Tongareva Henua

Climate Change - Vulnerability and Adaptation Assessment

April 09th to 13th 2013

Introduction

This report is a reflection of the impact of Climate Change on the island of Penrhyn. The information acquired was mainly through the following modalities:

1. Conducting of a Climate change and Disaster Risk workshop with the Leaders of the Island of Penrhyn;
2. Conducting of a Community Awareness Workshop for the island of Penrhyn;
3. Conducting of a house to house survey of questionnaires;
4. Other researched and personal contributions from the people of Penrhyn.

This purpose of this exercise was also to collect and collate information to formulate policy statements that would enable us to come up with strategic recommendations that can be implemented at the national and as well at island level.

Tongareva Henua is one of the five islands identified by the Climate Change Country Team and National Environment Service to complete the collation of baseline data for the Climate Change Vulnerability & Adaptation Assessment (V&A) program. The V&A Team for Tongareva consisted of staff from the National Environment Service.

Other outer islands whereby Climate Change Vulnerability and Adaptation assessment have been carried out, through various projects and organisations, are as follows:

Aitutaki	2003
Mauke	2008
Mangaia	2008
Mitiaro	2008
Pukapuka	2008
Atiu	2012
Penrhyn	2012
Manihiki	2012
Penrhyn	2013
Palmerston Island	2013

These assessments will require regular review, preferably every five years as changes to our daily living environment is always occurring as a result of climate change.

This work would not have been possible without funding assistance from the Pacific Adaptation Strategy Assistance Program (PASAP) under the Government of Australia and the Asian Development Bank Small Grants Activity (ADB SGA), as well as support from the Government of the Cook Islands.

The V&A team would like to thank the Mayor, Penrhyn Island Council members, the Island Secretary, Member of Parliament, leaders and people of Tongareva for their time and contributions to making this program a success.

Meitaki poriia.

Mr. Vaitoti Tupa
Director – National Environment Services

Ms Mii Matamaki
Senior Environment Officer

PART ONE
Background

Penrhyn Enua

Penrhyn Island, or *Tongareva* as it is traditionally known in the Cook Islands, is the most remote outer island and the largest atoll in the northern Cook Islands group. It is described as a pure coral atoll with a land area of 9.8km², lying 9.00º S 158.00º W, and some 1365 – km northeast of Rarotonga. . It consists of two villages, Omoka and Te Tautua, located on either side of the lagoon.

Omoka is located on the western side, on the motu of Moananui and Te Tautua on the eastern side, on the motu of Pokerekere.

Characteristics of the island of Penrhyn*	
Type of island	Atoll Island
Location	9.00º S 158.00º W
Population	1966: 545 1971: 612 1976: 531 2011: 203
Distance from Rarotonga (km)	1365
Land area (km^2)	9.8 km²
Highest Point (m)	4 meters
Area used for Agriculture (acres)	Not obtained
Lagoon size (sq. km) and reef length (km)	Lagoon Size, 180km² 60 km

The island has a hospital on Omoka with a Nurse Practitioner and a Public Health Officer. There is also a clinic on Te Tautua whereby the nurse practitioner travels to the other village weekly or sometimes fortnightly. The people of Tongareva are reliant on rain water as the main source of water for drinking, cooking and bathing. The rainwater is captured and stored in household tanks and in community water tanks.

The power supply for Penrhyn is by the diesel generators. Each village has their own generator; Omoka with a 68 kW installed capacity and 48 kW for Te Tautua. The power is on daily for 18 hours. There are plans in place to introduce a solar PV Mini Grid for the whole island with battery storage and having a diesel generator as backup[1].

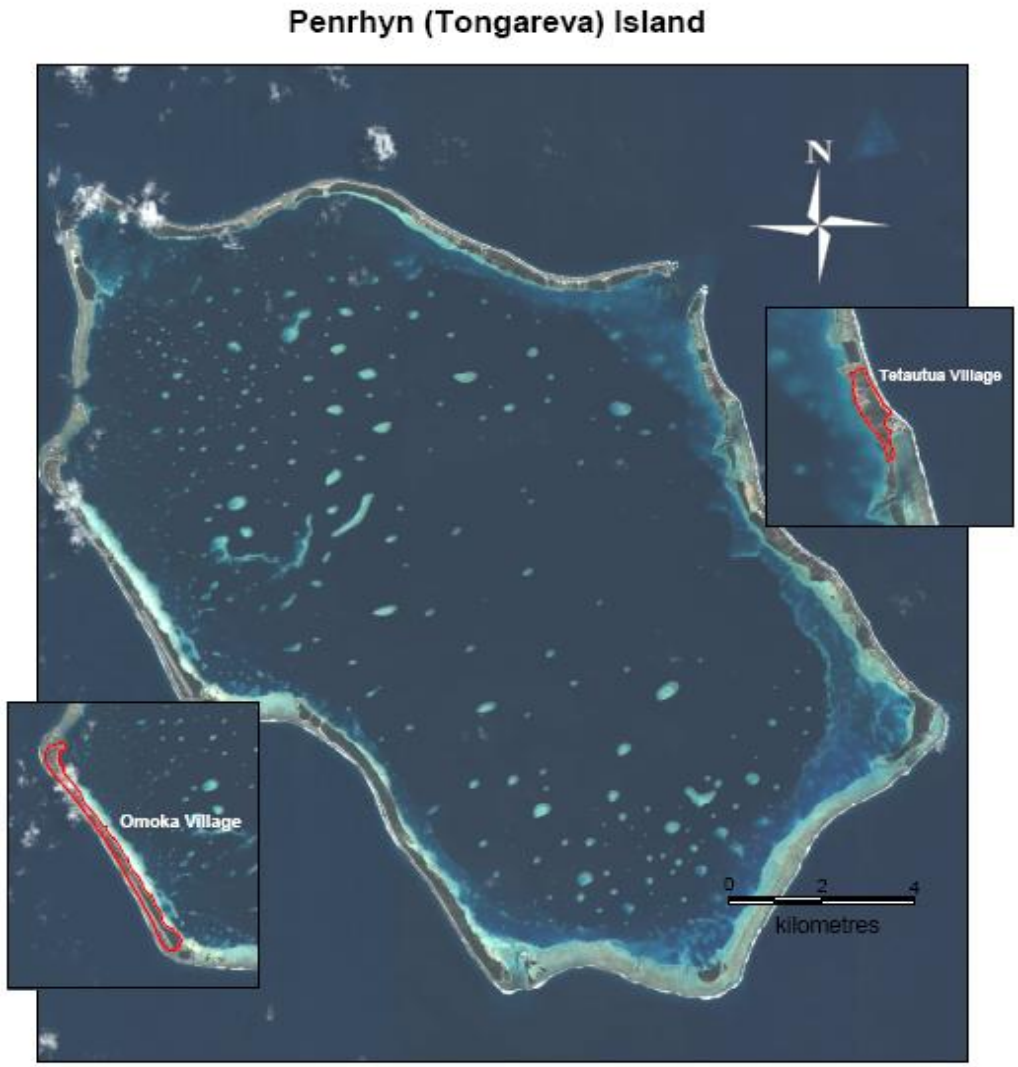
There are no regular scheduled flights to Tongareva. Air transport is provided by Air Rarotonga on a charter basis only which is extremely costly. Shipping to Penrhyn has a three to four month schedule interval.

Environment

Penrhyn like all other low lying atoll in the Northern Group Islands is thickly laden with coconut palm trees. Despite its narrow fledged outline, each and every islet is heavily over

[1] Government of the Cook Islands, 2012: Cook Islands Renewable Energy Chart Implementation Plan: Island Specific. pg 10

grown with wild native trees. Most of the islet is heavily populated by different types of birds. During the site visits, it was revealed that because of many of the islets disappearing, so is the number of birds.



Penrhyn has approximately 180 square kilometers of lagoon and is well known for its sharks that are treated by locals as the guardians for the lagoon. The visual presence of sharks in Penrhyn lagoon is much higher as compared to the lagoons in Manihiki and Rakahanga.

