Visitor Arrivals to the Cook Islands and the Environment

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Contents

Executive Summary

The environment on Rarotonga and Aitutaki is under stress from tourism development, with infrastructure for the protection of the environment long overdue and an overall growth in visitor arrivals at 4% since 1980. Yet the Cook Islands Tourism Corporation has adopted a policy to significantly increase visitor arrivals to the Cook Islands to 7% before infrastructure is put in place to protect the environment from further damage.

Although the typical tourist length of stay has reduced from 11-15 days to 7 days, the growth in tourist arrivals means that tourist nights have increased overall resulting in more water consumed and more solid and liquid waste produced.

The current landfill is superior to conventional dump sites because it is designed to protect the groundwater and lagoon from contamination by its toxic leachate (the toxic liquid that percolates out of the solid waste). The waste management facilities at Rarotonga and Aitutaki cost $3.1million so the life of the landfill must be extended as much as possible to maximise the benefits from each dollar spent. This can be done by purchasing equipment to enable tighter compaction of waste, implementing our national policy to reduce, reuse, recover and recycle (Maunsell, 2004a) and maintaining the current growth rate in visitor arrivals. The landfill may be full by 2013 or by 2050 depending on how it is managed and what growth rate in visitor arrivals we target.

Water storage capacity has increased only slightly relative to the growth in tourist accommodation capacity and almost all tourist accommodation is dependent on the reticulated water supply. Rarotonga residents increasingly experience water shortages and low water pressure despite tourism-led economic growth. This is because of the meagre funds allocated to water supply by successive governments. Corporatization will enable a more efficient water service and need not include user charges. The most environmentally sustainable method of supplying water is roof-top rainwater collection and storage. Unless more people are trained to install water tanks, or qualified installers are brought into the country, a scheme to install water tanks and fittings in all existing households in Rarotonga would take 9 years to complete and 16 years to pay off.

Tourist accommodation development has increased the volume of sewage generated on the beachfront. A recent survey of septic tank systems on Rarotonga concluded that 90% of these systems are treating sewage inadequately due to poor design, construction and/or lack of maintenance (Evans and Dakers, 2011). For improvements to be made in sanitation and for protection of public health and the lagoon environment the goal must be conservative accommodation densities according to international standards referred to in the Public Health (Sewage) Regulations 2008. Replacement of existing septic tank systems to meet the new standards will take an estimated 14 years unless additional registered installers are trained or brought into the country. There is enormous variation in sanitation knowledge and skill within and between government agencies and the industry. To ensure sanitation systems are in compliance with the regulations, government agencies and the sewage industry need to work together in a coordinated fashion towards learning and applying the new standards. Also, additional resources need to be allocated to a sanitation enforcement unit.

It will take many years before infrastructure is in place to address current environmental issues. It is recommended that the current visitor arrival growth rate of 4% be maintained, proposed institutional changes implemented and infrastructure put in place before reviewing the target visitor arrivals in five years time. It is also recommended that there be a moratorium on tourist accommodation development for the next 15 years and for developers to declare their intentions to develop within that time so special arrangements can be made for them. Finally new strategies to attract visitors throughout the year and to the outer islands are needed.

Introduction

The Cook Islands Tourism Corporation has adopted a policy to significantly increase visitor arrivals to the Cook Islands (CITC Strategic Plan, 2010). Visitor arrivals in 2009 totalled 100,591 and the Cook Islands Tourism target for 2015 is 150,000 visitors. This is an average growth rate of 7% per year. Whilst increases in visitor arrivals are desired in the outer islands, the environment in Rarotonga and Aitutaki is struggling to cope with tourism growth experienced to date.

There are three areas of environmental concern which can most clearly demonstrate the effects of rapid growth in tourism: solid waste, liquid waste and water. An examination of these environmental concerns on Rarotonga, where data is readily available, should help to determine the optimum growth rate in visitor arrivals. Until there is a time when tourists transit in Rarotonga and choose the outer islands for the full length of their stay, the carrying capacity for tourists in Rarotonga will have to dictate the carrying capacity in the Cook Islands.

It should be noted that there are several other areas of environmental concern resulting from increases in visitor arrivals. Particular varieties of plants and animals are threatened during nature tourism (bush walks, 4x4 tours and reef walks). Increased development results in affluence which in turn increases traffic on the roads. These concerns require further research and analysis and deserve treatment in a separate paper.

This paper examines the impact that a faster growth rate in visitor arrivals will have on three areas of environmental concern on Rarotonga: solid waste, liquid waste and water. Sustainable solutions to prevent effects on the environment are suggested and a timeline for achieving these estimated to show how improvements to our infrastructure cannot happen overnight. The paper will then demonstrate why a growth rate of 4% (the typical growth rate in tourist arrivals over the last 30 years) is more economically and environmentally sustainable with respect to managing solid waste than the higher growth rate of 7% proposed. It will also argue for strict adherence to a requirement for all buildings to install roof-top water collection and storage. Finally the paper will show that a conservative density of tourist accommodation and residential development will enable maximum protection to the lagoon environment from liquid waste.

