the paragraph above, on the other two days the sheets would only be changed in the checkout rooms and rooms where the guest has requested a change.

Hotels have had difficulty tracking the length of time that each guest has actually been in the room so that each guest's sheets are changed three days after they check in and then every three days after that. Unless the hotel has a very complex reservation system, this method of tracking sheet changing is nearly impossible. If this method is possible, it results in the greatest savings, since either of the above alternatives will often result in changing a guest's sheets one of the two days following check-in when they technically are not yet ready to be changed.

The hotel will have to determine which method it believes will work best and then make modifications as needed. Regardless of the method chosen to implement the program, it is important that all of the housekeepers be fully trained to understand their role in the initiative. If they do not do what they are supposed to do, the program cannot be successful.

Two other issues are key to the success of this program:

- ▶ Even if the guest does not request that the sheets be changed on a given day, if the housekeeper determines that the sheets are soiled, they should be changed anyway. A bed should never be made with dirty linens.
- ▶ If a guest checks out early on a day when sheets were not changed, it is important that someone be designated to change the sheets before a new guest checks in. One way to know for sure whether the sheets were changed is to leave the bedspread in a turn-down type of configuration when the sheets are left on the bed. If the bed is completely remade, it will look just like a bed with fresh sheets, but leaving the bedspread partly turned back will allow anyone entering the room to know that the sheets have been used.

This program can result in tremendous savings for the hotel but only if it is implemented properly. It is important that the proper materials be used, that the housekeepers be fully trained, and that everyone is left feeling good about the program.

Project II: Improve on the hotel's composting program

Composting has become the increasingly popular method by which to dispose of food scraps, floral waste and garden waste. The hotel should improve upon its current composting initiative by sending all yard waste to the off-site compost heap and by processing the compost appropriately so that it can be used as fertilizer and mulch around the property. The hotel may eventually want to incorporate food waste into this program as well.

A well-run composting program yields significant benefits including

- a reduction in the cost of waste handling and disposal,
- a reduction in the environmental impact resulting from the disposal of wastes in dumps or landfills,
- it provides the property with a high-profile program which can be advantageously used in public relations and media efforts,
- it provides the property with a constant supply of high quality fertilizer and soil conditioner.

Studies have revealed that up to 75% of waste generated in food service functions consists of compostable food scraps and other organic materials. If the compostable material, along with the recyclable plastic, glass, and metal items are diverted from the waste stream, the property can achieve a truly significant reduction in the amount of waste generated by the food service area.

Both pre-consumer and post-consumer food scraps can be composted. Pre-consumer food scraps include cuttings left from vegetable preparations, as well as complete servings of food which have been prepared, left unserved, and cannot be reused. Post-consumer scraps are food left on dishes after meals have been served. Although food scraps will be numerous and diverse, other wastes can be composted as well. Below is a list of commonly composted wastes.

- Produce – vegetables, fruits, peels, rinds, salads, etc
- Bread and pastries, excess batter
- Frozen foods
- Coffee grounds/filters, tea bags
- Egg shells
- Flower waste (wilted cut flowers from restaurants and guest rooms)
- Green waste from the garden and beach (grass, leaves, twigs, branches, seaweed)
- Paper items – paper napkins, paper towels, paper plates and cups, paper food wrappers
- Dairy products (see note 1)
- Seafood (see note 1)
- Meat trimmings, without bones or large quantities of grease or fat (see note 1)

Note (1) Although these items can be composted, they often generate foul odors and attract animals and pests. If the compost pile will be located close to public or work areas, Coral Seas should exclude these items from its composting.

program If these items are composted, the compost pile should be kept covered

Not everything is compostable, and some materials can lower the quality of the finished compost or hamper the composting process. The staff should be educated on the importance of preventing the following items from being placed in the composting receptacles and the composting pile

- Garden waste contaminated with pesticides
- Weeds with heads/ seeds (these will reproduce quickly in the compost heap)
- Glass
- Metals
- Unsoiled paper (if it can be recycled)
- Cardboard
- Plastics
- Aluminum foil or plastic wrap
- Batteries
- Diseased plants
- Wood chips from chemically treated wood products

Contamination of compostable material can be avoided only if employees know which items should not be discarded in the container for compostable materials. Continuous employee education and motivation and appropriate signage will help. In most instances, placing a sign on a container which reads "Compost only – no bones, plastics, glass or metals" should make the point.

Hotels and resorts often find it easier to have the composting program evolve slowly, that is, to start with flower and garden wastes and pre-consumer food scraps from prep stations in the kitchens, then add additional materials like paper, and finally add post-consumer leftovers from guests' and employees' plates. This is the process that is recommended for Coral Seas.