Penrhyn also has many oceanic species. Fishermen are always coming back with an abundance of different types of fish.

At the time of conducting this survey, Penrhyn Islands has not acceded to the Environment Act 2003. However during the awareness session, there was strong inclination towards introducing, enforcing and complying with Environment Act as many of the people sees the benefit of protecting and sustaining both land and sea ecosystems. Whether this eventuates remains to be seen.

The island does not have a proper waste management facility, although both villages have a dedicated dumpsite. Omoka dump is located near the airport and it consists of all types of waste from general household to e-waste, white ware and aluminum cans and glass bottles. Te Tautua dump is located outside of the village. There is a strong emphasis in retaining the pristine image of the island. Questions and queries were received from the audience during the workshop as to how to go about managing the disposal of waste.

Climate

In the Northern Group Islands, temperature is fairly constant throughout the year, while in the Southern Cook Islands there is a difference of around 4°C between the warmest and the coolest months. Annual maximum and minimum temperatures have increased in both Rarotonga and Penrhyn since 1950. These temperature increases are part of the global pattern of warming.

Penrhyn annual rainfall has increased data since 1950 show a clear increasing trend in annual rainfall in Penrhyn but no trend in seasonal rainfall. Climate trends assessed through recent work under the Pacific Climate Change Science Programme (PCCSP) 2011 indicates a cause for serious concern with increasing temperatures and rainfall, rising sea levels, and increases in the frequency, intensity and duration of extreme events. Here are some of the results[2]:

Conditions	Confidence Level			
	Very High	High	Moderate	Low
Surface air temperature and sea surface temperature are projected to continue to increase	√			
Annual and seasonal mean rainfall is projected to increase				√
The intensity and frequency of days of extreme heat are projected to increase	√			
The intensity and frequency of days of extreme rainfall are projected to increase		√		
The incidence of drought is projected to decrease			√	
Tropical cyclone numbers are projected to decline in the south-east Pacific Ocean basin (0–40ºS, 170ºE–130ºW)			√	
Ocean acidification is projected to continue	√			
Mean sea-level rise is projected to continue	√			

There is a weather station in Penrhyn manned by Warwick Latham whereby data is collected and sent to the Rarotonga Meteorological Service for storage and analysis.

The most recent climate related impact that occurred on the island was in 2010. The impact was caused by tropical depression 11F as it had not reached to even a category 1 cyclone. The lagoon side of Omoka was badly damaged from sea surge. Strong winds uplifted and caused damage to some buildings; high seas flooded coastal low lying areas up to 10 meters inland,

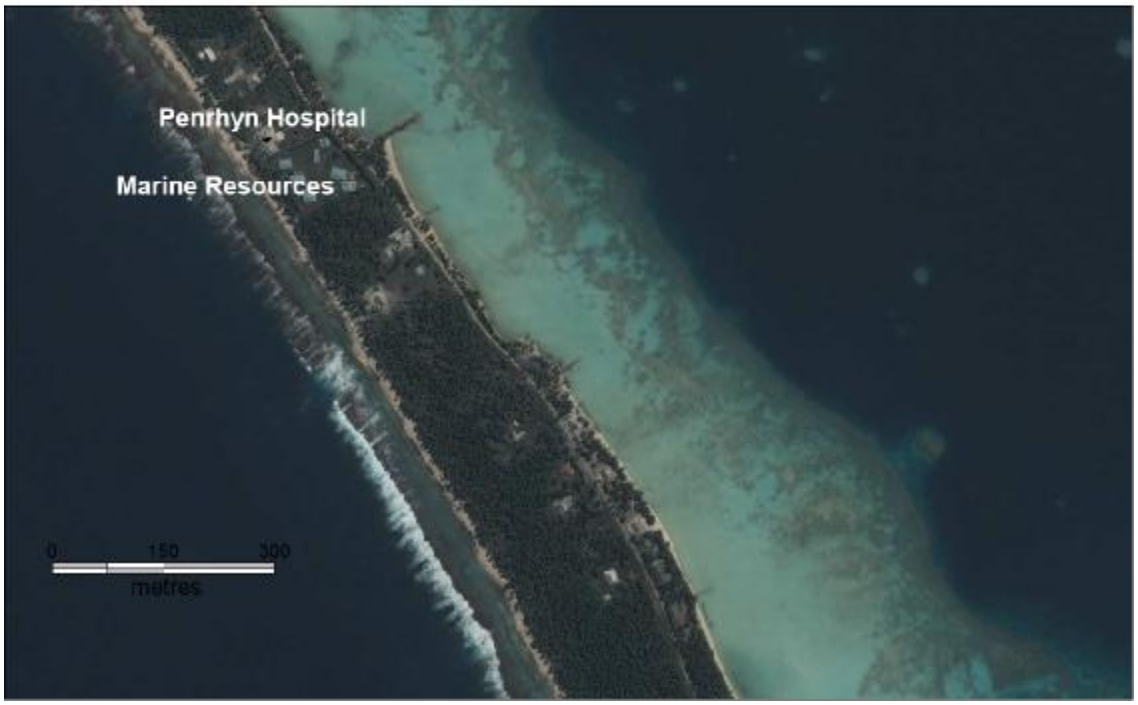
[2] Australian Bureau of Meteorology and CSIRO, 2011. *Climate Change in the Pacific; Scientific Assessment and New Research. Volume 2: Country Reports.*

damaging roads in some areas as well as the harbour. Heavy rain also contributed to the flooding of low lying areas. The communication between the villages was disrupted when the Te Tautua mast fell during the depression.

Figure 1: Omoka- Areas affected by tropical depression 11F on the village of Omoka in 2010

In 2011, the island of Penrhyn experienced severe drought when it went 4 months without rain, and was almost declared a state of emergency.

Penrhyn: Omoka Village

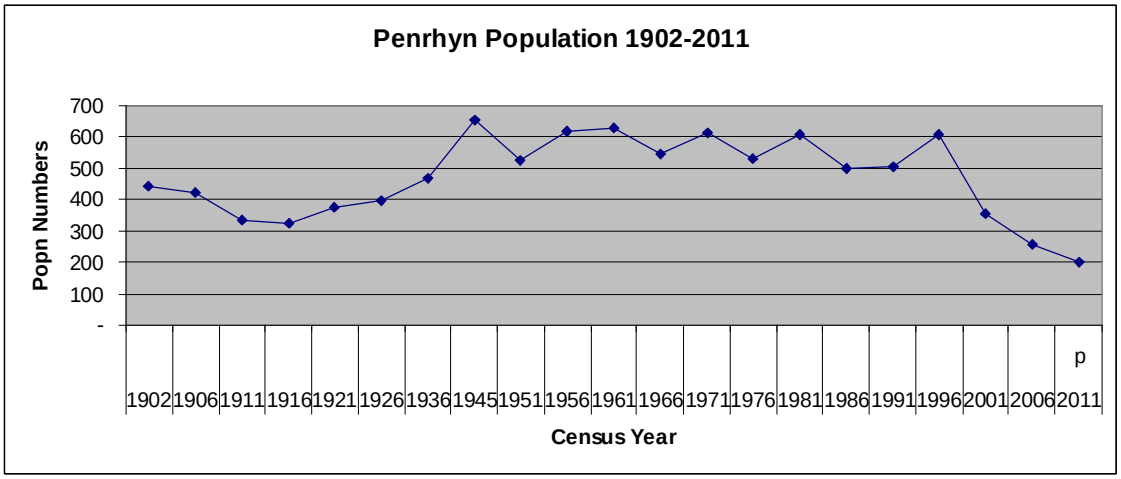


The location of the Penrhyn Hospital today is along the highest point of the island. This is around four meters above sea level.