Visitor Arrivals and Tourist Nights per Year

Since 1980, visitor arrivals have commonly increased at a rate of 4% over the previous year (Figure 1). The years with significant increases in visitor numbers of 25-31% were 1984, 1991, 1992 and 2000[1]. The years with a significant decline in visitor arrivals were 1981 (-12.3%) and 1995 (-16.4%). The average rate of growth over the last 30 years was 6%.

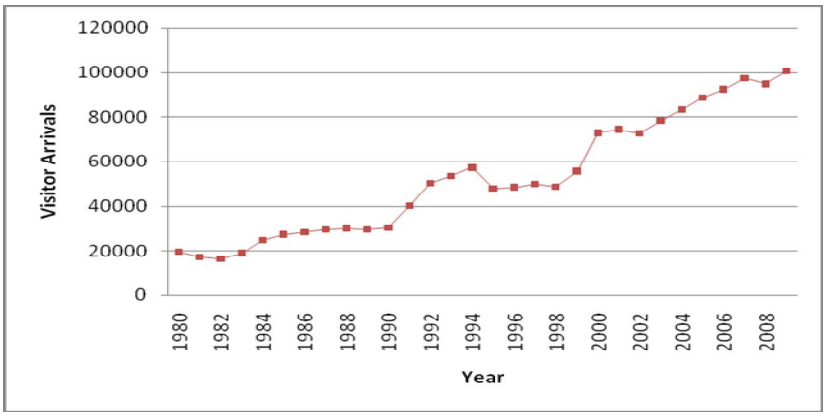

Figure 1: Visitor arrivals to the Cook Islands per year from 1980-2009.

Although the typical tourist length of stay has reduced from 11-15 days to 7 days, the growth in tourist arrivals means that tourist nights have increased overall as demonstrated by available data from 1999 to 2008. Figure 2 is a graph of tourist nights per year. For each year, the number of nights each tourist stayed is summed to provide total tourist nights per year. With every additional tourist night, more solid and liquid waste is generated and more water consumed.

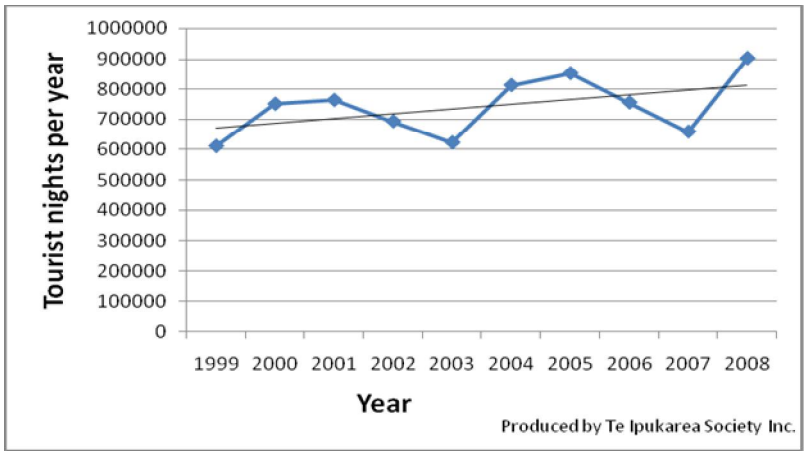

Figure 2. Tourist nights per year in the Cook Islands from 1999 to 2008. For each year, the number of nights each tourist stayed is summed to provide total tourist nights per year. The straight line is the trend line which shows an overall increase in tourist nights per year. NB: Due to the absence of data for the years 2002 and 2006, the midpoint between the previous and following years was used as the value for those years. Data was supplied by the Cook Islands Tourism Corporation.

[1] During a questionnaire survey in Muri village in 2004, most respondents believed pollution of Muri lagoon began in 1999 or 2000 and some said it began in the late 1980's or early 1990's (Evans, 2006:76).

Solid Waste

The Issue

In 1999 solid waste generated on Rarotonga amounted to 1,450 tons/year (ADB, 2001:11). Based on a count done in November 2010, 54.5 tons were generated in one week (Tai Nooapii, MOIP, personal communication). This is roughly extrapolated to 2,834 tons/year[2]. We have almost no recycling. The landfill was designed to be full by 2019 (Maunsell Ltd, 2004b:3-1). With good management it's life could be extended to 2039 (Finnigan, 2009:Appendix A:Raro F8). These estimates are based on projections made in 1999 of increases in visitor arrivals at mostly 2% per annum resulting in 104,000 tourists by 2015 (ADB, 2001: 63)[3]. Visitor arrivals have increased at a faster rate than this and with the new targets, visitor arrivals will be at 150,000 by 2015 (Figure 3).