Coral Seas may find it beneficial to purchase a wood chipper and paper shredder to allow even more items to be composted. Large pieces of wood (branches, lumber) and full pieces of paper cannot be added to the compost pile. The chipper and shredder can be used to convert these items to a more manageable size (less than one inch) so that they will decompose more readily.

In addition, the composting site should be large enough for all phases of composting (unloading materials, storing items before they are added to the compost, aerating/ mixing the compost, storing equipment such as the chipper, and storing the finished compost before it can be used). The hotel should also build a fence around the composting site to hide it from guest view and to prevent rodents and other animals from entering the area. Some items used in a compost pile will be unattractive or will attract animals, making this fence necessary. The hotel should also ensure proper drainage from the site, quickly clean up any food spills, and add food waste to the center of the pile to prevent bad odors.

It is important to ensure that the compost pile is properly aerated. Aeration helps the

bacteria in the pile to grow faster, which speeds the decomposition process. The staff managing the compost heap should aerate the pile, either manually or with a small bulldozer (depending on the size of the pile), at least once each week. Without proper aeration, the compost pile will develop a rotten-egg odor and will take much longer to fully decompose.

It is important to keep the program simple and efficient, in the long-run, it should not require additional staff time. In fact, the system, in coordination with a comprehensive recycling program, can streamline the entire disposal system from both a labor and a space efficiency standpoint.

Once the compost is ready for use (usually in about one month if the pile is managed properly), the resulting product should be used on the grounds. Compost is classified as a soil conditioner, not a fertilizer, because its levels of nitrogen, potassium, and phosphorus are not as high as commercial fertilizers. Finished compost will add these elements to the soil but will add them much more slowly and in lower quantities than fertilizers. Unlike fertilizers, compost also adds organic material to the soil, increases the water-retaining capabilities of sandy soil, and promotes root growth. The compost should be used over grassy areas or as a mulch around plants.

Appendix I

Hotel Environmental Policy *By the International Hotels Environmental Initiative*

We recognize that our business has an important role to play in protecting and enhancing the environment for future generations, and to help secure the long term sustainability of the tourism industry

To this end our hotel is committed to taking action

- *To achieve sound environmental practices across our entire operation*
- *To comply fully with all environmental legislation*
- *To minimize our use of energy, water and materials*
- *To reduce our pollution to a minimum and where appropriate, to treat effluents*
- *To invite our customers, suppliers and contractors to participate in our efforts to protect the environment*
- *Where we can, to work with others in the tourism industry in public agencies and the community to achieve wider environmental goals*
- *To provide all employees with the training and resources required to meet our objectives*
- *To openly communicate our policies and practices to interested parties*
- *To monitor and record our environmental impacts on a regular basis and compare our performance with our policies objectives and targets*

Appendix II: Summary of Coral Seas' environmental aspects, impacts and EMS objectives

Type of environ aspect of the hotel's activities	Type of activities which have these environmental aspects	Environmental impact of the activities	Objective of the property's EMS
WATER USE	<ul style="list-style-type: none"> - Use of guest room and public bathrooms - Laundry room and operations - Housekeeping and cleaning operations - Kitchen and bar operations - Garden upkeep 	<ul style="list-style-type: none"> - Inefficient use of a valuable resource 	<ul style="list-style-type: none"> - Reduce water consumption
ENERGY USE	<ul style="list-style-type: none"> - Operation of a/c units water heaters, washing machines, dryers and pool pumps - Use of hot water and lighting 	<ul style="list-style-type: none"> - Inefficient use of valuable and non-renewable resources - Generates air pollution (mainly at the power plant) greenhouse gases, acid rain 	<ul style="list-style-type: none"> - Reduce energy consumption
SOLID WASTE GENERATION	<ul style="list-style-type: none"> - Office operations (paperwork) - Food purchasing, preparation and serving - Bar operations - Maintenance operations - Garden and beach upkeep 	<ul style="list-style-type: none"> - Disposal of solid wastes in inadequate municipal dumps - Contamination of groundwater and surface water - Loss of raw materials 	<ul style="list-style-type: none"> - Reduce the amount of solid waste generated by the property
GENERATION OF WATER POLLUTANTS	<ul style="list-style-type: none"> - Laundry room operations (e.g. use of phosphate based detergents) - General housekeeping and cleaning operations (excessive use of chemical cleaning and disinfecting products) - Maintenance operations (improper disposal of used oil and spent solvents) - Food preparation (disposal of grease/oil) 	<ul style="list-style-type: none"> - Increases pollutant load discharged to surface and groundwater - Reduces the effectiveness of septic tanks and wastewater treatment systems 	<ul style="list-style-type: none"> - Reduce the pollutant load contained in the hotel's effluent
USE OF HAZARDOUS PRODUCTS	<ul style="list-style-type: none"> - Laundry room operations (use of bleach and acid or caustic cleaners) - General housekeeping and cleaning operations (use of bleach toxic cleaning chemicals, insecticides) - Maintenance operations (use of lead paint, drain clearing chemicals) - Grounds keeping (pesticides/insecticides) 	<ul style="list-style-type: none"> - Exposes guests and employees to hazardous products 	<ul style="list-style-type: none"> - Reduce the number and amount of hazardous products used on the property - Improve gray water handling
GENERATION OF AIR EMISSIONS	<ul style="list-style-type: none"> - Maintenance operations (e.g. release of CFC from air-conditioning units use of solvents) - General housekeeping and cleaning operations (use of aerosols) - Grounds keeping (insecticide fogging) 	<ul style="list-style-type: none"> - Release of CFCs to the atmosphere - Exposes guests and employees to hazardous air pollutants 	<ul style="list-style-type: none"> - Phase out CFC refrigerants - Reduce the use of solvents insecticides pesticides
DAMAGE TO THE ECOSYSTEM	<ul style="list-style-type: none"> - Use of fertilizer, insecticides and pesticides in the gardens - Discharging untreated gray water to the morass 	<ul style="list-style-type: none"> - Damages the environment and ecosystem surrounding the property 	<ul style="list-style-type: none"> - Reduce the damage caused by the property's operations on the ecosystem