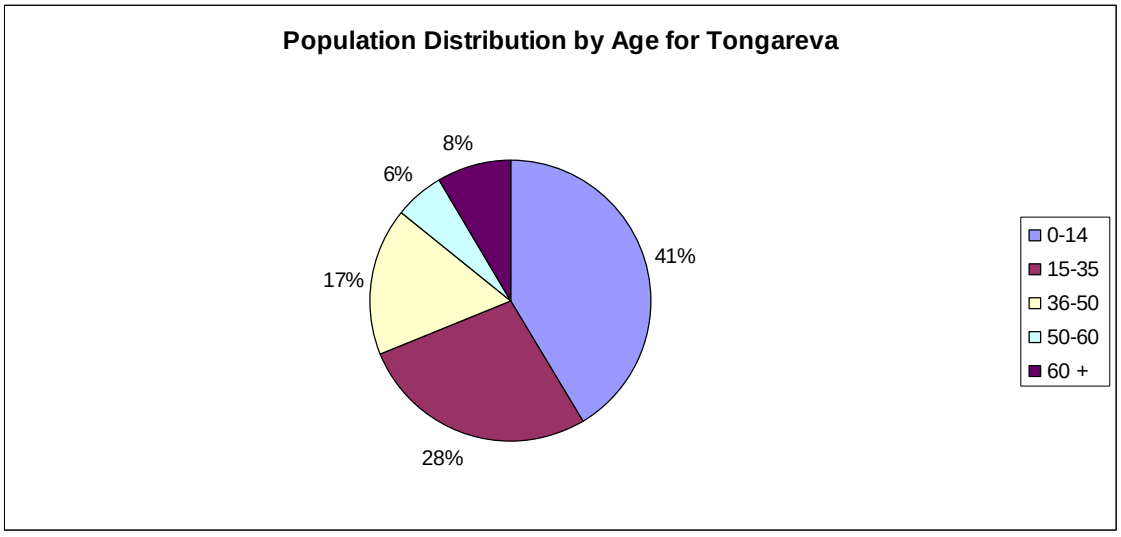
Social

Population

The household survey that was done by the team, a number of 53 occupied homes was surveyed. Total population was recorded at 213, with 94 females and 119 males.



The age distribution for the island from the 2011 Census[3] is that there are 119 male to 94 female.



Almost 70% of the population is from 0 to 35 years old. Forty one percent of the population is young school children.

History

Legends foretold by our *Tongareva* people highlighted the famous canoe full of voyages that traveled from Savaiki in the north-east in search of pandanus fruits, a known staple for atoll dwellers. On arrival on the island, they named it as Hararanga Island. (Literally meaning

[3] Government of the Cook Islands, 2012: Cook Islands 2011, Census of Population and Dwelling – Main Report

'abundant pandanus fruit') in remembrance of their achievement of their goal to find this fruit.

Captain Severn of the HMS Lady Penrhyn was the first European explorer to discover the island in August 1788. Christianity came to the island in 1854 where three teachers were stationed on the island by the London Missionary Society.

In 1862/63, the island was almost depopulated when Peruvian slavers took large numbers of the people to South America for cane farming. In 1944, during the Second World War, the US Army set up a base camp in Tongareva preparing to attack Japan. After two years on the island, they finally departed on 30th September 1946.

Following the war, copra production became a successful venture for the island. When copra no longer became popular, the Pearl industry became the next money making venture which picked up in the mid 90s. Today, people have moved on to explore other forms of money-making such as fishing and handicrafts.

Local Governance

With the recent amendment to the Local government Act passed in 2013, the Island Mayor now takes charge of the administration of the delivery of services by public servants. At the time of writing this report, the Office of the Prime Minister is in the process advertising the position of the Island Executive Officer (EO) who will now replace the Island Secretary. The EO will be directly responsible to the Island Mayor and Local Government who will be in charge of the island administration. Communication for disasters is from Rarotonga to the Island Administration and the contact point is the Mayor and its Island Councilors. They received warnings and messages from Rarotonga and make decisions there after during times of disaster especially cyclones. Some incidences the warnings are not received from capital and critical decisions needed to be made and the Mayor is in charge.

The Island also has a Member of Parliament who is currently based in Rarotonga and always visits the island as and when flights are available to travel to Penrhyn.

Economy

Marine Resources

Penrhyn has a very productive fisheries sector. There has always been discussion to use Penrhyn as a hub in the northern group for fishing ventures with a huge market potential in Rarotonga, New Zealand and even for the Asian Market.

In the mid 90s, there was a Marine Research Station built in Penrhyn funded by US Aid. Due to some difficulties, this Research Station was closed down and the premises remain dormant and currently used as accommodation for government officials visiting Penrhyn.

Pearls have previously been farmed on the island. The industry however collapsed, whether as a result of climate change, poor management or an onset of diseases on the pearl crops

could be the contributing factor. Administration, management issues and conflicts also contributed to the demise of the pearl industry.

Agriculture

Coconut remains the main agricultural product on the island. Given its multiple uses and benefits for each family, this crop is therefore will always be classified as the number one crop for the island. Other fruit trees such as breadfruit, lime, mangoes, pawpaws and bananas grow very well on the island.

Other fruit trees such as avocadoes, oranges and *Spondias dulcis* (vikavakava) are currently being trialed on the island to see if it will grow well.

Strangely, breadfruit trees and bananas are seen to be dying out. Whether the cause is due to climate change or simply because the breadfruit trees are getting old remains to be determined.

It was also surprising to learn that plants such as water melons, cucumber and pumpkin are the new plants that are starting to grow well on the island. Comments from the participants revealed that about 20 – 30 years ago, these plants would not even grow on the island.

The need to promote home gardening to provide a much more balanced diet is encouraged. Alternative methods of planting such as planting in plastic buckets and/or plastic bags including the erection of greenhouses to compliment planting were recommended. Ongoing supply of seedlings was requested by the community to be sent over to Penrhyn.

There is only one Agricultural Officer residing in Omoka. The Mayor requested for an extra Agricultural Officer for Te Tautua.

Handicraft

Women of Penrhyn are some of the most active and creative weavers in the Cook Islands. Product such as Rito Hats, hand held fans, mats and brooms are just some of their creations. The women are also experts in producing shell eis. The Rito hats produced by the women of Penrhyn are classed as one of top in the Cook Islands.

The sales of these products are some of the means of sourcing an income for the family and women of all ages for the island. Each hat can demand up to NZ$200 per hat which is a handsome reward for the women.

The use of natural white pearls (*pipi*) to adorn craft (which increases the value) is seen as another creative feature for the women of Penrhyn. The women of Penrhyn go into the sea to dive for these natural pearls on coral reefs for just this purpose.

Fishing

Fish in Penrhyn is a stable diet for its people. In June 2012, a workshop was held in New Caledonia where scientist predicted that by the year 2050, the northern group waters would

be very ideal for ocean fish especially skipjack and yellow fin tuna.[4] According to *Bell JD et al*, climate change is expected to add to the existing local threats of coral reefs in the Cook Islands, resulting in projected declines in percentage coral cover in both the medium and long term.

Local market

There is limited market capacity on Penrhyn however during our survey; handicrafts sent to families in Rarotonga resulted in little financial return for the families here in Penrhyn. Irregular flights and freight costs is also an issue that the people of Penrhyn have to endure. Flights to Penrhyn are only by chartering an Air Rarotonga plane and so there are no regular scheduled flights. Shipping is also irregular and so, families tend to make these handicrafts and store them for when there is available transportation to Rarotonga, by air or sea.

[4] Bell JD, Johnson JE, Ganchaud AS, Gehrke PC, Hobday AJ, Hoegh-Guldberg O, Le Borgne R, Lehodey P, Lough JM, Pickering T, Pratchett MS and Waycott M (2011) Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change: Summary for Pacific Island Copuntries and Territories. Secretariat of the Pacific Community, Noumea, New Caledonia.

PART TWO
Vulnerability Assessment

Vulnerability Assessment Methodology:

In compiling the data for this report, the following activities were undertaken.

1. Mini Workshop

In the Mini workshop, invites were extended to the Mayor, Island Council, Aronga Mana and Island Secretary. Present amongst the mini workshop was the MP for the Penrhyn Island. The Mini workshop was held on Wednesday 10th April 2013 in the Island Council Chamber commencing at 09:00am.