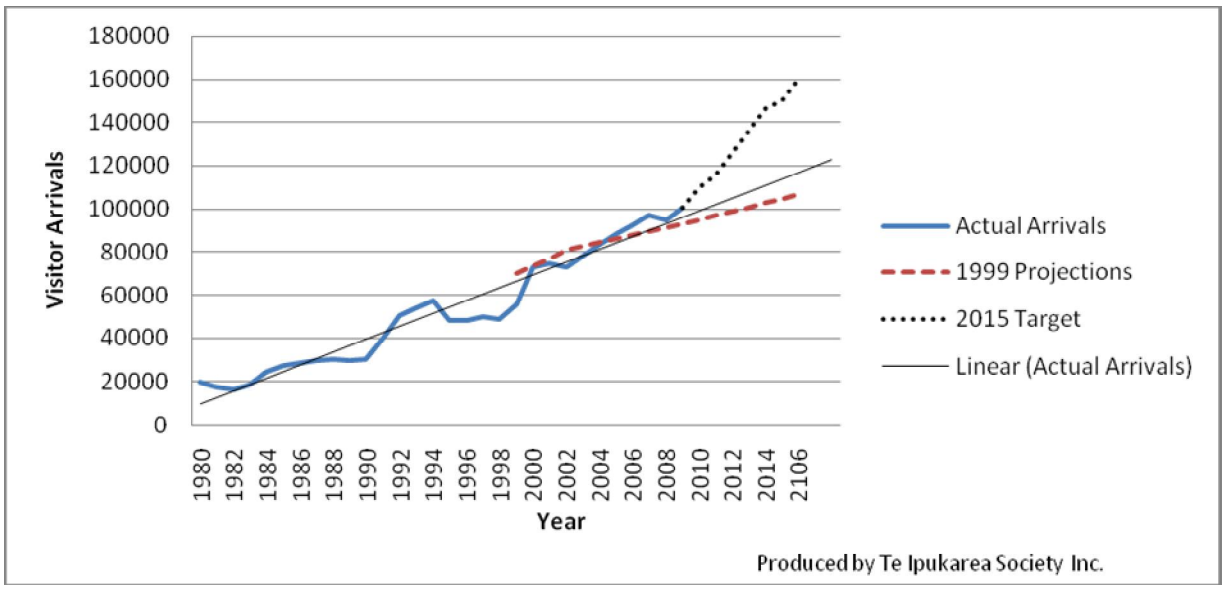

Figure 3: Actual visitor arrivals from 1980 to 2009 against 1999 projections and the 2015 target. The straight line is the linear projection to 2015 based on actual arrivals. 1999 projections are based on a 2-5% growth rate in arrivals suggested by ADB (2001). This results in 104,000 visitors by 2015. The current stated tourism industry target is 150,000 visitors by 2015. This graph was produced by Te Ipukarea Society and the spreadsheet of data is available to anyone for independent analysis.

Based on the typical tourist length of stay of 7 days, such an increase in visitor arrivals equates to 250 tonnes more solid waste than if visitor arrivals grew at 4%[4]. At a steady growth rate of 4% and current landfill management methods[5], the landfill will be full by 2023 (Table 1). At a growth rate of 7% and current landfill management methods, the landfill would be full by 2013 (Table 2). Setting a more conservative goal for tourism

[2] This is a very rough extrapolation as waste volumes are variable between seasons. Festive periods such as the Constitution Celebrations (August 4th) will likely generate more waste. The low tourist season may generate less waste.
[3] These projections assumed visitors stayed in Rarotonga for the entire length of their say. Due to the absence of data on length of stay in Rarotonga cf the outer islands and the acceptance by most that the majority of tourists stay in Rarotonga only, the same assumption is made in this paper.
[4] Tourists were found to generate 0.4kg of waste per day according to a study in 1999 (ADB, 2001:63)
[5] No recycling, compaction to 0.5 tons/m3 and 5% cover

growth would extend the life of the landfill by another ten years and give time for funds to be accumulated to identify and implement another solid waste disposal solution.

If 75% of our waste was diverted from the landfill through recycling, and visitor growth rate was maintained at 4%, the landfill would not be full until 2050. A comprehensive recycling programme is essential for the long term economic success of any waste management programme.

A loan from the Asian Development Bank was secured to cover the cost of constructing the two waste management facilities in Rarotonga and Aitutaki. The cost of the two facilities was $3.1million and the loan was for $2.2 million with a repayment term of 32 years at an interest rate of 1% for the first 8 years and then 1.5% thereafter (ADB, 2001:12-13). The current landfill is superior to conventional dump sites. It is lined to prevent contamination of the ground water and lagoon. It is designed with sampling bores to allow for groundwater sampling so that any environmental effects can be stopped as they arise. It is engineered to enable the collection and treatment of leachate (the toxic liquid that percolates out of the solid waste). It is best practice to extend the life of the landfill as much as possible to reduce costs to the country.

Possible Solutions

To extend the life of the landfill and reduce the growth in solid waste four things could be done:

1. Terms and conditions of the kerbside rubbish collection contract can be amended to ensure recyclables remain separated and are exported overseas for recycling.
2. Landfill can be compacted more densely than it is currently.
3. Educate tourists and the community to achieve higher rates of recycling and reduce waste generated *or alternatively* introduce a refundable deposit on recyclables (see Box 1)
4. Maintain the current growth rate of 4% per annum in visitor arrivals (A 2015 target for visitor arrivals of 130,000)

Box 1: The Case for Refundable Deposits

The National Waste Strategy is due for review. For a long term solution one option that could be examined is the introduction of a refundable deposit on recyclables. The disadvantage of this is the administrative and infrastructure requirements required to manage a collection and refund programme. The advantages are:

- Recycling rates are increased
- Littering is reduced
- Fundraising opportunities are established for the community through collection of recyclables
- Recycling is achieved at little or no cost to taxpayers

Refunds could be provided for glass bottles, plastic bottles, aluminium cans, tins, electronics, tyres, cars and white-ware. Kerbside collection can then be for general waste and green waste only.