Appendix III

ACTION PLAN FORM			
MAINTENANCE DEPARTMENT - WATER CONSERVATION ISSUES			
Action	By whom	Target date	Actual date
Implement a leak detection and prevention program			
<ul style="list-style-type: none"> • Prepare a plan for carrying out a monthly inspection of the property's water distribution system, guest bathrooms, public restrooms, kitchen, bar, beach showers, and irrigation system 	J Doe	12/1/97	
<ul style="list-style-type: none"> • Develop the checklist forms that will be used to track the preventive maintenance work conducted by this program 	J Doe	1/1/98	
<ul style="list-style-type: none"> • Hold a training workshop to teach housekeeping staff on how to detect and report malfunctioning equipment and leaks Prepare a summary of this information for inclusion in housekeeping staff's training manual 	G Bush	1/15/98	
<ul style="list-style-type: none"> • Begin the first round of inspections Repeat the cycle of inspection each month 	Maint staff	2/1/98 - onw	
<ul style="list-style-type: none"> • After each round of inspection present summary of findings to general manager 	J Doe	3/1/98 - onw	
Install 1 6 US gallon/flush toilets in the beach-side public restrooms			
<ul style="list-style-type: none"> • Identify the type/brand of 1 6 US gal/flush toilets which have given satisfactory results in Jamaica Get recommendations from maintenance staff of other hotels 	P Peters	2/1/98	
<ul style="list-style-type: none"> • Contact vendor and place order for 4 units 	S Holmes	3/1/98	
<ul style="list-style-type: none"> • Install the units 	P Peters	< 1 mth after receipt	
<ul style="list-style-type: none"> • Monitor weekly to ensure proper performance Continue the weekly monitoring for two months following installation 	P Peters	after installation	
Water consumption monitoring program			
<ul style="list-style-type: none"> • Prepare the forms that will be used to collect data from the property's 3 meters 	T Rex	12/1/97	
<ul style="list-style-type: none"> • Train all members of the maintenance staff on how to properly read the meters, enter the information on the forms and calculate the property's weekly water consumption 	T Rex	12/15/97	
<ul style="list-style-type: none"> • Begin collecting the water consumption monitoring program 	Maint staff	1/1/98 - onw	
<ul style="list-style-type: none"> • On the first day of each month calculate the total water consumption and collect total guest night figures for the previous month Calculate IG/GN value for the previous month Provide the IG/GN figure to the Green Team 	P Peters	2/1/98 - onw	