This workshop was mainly conducted and lead by Ms Mii Matamaki, Senior Environment Officer. She was ably supported by Mr. Mathew Rima and Mr. Olaf Rasmussen from the National Environment Services.

The purpose of the mini workshop was to:

a) Introduce the trip and the purpose of the Vulnerability and Adaptation Assessment;
b) Bring awareness to the people on Climate Change and its impact as well as Disaster Risk Reduction and the roles of the National Environment Services;
c) Compiling the data and results of the survey for preparing a report that would guide the planning for future climate proofing initiatives;
d) Exchanging views and experiences as well as lessons learnt in adapting to Climate Change.

During the workshop, sessions were opened to the leaders to make and share their own experiences pertaining to Climate Change and Disaster Management. Refer to the list of participants as attached.

Some of the responses given by the leaders are as follows:

IMPACT ON INCREASED TEMPERATURE

- Increase in temperature has resulted in clams dying out. This was experienced a couple of years ago;

- After returning back from Rarotonga, it's not good to sleep in the house and yet it is night time. It is better to sleep outside where there is more breeze;
- Question was asked: Can we challenge the big powers to stop whatever they are doing to stop the impact of green house impact?
- Even when the wind direction changes, the currents ends up taking the sand and dumping it in a different site, if the winds comes from the northern direction, it will take the sand straight into the ocean
- In the month of May and June we will have special times for marbled grouper (hapuku) to come inshore but today, it has been delayed 2 months later;
- *"God created earth as being balanced – there are no other causes of this chaos but by humankind. Today we see transfer of resources, soil and sand from one country to another – hence we see the imbalance. Land that has been exposed resulted in higher temperatures"*.
- In the past, we used to have seasons for fishing. Fish that comes by season is no longer happening. Would the bombing in our neighborhood countries – in French Polynesia - be a cause of these impacts? The question here, when it comes to the time of increased temperature, what is the help for the people on the island?

RECOMMENDATION:

- The increasing temperature perhaps there is a need to adapt to new times to work whether as public servants or even working at home;
- Working patterns has also affected our diet at home and at work. The lifestyle now has allowed people less physical activities – now people are getting bigger and more obese where non communicable diseases is becoming the norm;

IMPACT OF SEA LEVEL RISE

- High seas has resulted in coming further inland affecting the newly growing coconut trees and plants;
- Increase in sea level rise has resulted in many changes – 10 years ago, high seas always come once in a while, these days nearly 2 times a week we will have a sea surge. We are also seeing that one of the islets has vanished because of sea level rise (SLR).
- People of Penrhyn have relocated to Cairns or the Gold Coast in Australia for many reasons. Whether for health, economic or due to the impacts of climate change.
- SLR – what is the Government's assistance to SLR? Don't worry about cyclone and tsunami because SLR will affect us.
- In the past, there used to be a road across from the airport running along the coast but today, there is no longer any more roads at the airport.
- SLR – in the past, the normal high tide, it will reach 6 for the high tide but this year from February to March, it reached 8. This means that it has risen to 8 feet high. We had a local scientist Tony Utanga who came here. He concluded that the tide appears to be going forward; the high tide will even be higher. He recommended that the coast be built with high cement walls to protect sea surge or high seas coming onto the land;
- These issues raised have always been occurring. During the cyclone period, the island will experience inundation of sea on the road way. This is about 1 foot high. There was no warning from Rarotonga. Waves came along the wall at the church and along

the road. This is the first that we have come across such an experience; the picture below shows the impact that depression 11F had on Omoka Village in 2010.

- We are only 4 feet over the mean sea level.
- We should start thinking about building a Hurricane Center for us built with steel – not concrete but from steel.

RECOMMENDATION:

- Build a cyclone safety centre for each of the villages - climate proofed and reinforced with steel not concrete.
- Coastal protection for areas that are vulnerable

IMPACT ON FISHING

- There is a fish species called "tonu" whereby in the past we will always see it in the lagoon. About three years ago, it disappeared and the question is why? Is it climate change?
- There are five roto ava (fish ponds) but now it has disappeared. There is no sand that is currently sitting there to stop the fish going out. Is there any solution to stop the sand from going out? We have used rocks, coconut trees but the waves always come in and push it away;
- Before we have a fish species called "uru" who always travel in schools, but today, these are no longer experienced.
- Last year, lagoon was really dark at the bottom. Old people said that the coral rocks were giving birth. The coral rocks were releasing their eggs to increase its growth. This is always occurring but in this situation, it was delayed
- We have certain fish that cannot be eaten because of fish poisoning;
- There are holes in the lagoon whereby these are seen as the ventilating holes. These are all mapped out by MMR in a map
- Fish travel inshore using the shadow of the clouds and at special time of the day preferably late in the evening, any exposure to the sun will force the fish to instantly go back into the deep. This is similar to human nature where when it is hot, we tend to look for shady areas to rest;
- *Raui* proves to be a very good way of controlling the harvest of some of our resources namely the *paua* (clam). Protecting this resource and its habitat.

RECOMMENDATION:

- Changes in fishing methods based on the type of fish and season;
- Re-introduce coral fish traps in the lagoon – in the past, there used to be fishing traps but now it has disappeared;
- Revisit existing fish ponds (*roto ava*) to be monitored and preserved for fish nursery;
- There is adaptation in the types of fishing practiced by people today – for instance, the *raui* of *paua* is already adopted;
- There has been several attempts to introduce fishing ventures here in Penrhyn but did not sustain. What is really needed is the sustainability of these business activities to bring our people back on to the island.

IMPACT ON *AGRICULTURE*

- Before we have breadfruit in all households but now it has died out. This could be attributed to drought in 2011. Even chilly today has disappeared yet it used to grow well before. Lime nowadays struggle to grow here in Penrhyn;
- There used to be breadfruit that bares fruit all year round, now it is no longer bearing fruits all year around – it could also be that these breadfruit trees are very old – over 50 years old;
- When there is talk about food, Penrhyn people are okay because fish is in abundance. There is also an abundance of sea clams but these are seen to be food for turtles. There is however the need to regular ships to diversify the food supplies to lamb chops, chicken and beef;
- Nowadays, grass grows very well today. Before, there were not that many grasses as seen today.
- The mango trees on Penrhyn bare fruit all year. Yet there are breadfruit trees that are dying out. However some certain tree crops are doing very well. The landscape is now changing. The type of crops, vegetation and trees are now also changing.
- Coconut trees seem to be the only tree that will grow in any type of weather – whether it dry, wet, cold or hot. Perhaps concentrating on just plant young coconut trees along the coast and even along our home boundaries to provide shade and food security. Looking after the land for the future generation is vital. Be mindful that when seedlings are planted they should not be cut – leave them for coastal protection and for the generations to come for drink;
- Lesson learnt from trips to Rarotonga sees the planting of young *vikavakava* plants in a bucket. This is an alternative mean of planting where we can plant in buckets instead in the soil and also so land crabs do not eat the roots of the plants;
- The impact of drought for almost five months has resulted in all the bananas dying; this was experienced last year. The bananas are slowly regenerating and growing again on the island.

RECOMMENDATION

- Encourage coconut tree planting as coconut is one of the best crop to grow in Penrhyn; to plant young coconut plants along the coast;
- Home gardening should be encouraged and shades should be acquired to assist with the home gardening for each household;
- Hydroponics was approved for Penrhyn when Nga Mataio was secretary in Agriculture. We received ours when Papa Pupuke Robati was still PM. We pursued and received a second hydroponic system. An expert also told us that it is not an ideal model for Penrhyn. Hydroponics also requires high chemical and maintenance program. I was asked by the expert to taste organic planting versus hydroponic crops. It is not an ideal method for us to promote healthy leaving. The advice given to us is to run the plant in the water two weeks before eating it.
- Planting in *puru* is an alternative method for planting. Over here, home gardening is encouraged unlike what we have in Rarotonga and the southern group where planting is for commercial purposes. Soil from in the lagoon would be the most preferred soil for planting here in the homes. There was also a nursery planted here but never succeeded.