Refundable deposit systems became popular in the 1970s and their demise is largely because of centralisation of the beverage industry, the increased mobility of people and the convenience of throw-away containers (White, 2002:5). However, refundable deposit systems have been proven to increase recycling rates. In Sweden, aluminium can recycling was at 63% in 1984. When a refundable deposit system was introduced, the recycling rate increased to 75% in 1987 and 92% in 1995 (White, 2002:4). Ten states in the USA with container deposit legislation achieve average annual recycling rates 2-3 times higher than states that don't have this legislation. Austria has an Advanced Disposal Fee for refrigerators and refundable disposal fees are required for cars in Sweden (White, 2002:5). Such a system can operate in the Cook Islands but it should be led by the retail industry and triggered by government policy such as product bans and taxes on non-recyclable products.

Year	Tonnes of Solid Waste from Residents and Commercial[6]	Actual/Projected Visitor Arrivals at 4% growth[7]	Tonnes of Solid Waste from Visitors at 4% growth[8]	Total Tonnes at 4% growth[9]	Volume of Refuse[10] (m^3)	Volume of Soil Cover[11] (m^3)	Total Volume (m^3)	Cumulative Total[12] (m^3)
2005	1,459	88,405	248	1,707	3,414	171	3,584	3,584
2006	1,495	91,941	257	1,753	3,506	175	3,681	7,265
2007	1,533	95,619	268	1,801	3,602	180	3,783	11,048
2008	1,571	99,444	278	1,850	3,700	185	3,885	14,933
2009	1,611	103,421	290	1,901	3,802	190	3,992	18,925
2010	1,653	107,558	301	1,954	3,909	195	4,104	23,029
2011	1,695	111,861	313	2,008	4,016	201	4,217	27,246
2012	1,739	116,335	326	2,065	4,130	207	4,337	31,582
2013	1,784	120,988	339	2,123	4,245	212	4,458	36,040
2014	1,830	125,828	352	2,183	4,365	218	4,583	40,623
2015	1,878	130,861	366	2,245	4,490	224	4,714	45,338
2016	1,929	136,095	381	2,310	4,619	231	4,850	50,188
2017	1,980	141,539	396	2,376	4,752	238	4,989	55,177
2018	2,033	147,201	412	2,445	4,889	244	5,134	60,311
2019	2,086	153,089	429	2,515	5,030	251	5,281	65,593
2020	2,143	159,212	446	2,589	5,177	259	5,436	71,029
2021	2,200	165,581	464	2,664	5,328	266	5,595	76,624
2022	2,261	172,204	482	2,743	5,486	274	5,760	82,384
2023	2,323	179,092	501	2,825	5,649	282	5,932	88,315

Table 1: Projected accumulation of solid waste on Rarotonga based on a 4% growth in visitor arrivals. The Rarotonga landfill has a design capacity of 87,000m3 and would be full under this scenario by 2023. [13]

[6] This is calculated using projected total tonnes of solid waste per year (from ADB 2001) minus the proportion of solid waste projected to be generated by tourists. The proportion of waste projected to be generated by tourists is calculated using 0.4kg solid waste/tourist/night (provided by ADB 2001) multiplied by 7 nights stay (the typical tourist length of stay) multiplied by the projected number of tourists.

[7] Actual visitor arrivals are shown from 2005 to 2009. A projection of 4% growth is used thereafter.

[8] Based on 0.4kg solid waste/tourist/night as researched by ADB 2001 multiplied by 7 nights stay (the typical tourist length of stay) multiplied by actual/projected visitor arrivals/year

[9] This is projected resident and commercial solid waste plus projected visitor solid waste

[10] This is calculated based on the compaction of refuse at 0.5tonnes/m^3 recommended by ADB 2001

[11] This is based on the observed soil cover of 5% of refuse volume (Finnigan, 2009).

[12] The landfill design capacity is 79,000m3 or 87,000m3 when settled (Finnigan, 2009:Appendix A:2)

[13] With the adoption of recommendations by Finnigan (2009) including a higher degree of compaction at 0.8 tonnes/m^3, 25% soil cover to prevent pest infestation and 25% recycling in the first five years, followed by 50% recycling thereafter, the landfill will last until 2039.