Appendix IV

Personal Action Plan - Housekeeping staff		
Action	By whom	Date
<p>Guest room preparation checklist</p> <ul style="list-style-type: none"> • If the guests have left their a/c running, leave the guest room door closed during room preparation. If the door must be left open, turn the air conditioner off • Do not replace the trash can liners (plastic bags) unless these are soiled or otherwise unacceptable for further use • Report all malfunctioning equipment to the hotel operator -- contact the maintenance department directly only if the need for repair is urgent <p>Pay particular attention to water leaks in toilets, faucets and shower heads, excessively high flows from faucets or shower heads, sticking toilet flush handles, sink and bathtub stoppers which don't work or don't fit properly, damaged windows or louvers, scalding hot water malfunctioning air conditioners</p> <ul style="list-style-type: none"> • Collect all recyclable items placed in the guest room green recycling containers Recyclable items consist of <ul style="list-style-type: none"> ◦ clear, green, and amber glass bottles ◦ plastic beverage bottles ◦ aluminum beverage cans ◦ metal cans ◦ newspaper ◦ white paper • At the end of your shift place all collected recyclables in the appropriate recycling bins located by the laundry room • Before leaving the guest room <ul style="list-style-type: none"> ◦ turn off all lights, televisions and radios ◦ turn the a/c unit to the ' low cool ' setting if the guests have left the a/c running, ◦ if the a/c is left on, make sure that all windows and louvers are properly closed, ◦ ensure that faucets and toilets are not running 	<p>All house-keeping staff</p>	<p>Start on 12/01/97</p>
<p>Towel and linen reuse program</p> <ul style="list-style-type: none"> • • • 		

Appendix V

Sample water and electricity monitoring forms

Water - Monitoring form				
Meter number		Month and year		Reading units
Day	By	Meter reading	Consumption	Comments or corrective action
		⇨ Insert here the last meter reading of the previous month		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Total monthly consumption				

Number of guest nights for the month = _____

Water consumption index = (monthly water consumption) / (number of guest nights)

=

Example of a partially completed water monitoring form

Water - Monitoring form						
Meter number		34,524,356	Month and year	December 1997	Reading units	Thousand imperial gallons
Day	By	Meter reading	Consumption	Comments or corrective action		
		15,234 600	↩ Insert here the last meter reading of the previous month			
1	PGM	15,256 700	15,256 700 - 15,234 600 = 22 100			
2	PGM	15,278 300	15,278 300 - 15,256 700 = 21 600			
3	PGM	15,302 500	24 200			
4	PGM	15,322 200	19 700			
5	PGM	15,342 700	20 500			
etc						
25	PGM	15,768 700	21 800			
26	PGM	15 791 600	22 900			
27	PGM	15 880 900	89 300 Because of jump in water consumption maintenance began inspection of water distribution system			
28	PGM	15,976 400	95 500 Discovered leak in property's main distribution line Leak was fixed at 10 30 PM			
29	PGM	16,006 200	29 800			
30	PGM	16,027 500	21 300			
31	PGM	16 050 300	22 800			
Total monthly consumption			16,050 300 - 15,234 600 = 815 700 thousand imperial gallons			

Number of guest nights for the month = 3,077 GN (obtained from front desk records)

Water consumption index = (815,700 Imperial gallons) / (3,077 GN)
= 265,1 Imperial gallons/GN

Electricity - Monitoring form				
Meter number		Month and year		Multiplier
Day	By	Meter reading	Change in meter reading	Comments or corrective action
			↔ Insert here the last meter reading of the previous month	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Total change in meter reading for the month				

Total monthly electricity consumption = total change in meter reading x multiplier = _____ kWh

Number of guest nights for the month = _____

Electricity consumption index = (monthly elec consumption) / (number of guest nights) =

75

Appendix VI

Flow diverters: Technical information

AquaSaver

Help Save Our Most Precious Resource!

INSTALLS IN SECONDS ON ALMOST ANY STANDARD TOILET!

AquaSaver FOR STANDARD TOILETS

U.S. PATENT PENDING

EXISTING TOILET BOWL INTAKE HOSE

TOILET TANK

TOILET BOWL REFILL AND OVERFLOW PIPE

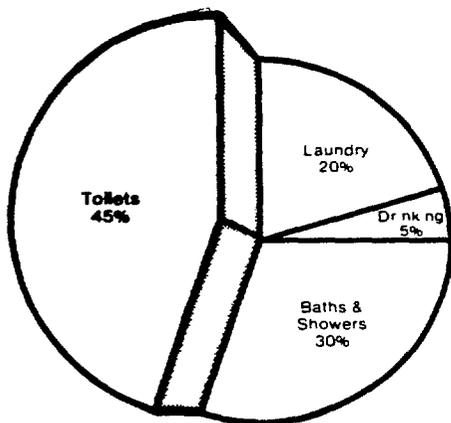
AquaSaver™ saves water by substantially reducing overflow during recovery – less water is wasted because the tank fills faster

You save on every flush the tank fills to capacity faster and your toilet operates at maximum efficiency because proper tank volume is maintained

You can save from 5 to 10 gallon of water per flush when an AquaSaver™ is properly installed in the position shown in the illustration (one spout in the the toilet bowl refill/overflow pipe three spouts outside the pipe) an average Illinois family can save up to 16 gallons of water everyday!