- Penrhyn people are not really planters but known fishermen – this is where their strength lies.
- Hats/Fans are occasional sent to Rarotonga when access to Rarotonga by airlines was frequent. Today, when access is limited, this has disrupted this form of economic activity;
- Each of the young men is to prepare and get ready 20 young coconut tree to be ready once the Island Council is ready, there will be a coconut replanting project;
- There is also a program to replant breadfruit tree to replace these old breadfruit growing here in Penrhyn.

IMPACT OF RAINFALL

- There is no accurate weather forecast coming for us. Forecast from Rarotonga says that there will be lightning but instead of lightning, we have showers;
- There is unpredictable weather patterns when we would least expect rain but then it rains;
- Even with our moon phases, we are told what are our calendar weather forecasts but instead of the phases of the moon for fish, we find that there is no fish or vice versa;
- At times, we have increased mosquitoes on the island. Perhaps we should get one of these smoke sprays to eradicate these mosquitoes.
- There was a recent water tank project won by Keta supplied by Arama and Associates. This was a bit of a shoddy work whereby had it been implemented by local labour, it would have been a much better job;
- Public Water Tanks are still sitting idle – what we would like is to seek reinforcing rods and lining for the inside to make use of these water tanks again;
- Can we access 60,000 liter bags/casing for spraying/inserting into these water tanks? - concrete/cement tanks could be a contributing factor some illness faced by the children;
- We would like to see an increase in water storage as water is one of the most important source for the island. The recent water tank of 6000 litre is too small. The one in Pukapuka of 45k liters would be ideal for us here in Penrhyn too;
- The community water tanks are old and should be upgraded whether by resealing it or by inserting a plastic water tank. Today, when people run out of water from using their 6000 liter home tanks, they would come and use these community water tanks;
- There is a lack of spouting in most of the households like this one belonging to the Government. So we should be looking at sourcing some more spouting to catch more water for storage.

RECOMMENDATION

- Increase water storage for homes;
- There was an AUSAID project whereby there was already boreholes done but no tank was installed. The boring of these water holes are completed. All it is now required is a pump and storage. So in the event that there is shortage of water, you can go with a water tank and get your water from this borehole. The next project would be to put in place a reticulation system where pipe would go straight in to the house for shower and cooking;
- The recent water project implemented by Keta was a huge failure. Government should not give any more contracts out to people of Rarotonga to come and build. Give the

work to the Local Government to build and implement. It was discovered that the Project Manager did not accompany Keta here to Penrhyn. It was also seen that these builders were not trained in plumbing and installation of water tanks;
- I have here the MoU and the list of households to be installed. We were forced to sign on to the Agreement.

IMPACT OF SEVERE WEATHER PATTERNS:
- Request for foreshore wall retention – either rock/cement, gabion process and or steel piling unfortunately there is no engineering report done on this proposal. This should be on the list of capital projects with MOIP;
- We are also considering in extending and developing the existing harbor as a Marina for yatchies. Perhaps we should start asking China to fund our harbours;
- We have a harbor reconstruction plan developed by Tenga Epi some years ago – this should be followed up, revived and implemented;
- We always see towards tree trimming as an exercise toward preparation for disaster season – please see if we can acquire 4 chain saw for tree trimming;

RECOMMENDATION
- Conduct a feasibility study on the appropriate coastal protection for the island of Penrhyn;
- The harbor project has been highlighted as one of the priority infrastructure projects in Penrhyn's Business Plan 13/14. The Harbour project is very important as it would be a hub for the Northern group;
- The rock wall currently existing now is really needed to be upgraded and used as a marina to berth yatchies. During cyclone periods, yatchies would come and berth here until the cyclones passes. This is another type of revenue that would come to the Island Administration. Conduct a feasibility study for the needed to look at the demand by the visitors and the possibility of having a marina built in Penrhyn.

The exercise went through the event and outcomes risk related to climate change and disaster risk assessment. Please find the list of priorities as set out under the ***Recommended Policy Actions.***

2. Public Awareness;

The public awareness for Omoka was held on Tuesday night 10th April 2013 at 7pm in the Community Hall. It was well attended by the whole of Penrhyn community where again Ms Mii Matamaki was able to make a presentation on defining what Climate Change is. Questions and answers were opened to the public. The public awareness for Te Tautua was held on Friday afternoon at the Sunday school hall. This was also well attended.

Most of the comments have been added and included in those as listed above.

The public meeting was ended with a closing prayer and refreshment was provided for all that attended.

3. Household Survey

The household survey was conducted by the team. The survey revealed some interesting and gripping lessons learnt and even traditional methods of preserving food, coastal land retention and the switch from traditional crops such as breadfruit, atoll taro (*puraka*) and banana. Today the new lifestyle crop encouraged and experienced are the pumpkins, watermelon, cucumber and mangoes. These new crops experienced were never known to be grown in the past.

The survey also revealed certain aspects of changes impacted by changing patterns of climate change has provided an ideal weather for these new crops to grow.

There were a total of 53 households interviewed with 13 in Te Tautua with total population of 52 and 40 households in Omoka with a total population of 157.

Risks and Vulnerabilities –
Climate Change and Disaster Risk Assessment

Step 1 - Summarize the Risks – With reference to each of the relevant climate change and disaster risk reports, (and other relevant documents collected during the stocktaking), the Climate Change Adaptation and Disaster Risk Penrhyn Community Leaders will summarize the nature of the risks from climate change and natural disasters to the relevant sector. The initial step is to identify ***event risk*** (i.e. the "risk of occurrence of any particular hazard or extreme event" for example flood, drought, increased hurricane intensity) and ***outcome risk*** (i.e. "the risk of a particular outcome" for example loss of life, loss of income, loss of property, increase in pests/disease, increase in water/vector borne disease).

Table 1: Event Outcome Risks (Source: Cook Islands *Second National Communication* and *Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation* (CI JNAP DRM CCA)*)*

Event Risk	Outcome Risk NOTE: Following outcome risks listed in SNC and JNAP DRM CCA
Climate Change	
1. *Sea level rise and storm surge-* Ø A rise in sea level of 1 meter by 2100 Ø Increase in storm surge events inundating up to 4.5 meters above mean sea level.	1. *Damage to coastal infrastructure – airport/harbor/road, community water tanks and fuel depots;* 2. *Loss of (access) to fishing areas due to sea level rise* 3. *Degradation of coastal habitat and biodiversity including fish nursery* 4. *Increased incidents of coastal erosion of what little beach Penrhyn has – Loss of coastal land – note: this could also be a human influence from sand mining;* 5. *Increased incidents of coastal flooding and inundation from sea surge and high seas;* 6. Increased salinity of freshwater table – leading salt water

	intrusion 7. Impacts on traditional livelihood and culture 8. Impact on economy and loss of investments especially on coastal infrastructures
2. *Changes/variations and increase in local and national temperatures regimes* Ø increase of between 1.5 and 3.5 degrees, more hot days and warm nights particularly in Southern Group	1. *Heat stress impacting productivity as people will not be able to work during very hot temperature;* 2. *Increasing energy demand (for cooling and refrigeration).* 3. *Changes in migration and breeding patterns for birds and fish, especially tuna.* 4. *Impact on agricultural productivity and food security – fruit plants may not be viable as the heat is overwhelming;* 5. *Normal fruiting/fishing seasons will be changed* 6. *Increased incidents of coral bleaching* 7. *Wind and current patterns will be affected.* 8. During drought period, bore ground water is used for sanitation purposes; 9. Increased prevalence of invasive species (productivity, species distribution or migration) 10. Impact on ecosystems (marine, terrestrial and aquatic) 11. Impact on food – will rot quickly due to the heat causing further problems to the health of people 12. Impacts on marine and terrestrial biodiversity - migratory and distribution changes 13. Impact on vector borne disease (water quantity, demand, quality) Increase in diarrhea related illness especially for babies. 14. Emergence of tropical diseases 15. Bacteria breeds in hot conditions and this will worsen 16. Possible cold snaps in summer to increase illness for instant changes in the weather 17. Increase in vector borne diseases 18. Bacteria increase will lead to new and severe diseases. 19. Wind direction change will spread air borne viruses and bacterial and amplify diseases. 20. When temperature is cooler, mosquitoes will fly slower, if warmer they fly further. 21. Pollination will be affected e.g. coconut flowers
3. *Changes in rainfall patterns -* Ø an increase in precipitation especially during the wet season in Southern group Ø Incidents of extreme rainfall are likely to occur more often and be more intense.	1. *The availability of water in general for drinking and bathing* 2. *Increased prevalence of invasive species – te mauku* 3. Blockage and damage to water infrastructure (tanks) and drainage 4. Increased runoff, sedimentation, & salinity affecting water quality and availability – pot holes and muddy roads making access difficult 5. Increased incidents of flooding causing damage to roads 6. Impact on aquatic ecosystems 7. Increased incidents of crop diseases affecting food security