Year	Tonnes of Solid Waste from Residents and Commercial[14]	Actual/Projected Visitor Arrivals at 7% growth[15]	Tonnes of Solid Waste from Visitors at 7% growth[16]	Total Tonnes at 7% growth[17]	Volume of Refuse[18] (m^3)	Volume of Soil Cover[19] (m^3)	Total Volume (m^3)	Cumulative Total[20] (m^3)
2005	1,459	88,405	248	1,707	1,707	85	1,792	1,792
2006	1,495	92,328	259	1,754	3,461	173	3,634	5,426
2007	1,533	97,316	272	1,806	5,267	263	5,530	10,956
2008	1,571	94,776	265	1,837	7,103	355	7,459	18,414
2009	1,611	100,591	282	1,893	8,997	450	9,446	27,861
2010	1,653	107,632	301	1,955	10,951	548	11,499	39,359
2011	1,695	115,167	322	2,017	12,968	648	13,617	52,976
2012	1,739	123,228	345	2,084	15,053	753	15,805	68,782
2013	1,784	131,854	369	2,153	17,206	860	18,066	86,848

Table 2: Projected accumulation of solid waste on Rarotonga based on a 7% growth in visitor arrivals. The Rarotonga landfill has a design capacity of 87,000m3 and would be full under this scenario by 2013.

[14] This is calculated using projected total tonnes of solid waste per year (from ADB 2001) minus the proportion of solid waste projected to be generated by tourists. The proportion of waste projected to be generated by tourists is calculated using 0.4kg solid waste/tourist/night (provided by ADB 2001)multiplied by 7 nights stay (the typical tourist length of stay) multiplied by the projected number of tourists.

[15] Actual visitor arrivals are shown from 2005 to 2009. 7% is the growth rate in visitor arrivals proposed by Cook Islands Tourism Corporation and this is calculated using the 2009 figure as a base.

[16] Based on 0.4kg solid waste/tourist/night as researched by ADB 2001 multiplied by 7 nights stay (the typical tourist length of stay) multiplied by actual/projected visitor arrivals/year

[17] This is projected resident and commercial solid waste plus projected visitor solid waste

[18] This is calculated based on the compaction of refuse at 0.5tonnes/m^3 recommended by ADB 2001

[19] This is based on the observed soil cover of 5% of refuse volume(Finnigan, 2009).

[20] The landfill design capacity is 79,000m3 or 87,000m3 when settled (Finnigan, 2009:Appendix A:2)

The kerbside collection contract includes recycling but the Ministry of Infrastructure and Planning has not enforced this part of the contract. Amendments to the kerbside collection contract would facilitate enforcement. Such amendments are described in a recent review of the Rarotonga and Aitutaki Waste Management Facilities (Finnigan, 2009).

Box 2: Timeline for Achievement of Outcomes via a Refundable Deposit System

The introduction of a refundable deposit system will require amendments to national policy, legislative changes and re-orientation of policy within the retail industry. Amendments to national policy and legislative changes could be achieved within a year if the national policy and planning unit, cabinet and parliament made this a top priority. Realistically it might be achieved within two years. Such legislative change will force the retail industry to reorganise and this may take another year before we see the outcomes of this. This will enable 75% recycling within three years.

Timeline for Solutions and their Outcomes

Amendments to the kerbside collection contract could be made immediately and may become effective upon commencement of the next contract (currently due for tender). This could increase rates of recycling to about 25% within one year (Finnigan, 2009:67). A waste audit to determine the proportion of recyclable materials should also be conducted to provide information for the tender process.

Compaction of refuse in the landfill to 0.8 tonnes/m^3 as has been suggested could begin immediately (Finnigan, 2009:xiv, 49, 67). This would extend the life of the landfill by 5-6 years (Finnigan, 2009:ix, 49, 67).

The achievement of outcomes through education, such as reduced waste generation (through bulk buying, purchasing products with less packaging etc) and higher rates of recycling could take ten to twenty years. Most people do not change their habits and change is more likely amongst the new generation if educated from a very early age. With a solid and consistent education campaign, we may achieve 50% recycling within 10-20 years. Alternatively, a higher percentage of recycling could be achieved within a shorter period if a refundable deposit system was introduced (see Box 2).

Water Supply

The Issue

Water storage capacity has increased only slightly relative to the growth in tourist accommodation capacity and almost all tourist accommodation is dependent on the reticulated water supply. Rarotonga residents increasingly experience water shortages and low water pressure. New tourist accommodation have not been required to install their own supply of water and many store reticulated water which reduces what would otherwise be stored for use by the rest of the island. Large hotels have priority use of water over other users during times of drought (SOPAC, 2007:16).

Droughts are linked with the El Nino Southern Oscillation (ENSO) with significant droughts on Rarotonga occurring in 1982, 1987 and 1997-98 (SOPAC, 2007:13). Droughts have become more frequent since the 1930s and the enhanced greenhouse effect is likely to cause more intense droughts (SOPAC, 2007:20-21).

The increase in tourist accommodation capacity combined with the limited growth in water storage capacity has exacerbated the effects of these droughts. The first major water shortage since improvements to the water

supply in the 1980s was experienced in 1997. Since then, many households have experienced either no water or low water pressure on an increasingly regular basis.