Based on figures supplied by the Illinois Department of Commerce and Public Affairs

IN-HOME WATER USE



Source: National Wildlife Federation

The new AquaSaver™ from Aqua Smart,™ Inc , saves water by controlling the amount of water feeding into the toilet bowl refill/overflow pipe. Only the amount of water necessary for proper functioning goes into the bowl and the tank fills faster, reducing the amount of water used on every flush.

St. Louis based Industrial Testing Laboratories, Inc., ran performance tests on the device and reported a water savings from one-half gallon to one gallon per flush, depending on toilet model and tank capacity. And, best of all, toilets function properly because proper tank volume is maintained.

The environmental impact of the device goes far beyond the economic savings for individual users, which can be substantial since 45% of household water usage is attributed to toilets (see chart at left). Every gallon of water saved from being flushed into municipal sewage systems is a gallon of water that doesn't need to be treated, so the AquaSaver™ saves both on front-end water usage and back-end wastewater treatment.

We think you will be pleasantly surprised at how much you can save after installing the AquaSaver™ in your home, apartment complex, hotel/motel, nursing home, etc. In Boston, MA, you can save \$135.00 per year on a family of four by using the AquaSaver™. Good Results wouldn't you say?!

11

**New
Water
Saving
Product!**

SAVE!

Up to **6000 gallons**
every year for a family of four.

SAVE 16 GALLONS
OF WATER
EVERY DAY!

aqua smart, inc.
every drop counts™

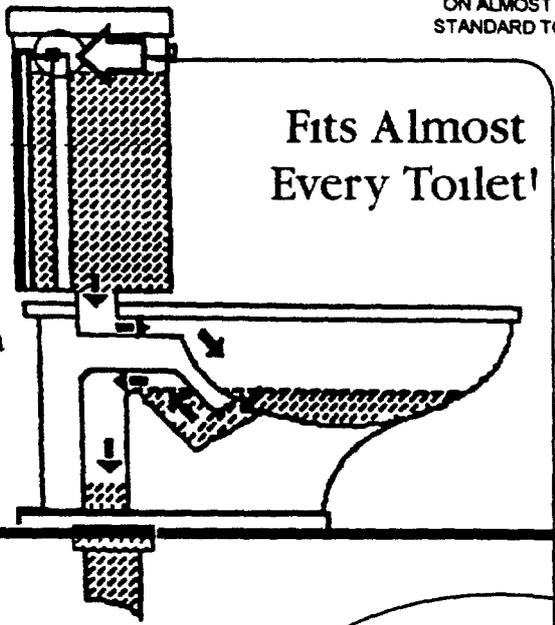
How It Works

aquaSaver™

INSTALLS IN SECONDS
ON ALMOST ANY
STANDARD TOILET

The Problem

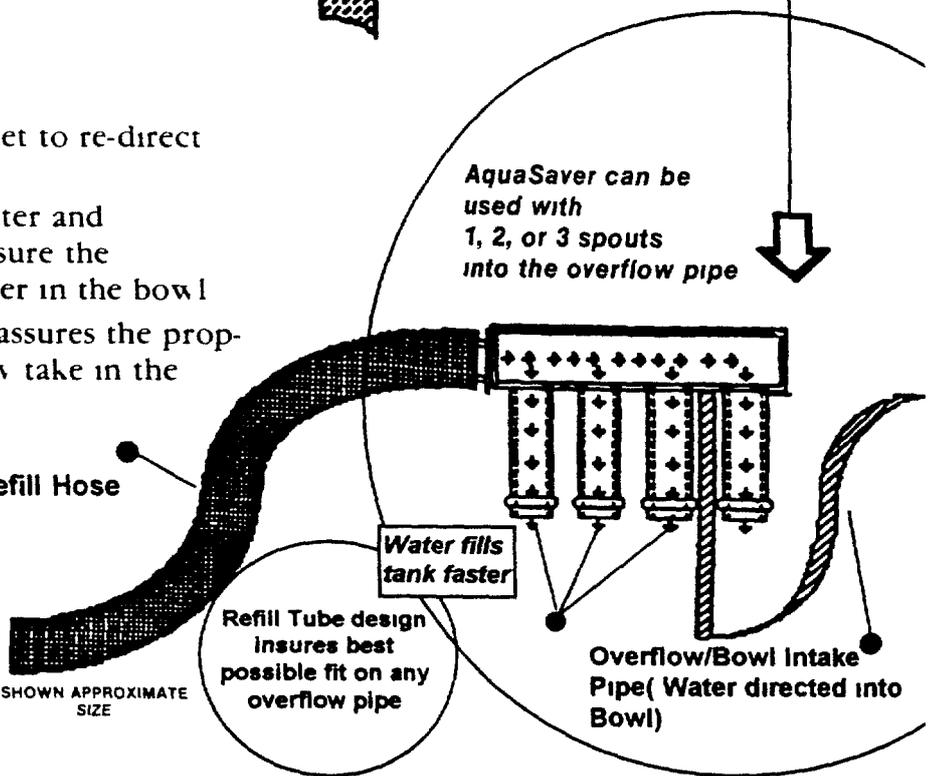
As the toilet refills, some of the water is directed into the overflow pipe refilling the bowl. The bowl will continue to fill until the tank is full. Most toilet bowls will take water beyond the amount required to have a satisfactory surface area and even overflow. Overfilling results in not just more water than you need in the bowl, but water and money pouring down the drain until the tank is full.