	– the livelihoods of pigs 8. Impact on human health from water and vector borne diseases 9. Reduced tourism attractiveness, and economic losses from productive sectors, food insecurity, natural resources for handicrafts etc
4. *Increased climate variability –* Ø Changes in seasonal temperatures, timing of rainfall,	*1. Impact on agricultural productivity and food security – pawpaw, mangos and avocados: seasonal changes and also its quality is not as good as it used to be.* *2. Impact on terrestrial and marine biodiversity (pollinators-bees etc, migratory species, growing cycle, food chain)* 3. Impacts on tourist arrivals and duration of stay??
5. *More severe weather events* (droughts, rainstorms, heat waves, and category 4/5 cyclones) - Ø Increase in frequency, intensity and duration of extreme events (floods, droughts and storm surges) Ø Increase in intensity of cyclones (i.e. more category 4 and 5 cyclones) in annual average of 1.6 cyclones in the Southern group, and annual average of 6 cyclones in the Northern group Ø Increase in wind intensities between 5-10% by 2050	*1. Increased incidents of damage to infrastructure – harbour/wharf* *2. Impact on water quality/quantity and availability (storage)* *3. Loss and damage to agricultural infrastructure and crops affecting food security/falling trees e.g. coconut* *4. Increased incidents of loss and damage to ships and fishing boats* *5. Impact on coastal ecosystems (wave damage, erosion)* *6. Increased costs for recovery, impact on economy and reduced ability to attract foreign investment* 7. Increased incidents of water pollution and damage to water infrastructure 8. Increased incidents of loss of human life and injuries 9. Increased damage to terrestrial and aquatic biodiversity 10. Increased incidents of water and vector borne diseases 11. Stress and social disruption – family members leave for income earning activities, stress on family members 12. Disruption of education and social services, affecting already vulnerable groups like disabled, youth, and women 13. Increase incidence of fire due to droughts and loss of vegetation after cyclones 14. Cumulative impacts on health service delivery 15. Increase internal migration 16. Increase cost and service delivery 17. Increase dispersal of invasive species 18. Increase demand on emergency shelters 19. Impacts on livelihoods, culture and way of life 20. Increase demand for desalinization plants
6. Increased incidents of ocean acidification	*1. Impact on coral growth and fish nurseries – paua/kaoa* 2. Impact on marine biodiversity and resources including migration of fishery resources
7. Increased levels of Green House Gases (GHGs)	*1. Impacts on human health: respiratory/asthma NOTE: some of the drugs have reached its used by dates, expired..etc* 2. Increased incidents of ocean acidification

Disasters	
8. *Hazardous substances spillage* (oil and petroleum products) There is a possibility due to the fuel depot storage on the harbour for the Kukupa boat.	1. Long term impacts on terrestrial and marine biodiversity, food security 2. Impacts on tourist arrivals and attractiveness of tourism product
9. *Bush Fire*	1. *Loss of and damage to property and livestock – coconut crab (kaveu)* 2. Loss of life and injury 3. Impact on terrestrial biodiversity 4. - Impact on human health (increase in respiratory illness and stress)
10. *Epidemics* (Dengue fever, cholera)	1. *Impacts on health service delivery – doctors and nurses may become patients as well/not enough medicine* 2. Impacts on productivity – people cannot work as they have fallen ill 3. Loss of life
11. *Geo-physical hazards* (tsunamis)	1. Loss of life and injury 2. Loss of and damage to property and livestock 3. Impact on terrestrial and marine biodiversity 4. Impact on human health (increase in respiratory illness and stress) 5. Impact on economy

The priority Outcome Risks are in *ITALICS* and List Priority Outcome Risks Identified by Penrhyn Community Leaders:

Step 2 – Estimate Risks **-** Using the summary of risks to the relevant sector developed under *Step 2*, the Penrhyn Community Leaders undertook an estimation of the following key elements of risks:

Estimate of the ***Severity of the Impact (Event and Outcome Risks)***

- In the context of climate change adaptation, the Penrhyn Community Leaders could choose to include non-financial criteria such as the loss of life, effect on GDP, impact on social capital and quality of basic services, environmental impacts or any other relevant measure that is suited to best expressing the potential impacts in measurable terms.
- The Penrhyn Community Leaders developed an impact severity rating scale appropriate to the risk scenarios (***event*** and ***outcome***).

TABLE 2 a: Direct Impact Rating Matrix

Event ***Sea level rise and storm surge-***
Outcome *Damage to coastal infrastructure* (roads, airport, harbors, fuel depots, community water tanks) 7/11

Impact / *Severity*	Social			Economic				Environmental			
	Displacement	Health	Cultural aspects	Loss of livelihood	Property loss (house/land	Financial loss (crop	GDP loss ??	Air	Water	Land	Biodiversity / ecosystem
Very low											
Low		X						X			
Moderate			X								X
High	X									X	
Very high				X	X	X	X		X		

The following are the top 26 priority risk that was identified by the Community Leaders. The ratings for the "high" and "very high" occurrence of severity were recorded for the purpose of determining areas of high impact.

Number	Outcome Risk	Social	Economic	Environmental
1	*Damage to coastal infrastructure – airport/harbor/road, community water tanks and fuel depots;*	1	4	2
2	*Loss of (access) to fishing areas due to sea level rise;*	1	2	2
3	*Degradation of coastal habitat and biodiversity including fish nursery;*	1	2	2
4	*Increased incidents of coastal erosion of what little beach Penrhyn has – Loss of coastal land – note: this could also be a human influence from sand mining;*	1	2	2
5	*Increased incidents of coastal flooding and inundation from sea surge and high seas;*	2	2	3
6	*Heat stress impacting productivity as people will not be able to work during very hot temperature;*	2	3	1
7	*Increasing energy demand (for cooling and refrigeration).*	1	2	0
8	*Changes in migration and breeding patterns for birds and fish, especially tuna.*	0	3	1
9	*Impact on agricultural productivity and food security – fruit plants may not be viable as the heat is*	1	1	2

	overwhelming;			
10	*Normal fruiting/fishing seasons will be changed*	1	1	1
11	*Increased incidents of coral bleaching*	1	1	1
12	*Wind and current patterns will be affected.*	1	2	2
13	*The availability of water in general for drinking and bathing*	2	1	2
14	*Increased prevalence of invasive species – te mauku*	1	1	3
15	*Impact on agricultural productivity and food security – pawpaw, mangos and avocados: seasonal changes and also its quality is not as good as it used to be.*	2	0	2
16	*Impact on terrestrial and marine biodiversity (pollinators-bees etc, migratory species, growing cycle, food chain)*	1	0	2
17	*Increased incidents of damage to infrastructure – harbour/wharf*	2	3	1
18	*Impact on water quality/quantity and availability (storage)*	2	2	2
19	*Loss and damage to agricultural infrastructure and crops affecting food security/falling trees e.g. coconut*	2	2	2
20	*Increased incidents of loss and damage to ships and fishing boats*	1	2	1
21	*Impact on coastal ecosystems (wave damage, erosion)*	2	2	2
22	*Increased costs for recovery, impact on economy and reduced ability to attract foreign investment*	2	3	0
23	*Impact on coral growth and fish nurseries – paua/kaoa*	2	1	2
24	*Impacts on human health: respiratory/asthma NOTE: some of the drugs have reached its used by dates, expired..etc*	2	0	2
25	*Loss of and damage to property and livestock - kaveu*	1	1	2
26	*Impacts on health service delivery – doctors and nurses may become patients as well/not enough medicine*	1	1	1

Step 3 - Estimate Frequency or Probability of Event

The Penrhyn Community Leaders estimate the frequency or probability of an event identified in the relevant reports based on their expert judgement.