The Government budget allocations to the Division of Water Supply at MOIP are insufficient to provide the capital and human resource investment needed to meet the demand for water. The capital appropriation for 2010-11 for the Ministry of Infrastructure and Planning was $1,585,000 (MFEM, 2010). Economic growth and the subsequent annual increases in government revenue have not resulted in investments in water storage capacity. Instead annual incremental increases in government revenue have supported a growing public service and ad hoc projects. Unless the Division of Water Supply is made into a public corporation with its own bank account this is unlikely to change. Past governments have not been willing to introduce user charges because of the political repercussions. The only other alternative is to cut back on public service expenditure and formalise the allocation of a larger proportion of funds to water supply.

Possible Solutions

The establishment of a public corporation as proposed in 1995 and 2009 would enable water supply to be managed like a company but also supported with public funds (ADB, 1995:5-7; ADB, 2009: Appendix F:1). Corporatization of water supply would have the following benefits:

- Corporatisation replaces government administration by commercial management which
    - permits more flexibility in cash management
    - simplifies the recruitment and dismissal of personnel, improving performance
    - facilitates resource generation
- Costs can be accounted for more accurately and any subsidies inherent become transparent and measurable
- Reduces direct political influence on the sector

Such a public corporation could also encompass solid and liquid waste management.

The most environmentally sustainable method of supplying water is roof-top rainwater collection and storage. The construction of larger dams at the water intakes will affect the surrounding vegetation as well as stream water flows and freshwater biodiversity. The extraction of groundwater requires careful management to prevent the irreversible situation of saltwater intrusion. Extraction of groundwater also requires energy for pumping and treatment. Catching rainwater on roof-tops reduces stormwater flooding, thereby preventing stream and lagoon pollution from the stormwater runoff. A focus on subsidies for private roof-top rainwater supply and ongoing programme of monitoring and repair of leaks will help to protect the community against the water demands of the growing tourist accommodation capacity.

New development projects should be required to catch their own water. This requirement will need to be incorporated into the building code. Capacity will need to be invested in the building control section of the Ministry of Infrastructure and Planning to help monitor and enforce this requirement. In-country training could be provided by regional council inspectors under the NZAID scheme.

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Timeline for Solutions and their Outcomes

Corporatisation of water supply will require policy development and the drafting and passing of amendments to existing legislation through parliament, as well as the documentation to establish a body corporate. This could be done within a year if it was made a high priority.

If each of the 2,899[21] private dwellings on Rarotonga was provided with a 6,000 litre water tank (which could carry a family of four through a two-week drought), and that tank was worth $1,450 it would cost $4,203,550 to fund such a scheme[22]. Using the 2010-11 budget allocation of $1,585,000 for MOIP capital expenditure, and assuming half of this expenditure was used for water supply and the other half for projects such as roading and waste, it would take 6 years to pay for the scheme. Another $8.7 million or ten years of funding would be needed for a revolving fund for fittings such as spouting, first flush mechanisms, filters and pumps.

The time taken to install the tanks, spouting and fittings will be dependent on the number of people qualified to do roofing on the island. Assuming there are two people and they do three roofs per week each, it would take nine years to install tanks, spouting and fittings for all households.

Up to two years would be needed to build capacity to enforce standards for water collection.

Liquid Waste

The Issue

Coastal lagoon water quality has been monitored by the Ministry of Marine Resources with the guidance and advice of the New Zealand National Institute of Water and Atmosphere (NIWA) since 2007. The sampling and analysis of the Rarotonga and Aitutaki lagoon and streams was subject to quality control by NIWA and the results peer reviewed. Results for Rarotonga for the first three years (2007-2009) show that there has been a progressive deterioration in water quality in the lagoon (CIMRIS, 2010). The results show that bacteria levels in the lagoon are within WHO standards for swimming, but there is heavy bacterial pollution in the streams that empty into the lagoon. The monitoring also shows that the lagoon is often highly enriched with nutrients and the ecological health of the lagoon is poor in many places (CIMRIS, 2010).

All properties are dependent on treatment of their sewage on-site except in the Tereora-Tepuka area where a cluster sewage system has been installed. A study to determine the growth in maximum tourist accommodation capacity on the beachside in Muri showed a rapid growth rate from beds for 52 people in 1985 to beds for 574 people in 2004 (Evans, 2006:56). This translates to an increase in maximum generation of sewage on the Muri beachfront from 10,400 litres/day in 1985 to 114,800 litres/day in 2004[23]. The recent survey of sewage systems concluded that ninety percent of these systems are treating sewage inadequately due to poor design, construction and/or lack of maintenance (Evans and Dakers, 2011). Most of these sewage systems are situated in porous sandy soil over a high groundwater table which means pathogens and excess nutrients can drain easily to the lagoon. This presents a significant risk to public health, the environment and the tourism industry.

[21] The number of private dwellings accounted for in the 2006 census
[22] This does not include the cost of spouting, first flush mechanisms, filters and pumps
[23] This is using the standard wastewater producton rate of 200 litres/person/day

There are other activities which cause the deterioration of coastal lagoon water quality. Almost all are driven by tourism development and economic growth. Commercial pig farming supplies resorts and retailers with pork. These farms dispose untreated wastewater via drains, wetlands, soakage to groundwater and streams, eventually reaching the lagoon. With development is an increase in the generation of laundry wastewater. The failure to use phosphate free detergent at many laundries contributes phosphorus nutrients to the lagoon. The filling in of wetlands to allow for the construction of tourist accommodation or dwellings also aids in the deterioration of the lagoon. Wetlands are a natural filter of sediment and nutrients and there is a Rarotonga Island Environment Authority policy to preserve them but the Environment Service does not enforce it. Uncontrolled sediment from excavated land and road cuttings also contribute nutrients to the lagoon as do excess fertilizers used in horticulture.