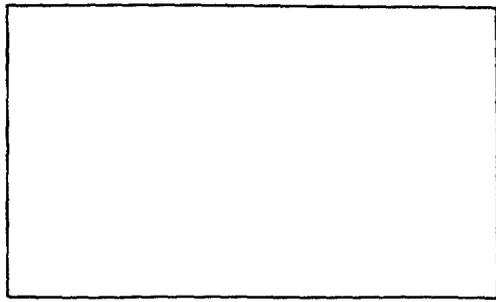
The Solution

The AquaSaver allows the toilet to re-direct this incoming water. This allows the tank to fill faster and because it can be adjusted will assure the minimum effective amount of water in the bowl. Installation of the AquaSaver assures the property owner that the toilet will only take in the proper amount of water.

AquaSaver can be used with 1, 2, or 3 spouts into the overflow pipe



For more information contact your distributor



INSTALLATION INSTRUCTIONS (See inside pictures)

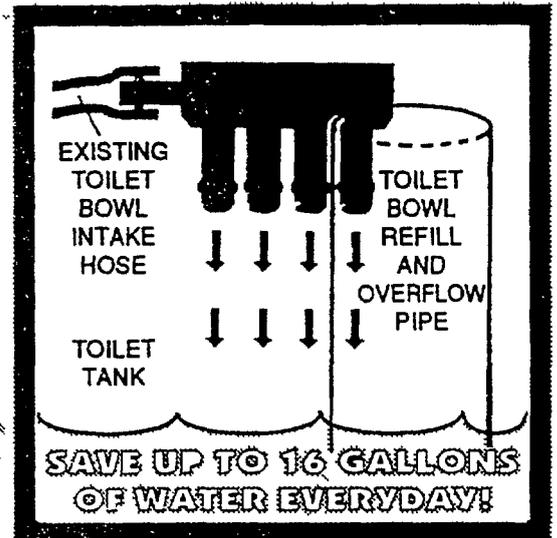
- 1 Detach existing toilet bowl refill hose from the refill/overflow pipe. If there is a clip remove it - if there is a cap on the refill pipe remove it.
- 2 Insert AquaSaver into end of hose.
- 3 Place AquaSaver onto the bowl refill/overflow pipe so that any one spout is inside the pipe and the remaining three spouts are outside the pipe.
- 4 After flushing the water level in the bowl may or may not be a little lower than before. If you prefer more water in the bowl adjust AquaSaver by placing two spouts into the pipe.