TABLE 4: Frequency/Probability Rating (based on climate change risks that are likely to occur during the next 5 years)

Climate Change Risk	Very Unlikely to Happen 1	Occasional Occurrence 2	Moderate Frequent 3	Likely to Occur Often 4	Likely to Occur Regularly 5
CC risks from risk scenario – *Step 2* (deal with each separately)	Not likely to occur during next 5yr period	May occur sometime but not during next 5 yr period	Likely to occur at least once during next 5yr period	Likely to occur several times during next 5 yr period	Happened often and will happen again during next 5yr period

Once the top 26 priority risks were identified by the community leaders, the frequency and probability rating was then indentified. Below are the results from the leaders.

Event + Outcome Risk	Frequency/Probability Rating
Sea level rise and storm surge + Damage to coastal infrastructure – airport/harbor/road, community water tanks and fuel depots;	4
Sea level rise and storm surge + Loss of (access) to fishing areas due to sea level rise;	4
Sea level rise and storm surge + Degradation of coastal habitat and biodiversity including fish nursery;	5
Sea level rise and storm surge + Increased incidents of coastal erosion of what little beach Penrhyn has – Loss of coastal land – note: this could also be a human influence from sand mining;	5
Sea level rise and storm surge + Increased incidents of coastal flooding and inundation from sea surge and high seas;	4
Changes/variations and increase in local and national temperatures regimes + Heat stress impacting productivity as people will not be able to work during very hot temperature;	5
Changes/variations and increase in local and national temperatures regimes + Increasing energy demand (for cooling and refrigeration).	4
Changes/variations and increase in local and national temperatures regimes + Changes in migration and breeding patterns for birds and fish, especially tuna.	3
Changes/variations and increase in local and national temperatures regimes + Impact on agricultural productivity and food security – fruit plants may not be viable as the heat is overwhelming;	3

Changes/variations and increase in local and national temperatures regimes + Normal fruiting/fishing seasons will be changed	3
Changes/variations and increase in local and national temperatures regimes + Increased incidents of coral bleaching	2
Changes/variations and increase in local and national temperatures regimes + Wind and current patterns will be affected.	3
Changes in rainfall patterns + The availability of water in general for drinking and bathing	5
Changes in rainfall patterns + Increased prevalence of invasive species – te mauku	3
Increased climate variability + Impact on agricultural productivity and food security – pawpaw, mangos and avocados: seasonal changes and also its quality is not as good as it used to be.	3
Increased climate variability + Impact on terrestrial and marine biodiversity (pollinators-bees etc, migratory species, growing cycle, food chain)	3
More severe weather events + Increased incidents of damage to infrastructure – harbour/wharf	3
More severe weather events + Impact on water quality/quantity and availability (storage)	5
More severe weather events + Loss and damage to agricultural infrastructure and crops affecting food security/falling trees e.g. coconut	4
More severe weather events + Increased incidents of loss and damage to ships and fishing boats	4
More severe weather events + Impact on coastal ecosystems (wave damage, erosion)	4
More severe weather events + Increased costs for recovery, impact on economy and reduced ability to attract foreign investment	3
Increased incidents of ocean acidification + Impact on coral growth and fish nurseries – paua/kaoa	3
Increased levels of Green House Gases (GHGs) + Impacts on human health: respiratory/asthma NOTE: some of the drugs have reached its used by dates, expired..etc	1
Bush Fire + Loss of and damage to property and livestock – kaveu	2
Epidemics + Impacts on health service delivery – doctors and nurses may become patients as	2

well/not enough medicine	

Evaluate the Risk **-** Based on expert judgement, identified risks were examined by the Penrhyn Community Leaders in terms of costs (, benefits and acceptability, considering the needs, issues and concerns of stakeholders. The purpose of this evaluation was to give consideration to:

- Ø ranking the risks from "least severe" to "most severe" from the analyses completed earlier and the perceptions of the stakeholders – see *Table 5* and *Table 6*;
- Ø estimating the costs of potential losses;
- Ø Assessing the acceptability of the risks.

- The Penrhyn Community Leaders ***compared levels of risk and acceptability of risk scenarios*** by reviewing the data that has been recorded during the risk estimation process.

Step 4 – Identify Priority Risks and Vulnerable Communities - based on the outcomes from step 1-3 above the Penrhyn Community Leaders identified the top ten priority risks, and identified the whole island as vulnerable as the island is very small to separate different communities.

Event + Outcome Risk	Three Most Vulnerable | Communities - areas
•	
•	

For the purpose of this exercise, the leaders felt that the whole island would be vulnerable and not specific areas as required to be undertaken under Step 4. The other islets surrounding the lagoon would also be vulnerable and so this part of the process was agreed upon unanimously.

Step 5 – Identify possible intervention options to address priority risks

Once it was confirmed that the whole island was at risk, the methodology moved on to look at some adaptation options. The options are further elaborated in part three of this report.

PART THREE
Community Adaptation Plan

POSSIBLE INTERVENTIONS - ENVIRONMENT	
Establish governance structure for National Environment Services on Penrhyn Island	1. Promote and enable Local Government to accede to the Environment Act; 2. Establish an Island Environment Authority to develop policies, coordinate and monitor activities on the island; 3. Appoint and train an Environment Officer to ensure compliance with Environment Act and any by-law pertaining to conservation and preservation of native plants and endangered species;
Promote and enhance a healthy coastal ecosystem and lagoon	1. Strengthen and build upon the 'raui' system already established and maintain community awareness on such practice; 2. Minimize degradation of coastal habitat thru tree planting – coconut trees, *ngangie*, *tamanu* trees; 3. revive some of the traditional fishing methods such as the reestablishment of the 'pa' (fish traps made from stacked coral stones) 4. Promote and encourage minimal sand mining only for personal use, not for industrial purposes.
Increased prevalence of invasive species –	1. Ensure control of invasive species such as *te mauku* (grass) In the past, it was very rare to see '*mauku*' growing whereas today, grass has now become a nuisance.
POSSIBLE INTERVENTION FOR – INFRASTRUCTURE	
Ensure future developments and or upgrades critical infrastructure harbor, wharf, communication, airport, government buildings and other essential services are climate proofed.	1. Give priority to the Omoka Harbour to ensure that it can withstand category 4 – 5 cyclones; 2. To build steel pilings and concrete for Tetautua Harbour; 3. To install pilings along the coast of Omoka from the CICC Pastor House to Omoka School; 4. To relocate and install a proper fuel depot to service Te Kukupa and other vessels; 5. To build a cyclone shelter for both Omoka and Tetautua Village; 6. Introduction of gabion to be used as coastal protection method;