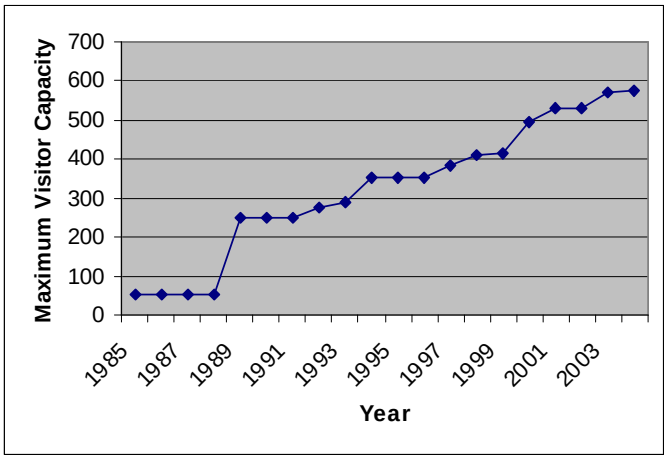

Figure 4: Changes in maximum visitor accommodation capacity on the beach side of the main road through Muri village (Avana Stream to Parengaru Stream) from 1985 to 2004 (from Evans 2006)

It should be noted that even if every tourist accommodation currently in Muri installed an advanced sewage treatment unit, the accommodation density may be so high, that the treated wastewater could still present a risk to the lagoon environment. Even advanced sewage treatment units that are economically feasible to operate in the Cook Islands do not produce pathogen-free or nutrient-free effluent. They also fail more regularly than the average person is aware. To clean this treated wastewater further and protect the environment during malfunctioning of the treatment system, it must be dripped through soil where aerobic bacteria can break down pollutants. An adequate area of land for irrigation is required for this to happen. The land area required is based on the capacity of the soil to absorb the effluent. As a rule, the higher the volume of wastewater produced, the more land needed to provide final treatment of this wastewater.

According to the Public Health (Sewage) Regulations 2008[24] a secondary treatment plant with a trench on moderately draining soils, needs 4-7m^2 of land dedicated for the trench for every person accommodated on the property. On clay soils 17-25m^2 of land must be dedicated for every person accommodated. Based on preliminary results of the 2010 Muri risk assessment survey funded by the European Union there may be inadequate land available to fully treat wastewater produced on some properties in Muri due to the high density of accommodation there.

High density development presents the following issues:

[24] The Public Health (Sewage) Regulations 2008 and its associated code Public Health Sewage (Code) Regulations 2008 are based on New Zealand and Australian standards in particular AS/NZS 1547:2000

1. Inadequate land area available on-site to provide final in-soil treatment of advanced treatment unit effluent
2. Inadequate acreage of plantations on Rarotonga under long-term lease to accept large volumes of partially treated sewage effluent
3. Likely negative impact on local fisheries and the immediate coral reef environment should the wastewater be disposed at sea

An ADB report published in 1995 discussed the problems with algae blooms in Muri lagoon observed in the early 1990s and stated:

> *"At existing populations levels, Rarotonga is beyond its capacity to assimilate these impacts without a noticeable effect on the environment. Population and tourist projections presented in this Report will accelerate this degradation. Liquid waste management is seen to be a key to the overall success of an environmental management program."* - Asian Development Bank, 1995 Rarotonga Urban Infrastructure Project Chapter 7 Page 97

Although sewage treatment standards have been raised, trade and engineering training implemented and septic tanks surveyed, there have been few actual improvements in liquid waste management since this statement was made. However, tourist accommodation capacity has continued to grow. The main impediment to achieving a high degree of compliance with the sewage regulations is the enormous variation in knowledge and skill within and between government agencies and the industry and the lack of capacity in government to enforce the sewage regulations. To progress the enforcement of the sewage regulations government agencies and the sewage industry must work together in a coordinated fashion towards meeting the new standards and additional resources need to be allocated to a sanitation enforcement unit.

Possible Solutions

To protect the fringing reef and lagoon, public health and the tourism industry, the goal should be conservative accommodation density according to wastewater treatment and assimilation rates set by the new Public Health (Sewage) Regulations 2011. Very clear standards are provided in these regulations to guide rates of development.

Existing developments that do not have sufficient land area for full treatment of their sewage can reduce their environmental impact by installing advanced treatment units, reducing accommodation capacity and increasing available garden space on their property. This would need systematic enforcement of sewage regulations on existing properties, which requires building the capacity of the relevant enforcement agency. There has already been a report completed on these capacity building needs (Dakers, 2009)

Some existing developments would not be able to reduce accommodation capacity and increase available garden space sufficiently and would need to be connected to a community sewage system. This means finding a place to apply thousands of litres of effluent each day (ADB, 2009).