QUESTIONS THAT YOU MIGHT HAVE

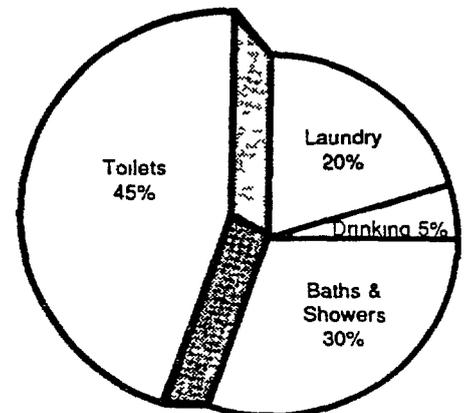
- 1 Do all installations take only a few seconds? And are all stools easy to install in?
 - A. Yes in most cases. However some refill pipes are not a plastic or metal pipe but rather are cast into the tank. In those cases the walls of the refill are too thick for the AquaSaver to fit onto - merely fit a hose (available at hardware stores) onto one of the spouts of the AquaSaver & place it (the hose) into the refill pipe. The important thing is One spout in & three out.
 - B. On the Mansfield toilet the refill tube and the flapper are one unit and when the toilet is flushed they both lift up. Again the AquaSaver will need to be fitted with a hose on one spout.
 - C. Kohler and Crane each have an expensive model where the refill pipe is built into the ballcock and the AquaSaver will not work.
 - D. Some toilet refill pipes have a cap on them that you can remove by twisting upward.
 - E. You can install the AquaSaver any of these ways just keep in mind that you can cut hoses to length needed to position AquaSaver so one spout fitted with a hose goes into the refill pipe and three spouts into the tank.
- 2 What water level should be in the toilet tank?
 - A. Sometimes you will see the water line mark on the tank. The water level should be within one half inch from the top of the refill pipe.
- 3 Does the AquaSaver work with replacement Fluidmaster?
 - A. Yes. The Fluidmaster adjusts the water level within 1/2 inch from the top of the refill pipe. It is not there to save water. The water level will vary with different toilets. Do not adjust the Fluidmaster below the recommended 1/2 inch from the top of the refill pipe.
- 4 What should you look for before installing the AquaSaver?
 - A. Make sure the water level is turned on all the way.
 - B. Check water level in the tank - again 1/2 inch from the top of the refill pipe. (These things will reduce flush quality repeat flushings defeat the purpose of the AquaSaver.)
- 5 Does the AquaSaver work with the brick, the plastic bag or the water dam?
 - A. No. The quality of the flush has been significantly reduced if used in correlation with these devices. When using the AquaSaver you get a quality flush, and most importantly you save.
- 6 Does the AquaSaver work on the new 1.6 gallon tank?
 - A. Yes - but not recommended. There is very little savings and the 1.6 gallon toilets are having problems with their quality flush even before the installation of the AquaSaver. We feel the AquaSaver will be more effective on tank sizes ranging from 3.5 to 7 gallons.
- 7 Is the refill hose always the right size to slip onto the intake spout of the AquaSaver?
 - A. Sometimes the refill hose is stretched or in some cases just a little larger OD. If the end of the refill hose is stretched cut off about 1/2 inch and then insert into the AquaSaver. If however the refill hose is too large OD use a short section of hose (available at hardware stores) and insert into the too large refill hose that is in place then snap AquaSaver into the step down size. Remember you can cut and position as needed to get hoses lengths needed to accomplish the objective of one spout in the refill and three out.
- 8 Is the amount of water coming out of each of the four spouts equally the same in volume?
 - A. Yes. The AquaSaver has been carefully engineered to achieve that objective. The volume of water coming into the AquaSaver at the intake is exactly the same coming out each spout. Therefore it does not matter which of the four spouts is routed into the refill pipe.

WHY DOES THE AQUASAVER SAVE WATER?

The water line coming into the toilet stool comes into the water control valve (ballcock). The water control valve disperses the water to two places: 1 To refill the tank, and 2 To refill the toilet bowl stool. The problem with this situation is that water continues running into the bowl until the tank is full and most of this water goes down the drain, therefore *wasted*. The AquaSaver redirects this incoming water by only putting 1/4th as much into the bowl - the other 3/4ths is directed into the tank - causing the tank to fill faster.