As for new development projects, every person who is considering building or expanding accommodation must be made aware of the limitations placed on them by the sewage regulations before they progress too far down the road of project implementation. Waiting for developers to apply for an environment permit or sewage construction permit is far too late. The general public must be made aware of the allowable density of

development so that when a development project is conceived in their minds, they can avoid disappointment and wasted expenditure on BTIB approvals, building plans and project permits.

Timeline for Solutions and their Outcomes

As the current level of skill is so low, a sanitation unit with a full complement of staff will likely take at least three years to establish. Two years would be spent training existing inspectors in drainlaying and wastewater engineering and another year is needed to gain sufficient experience to do the work. This means it will be at least three years before sewage regulations begin to be systematically enforced to enable strict adherence to conservative accommodation densities and replacement of existing sewage systems according to the Public Health (Sewage) Regulations 2008.

The completion of the replacement of existing sewage systems will take many years. There are two registered installers on Rarotonga and both could only do four systems per week including design, installation of tank, and installation of land application system. There are 2,899 private dwellings on Rarotonga. At this rate it would take 14 years before all systems are upgraded unless registered drain-layers are attracted to the country to participate in the scheme or drain-layers are trained locally. There is also a need to find alternatives to sand used for the construction of septic tanks and trenches as sand is being rapidly depleted. The capacity for septic tank manufacturers to produce quality septic tanks will also need to be expanded.

A summary of the possible solutions and their timelines are show in Table 3.

Suggested solutions to address solid waste, water and liquid waste issues	**We will see results/outcomes from this action within:**
Solid Waste	
25% recycling through amended kerbside collection contract, waste audit, advertising and award of tender and export of recyclables	1 year
Compaction of landfill to 0.8 tonnes/m^3	1 year
50% recycling and a fully educated public regarding recycling	10-20 years
75%+ recycling through a refundable deposit scheme after review of National Waste Strategy, amendments to legislation and a reorganised retail industry	3 years
Water	
Corporatisation of water supply through policy development, legislation, documentation and establishment	1 year
Installation of water tanks for all households including spouting and other fittings	9 years
Build capacity to enforce building standards	2 years
Liquid Waste	
Build capacity to enforce sewage regulations and enable strict adherence to conservative accommodation density	3 years
Upgrade of sewage infrastructure according to standards	14 years

Table 3: Suggested solutions to address solid waste, water and liquid waste issues and timelines for their results/outcomes

Conclusion

The environment on Rarotonga is already under stress and a policy to significantly increase the growth in visitor arrivals will further put pressure on the environment. It is important to focus on building the infrastructure needed to protect the environment before adopting an aggressive policy of tourism growth. As the majority of tourists to the Cook Islands stay in Rarotonga for most or all of their say, the carrying capacity of Rarotonga determines the sustainable number of visitors to the Cook Islands. It would be beneficial to the environment and national development if an aggressive policy was adopted to attract visitors directly to the outer islands.

The time available to build infrastructure is an important factor in determining target growth rates. It will take up to three years to put in place the systems needed to improve management of the landfill. Private water supply for all households will take an estimated 9 years to install and 16 years or more to pay off. The upgrade of all sanitation systems could take up to 14 years unless additional qualified drain-layers are attracted to the island and capacity is expanded to build quality septic tanks. It is clear that infrastructure cannot be developed overnight and that a policy to rapidly grow visitor arrivals should be adopted once infrastructure development is underway.

A moratorium on new tourist accommodation development on Rarotonga for the next 15 years would be beneficial to the tourism industry. Developers that are planning visitor accommodation within that period would be asked to declare their intentions now so that special arrangements can be made for them to build. This would enable early and integrated planning with government authorities and the community so that any new development within that period will meet the required environmental standards. This would benefit the developer because it would avoid the expense and delays of commissioning building plans and an EIA (Environmental Impact Assessment) report that might not be accepted by the government or community. A moratorium would also enable existing accommodators to improve their occupancy rates and investors to invest in existing accommodation to ensure they meet revised tourism accreditation standards.

A moratorium on the registration of new tourist accommodation has been in place on Norfolk Island since 2000. The purpose was to provide a period to reassess the impact of tourism on the management of resources and waste (Tourist Accommodation [Moratorium] Act 2000). Reports indicate that a moratorium on tourist accommodation did not prevent economic growth and that strategies to attract tourists such as increasing flights are more important for growing the economy (Econtech Pty Ltd, 2008).

The growth in visitor arrivals in the future should be diverted to the slow season during the months of January, February, March and May. This will reduce environmental pressure during the high season and allow the tourism industry to maintain revenue during the slower months. There is also a need to attract visitors to the outer islands where revenue is desperately needed.

Recommendations

1. Maintain the tourism growth rate at 4% and revise this rate in five years time.
2. Place a moratorium on the construction of new visitor accommodation for the next fifteen years and make this moratorium reviewable depending on progress with infrastructure.
3. Establish strategies to ensure future growth in visitor arrivals is diverted to the current slow season.
4. Put new strategies in place to attract visitors to islands other than Rarotonga and Aitutaki

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