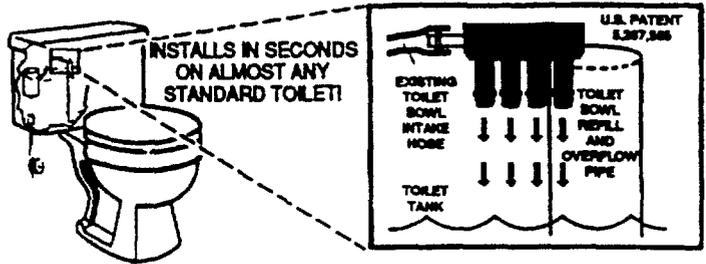
IN-HOME WATER USE



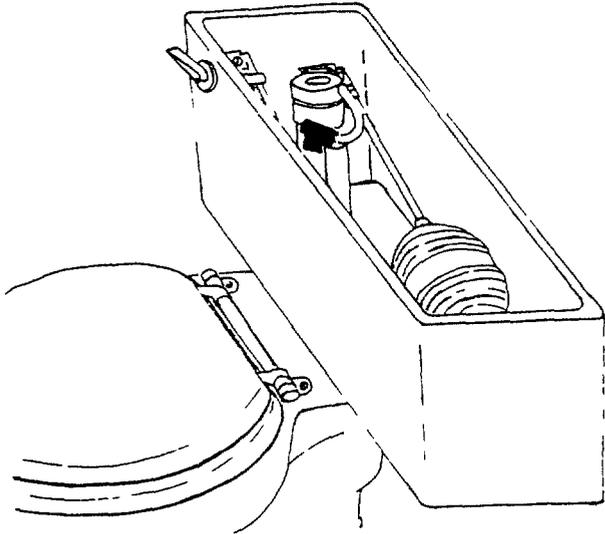
Source: National Wildlife Federation

INSTALLATION ON VARIOUS TOILETS

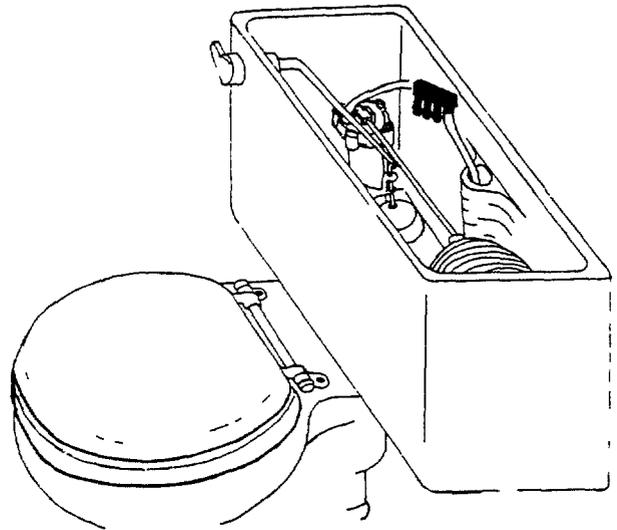
1 Normal installation



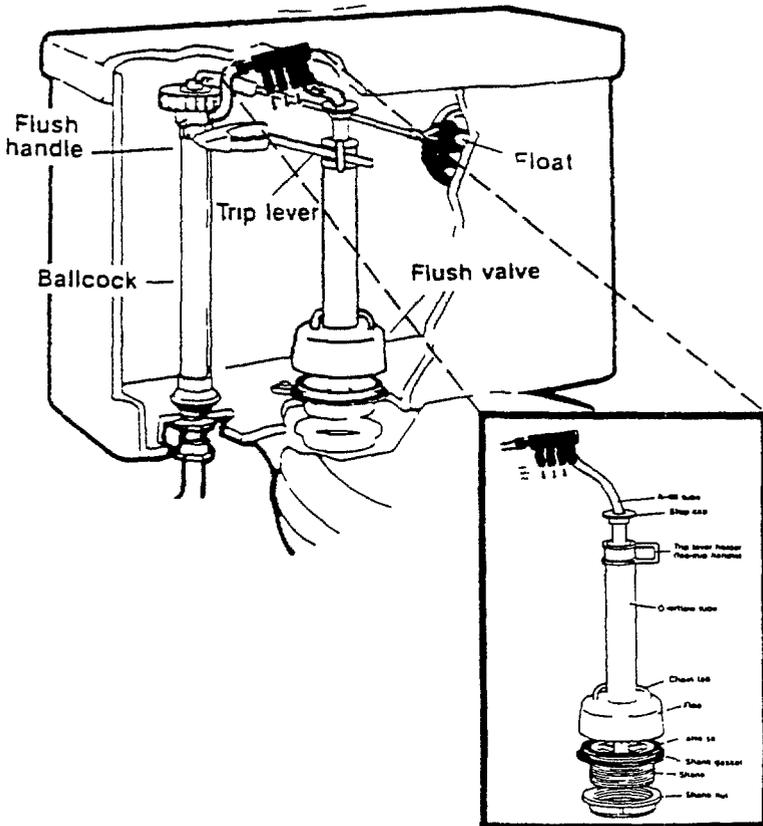
- 2 Install the AquaSaver in the down spout furthest from the intake spout. If it interferes with the mechanics of flushing, place the first down spout of the AquaSaver in the overflow tube.



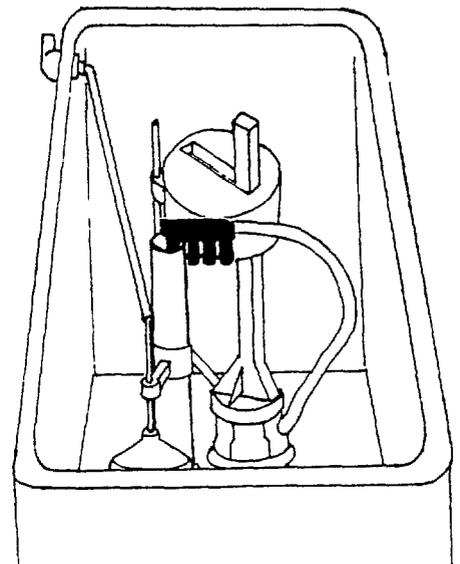
- 3 You may install the AquaSaver as shown in diagram, if necessary.



- 4 Mansfield toilets that have this type of overflow tube should be installed as shown in diagram.



- 5 Fluid Master - Install as shown in diagram.



Appendix VII

Monthly occupancy calculation form **Coral Seas Hotel**

Month/year _____

Day	# of rooms occupied	Total number of guests	Number of foreign guests	Number of local guests
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Total	(= A)			

B) Total rooms available each day = _____

C) Total rooms available for month = (B x Number of days in month) = _____

D) % occupancy for month = (A / C) x 100 = _____