To install and promote energy security and efficiency for the Island	1. To fast track the renewable energy program - solar/wind turbine – to reduce cost of energy on the island; 2. Ensure that the power capacity will be able to take on extra energy demand goods such as fridges/washing machines/air cons 3. Promote and introduce efficient electrical appliances such as 5 star fridges/freezers, fans, air conditioner, kettles and ovens
Ensure that there is adequate water storage within the homes and community that is suitable for drinking and cooking.	1. increase water storage capacity within homes to at least 15 000 litres per household by 2015; 2. Upgrade/maintain existing community cement tanks; 3. Capitalize and maintain water storage in vacant homes for reserves; 4. Install overhead tanks for gravity feed to reduce energy usage; 5. Encourage separation of water storage for shower and toilet/cooking/agriculture; 6. Promote and continue water conservation methods
POSSIBLE INTERVENTION FOR - AGRICULTURE	
Heat stress impacting productivity as people will not be able to work well under very hot condition	1. Possible change in working hours, break during peak 'hot' hours 2. Increase in cooling systems 3. Safety equipments/rehydrating needs etc
Impact on agricultural productivity and food security – pawpaw, mangos and avocado, breadfruit: seasonal changes and also its quality is not as good as it used to be. Loss and damage to agricultural infrastructure and crops affecting food security/falling trees e.g. coconut	1. Encourage coconut tree planting as coconut is one of the best crop to grow for on the islands despite any weather whether it is dry or wet, hot or cold. At the time of the survey, the Mayor has instructed that each and every youth should start preparing and growing 20 young coconut plants to plant along the coast; 2. Introduce and encourage all year round crops that are suitable for Penrhyn 3. Encourage replanting of breadfruit and Pacific Mahogany trees to replace old/dead trees; *4.* Introduce new plants that are tolerant to heat, salt water and sandy environment; 5. *Promote and enhance food preservations methods such as dry fish, fish jerky,* 6. Supply seeds to Penrhyn for the

	Agriculture Officer to propagate and supply to households to promote home gardening; 7. Introduce and promote organic growing on the island 8. Reintroduce and promote Hydroponic planting. Hydroponics requires high chemical and maintenance program. 9. Promote ongoing alternative agricultural program such as planting in buckets, in black plastic bags or other means such as using coconut husks; 10. Home gardening should be encouraged and shades should be acquired to assist with the home gardening for each household; 11. There is also a program to replant breadfruit tree to replace these old breadfruit growing here in Penrhyn.
POSSIBLE INTERVENTION FOR MARINE	
Promote sustainable fishing methods for both coastal, lagoon and ocean.	1. Consider the use of a barge and excavator to refill fishing areas that have been eroded or affected; 2. Changes in fishing methods based on the type of fish and season; 3. Re-introduce coral fish traps in the lagoon – in the past, there used to be fishing traps but now it has disappeared; 4. Revisit existing lakes (roto ava) to be monitored and preserved for fish nursery; 5. There is adaptation in the types of fishing practiced by people today – for instance, the raui of paua is already adopted; 6. There has been several attempts to introduce fishing ventures here in Penrhyn but did not sustain. What is really needed is the sustainability of these business activities to bring our people back on to the island. 7. Promote planting of coconut, toa, ngangie as means of delaying to onset of coastal erosion;
POSSIBLE INTERVENTION FOR DISASTER MANAGEMENT	
Strengthen Disaster Management and Response to minimize impact on the people of Penrhyn	1. Improve early warning system and weather forecasting; 2. Build a dedicated Cyclone Shelter (refer

	to point 5 in the Infrastructure Sector) 3. Establish the Emergency Operation Center to coordinate response and maintain communication with National Emergency Operation Center in Rarotonga; 4. Put in place an effective response plan for drought situations; 5. Ensure on going disaster training to test Disaster Plan and maintain awareness.

Conclusion and Recommendations

It is apparent that the people of Penrhyn are well aware of the climatic changes that are happening around them.

The leadership shown by the island during the visit revealed that the island can deliver on activities to build up its own resilience. During the mini workshop, the Mayor announced that the men on the island are to plant at least twenty coconut trees each to replace some of the old trees and act as a control to coastal erosion.

Several other adaptation initiatives were highlighted both from the workshop and meetings conducted. The issue of increased water storage for personal consumption was one of the key priorities. The ability for the island to respond and take preventative measures to cope with extreme events including cyclones and droughts were also raised and discussed.

The survey has enabled the team to collect, collate and store data for GIS purposes to make better informed decisions. These data will be shared and distributed amongst key governmental and other stakeholders for their use and contribution towards Penrhyn Island's development.

The team realizes that the cost of inaction will double or even treble when the impact occurs. The need for a collective approach to realize the initiatives highlighted within this VnA Report whether at the regional, national and community level must be advanced in a more coordinated and cohesive manner.

There must be ongoing review and monitoring of where we have progressed in the next five years. A stock take of where we have been in the last 10 years to learn from our past must be done to enable us to plan ahead for the next 10 years to sustain our livelihood and become more resilient.

APPENDIX

1. Copy of the survey form;

Penrhyn Vulnerability and Adaptation Assessment
In Association with
Cook Islands Red Cross Society and the Office of the Prime Minister

Questionnaire completed by: ……..Island.....

Date: ___/___/2013__ Power Connection: _____

Household Questions

A. Ingoa; Name of Informant(s): _____ Contact Number:
   i. Landline: _____
   ii. Mobile: _____
   iii. Email: _____

B. Tare Numero Tangata; Number of Occupants _____

C. Household data:

Name	Gender (M, F)	Age	Relationship Ex: father/mother/daughter/grand child	Occupation	Special Needs

D. How many years have you lived on this island? _____ Years Whole Life ☐

Questions about Climate Change

E. Do you understand enough about Climate Change

Fully understand ☐ Just enough ☐ Not Much ☐ Don't Understand ☐

F. Please list what you think how Climate Change going to impact your Island

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G. Have you made any changes to adapt or cope with Climate Changes you are experiencing.

Questions about Imported Foods

H. What are your main Imported food

_____

_____

I. What are your main Island food

_____

_____

J. Rate Your Food Intake Imported Food [%] Island Food [%]

K. Have you ever had a food shortage? Fill in the table below the required data for the most recent food shortages

Caused by	Length of shortage	Date	Action taken to cope with Shortage
Shipping Delay			
Rough seas for fishing			
Crops Destroyed			

L. How do you preserve your Food.

Food Preservation	Y/N	Remarks
Refrigerator		
Freezer		
Imported Dried/Canned		N/A
Local Preserved		N/A
Sealed Containers		N/A

Questions about Food Preparation

Main Cooking Fuel	%	Remarks
Firewood		
Gas		
Electric		
Other		

Questions about Marine Resources

M. Where do you do your fishing? Lagoon □ Reef □ Over the reef/Ocean □

N. Have you noticed any change in the amount of fish catch in the last ten years?

Increased Catch [ ] Drop in some Species [ ] Drop Catch [ ] Decreasing Catch [ ]

O. "Fishing Arapo" have you noticed any changes in the last 15 years Yes [ ] No [ ]

P. What changes have you noticed with your pearl farm that maybe due to climate change?

_____

_____

Questions about Water Supply

Q. Major source of Drinking Water

Community Tank Only	Own Water Catchment. Tank	Own and Community Tank	Bottled Water	Well/ Borehole	Springs

R. Do you have a water tank(s)? Yes □ No□ How many water tanks do you have? ___

S. If yes, what material is it made from

Plastic	Metal	Concrete	Other

T. How big is it (in litres)? _____

U. Is your roof suitable for catching rain? Yes □ No □

V. If yes, how extensive is the guttering to catch the rain?

1. *All around the house* □
2. *Half of the house* □
3. *A single spout (guttering-piece)* □
4. Pump from tank to house □

W. What actions do you take to cope with water shortages?

_____

_____

X. Do you reuse any water e.g. from washing machine, shower, cooking, dish washing etc?

Yes □ No □

Y. If yes, what do you use this water for? _____

Questions about Energy Use

Z. Appliances that are being used by the household

Appliance	Tick	Number	How often do you use your appliances
Wash machine			
Radio			
Electric Jug			
Electric Pan			
Compressor			
Fridge			
Freezer			

Questions about Transport and Machinery

AA. Transport and machinery used by the household

Tick	Tick	Number	How often do you use your Vehicle
Motorbike			
Boat			
Vaka			
Tractor			
Outboard motors			
Generator			
Battery Charger			
Mower			
Grass cutter			
Chainsaw			

Questions about Waste

BB. What type of toilet (s) do you have

Type	How many	Location In/out
Pour flush		
Flush		

CC. How do you dispose your rubbish?

Waste Disposal	%
Hole	
Collected	
Open Burning	
Other	

Questions about Climate and Vegetation

DD. What changes have you noticed within your surrounding environment over time?

Yes ☐ No ☐

EE. What do you think caused these changes?

_____

_____

FF. Have you noticed any changes to the vegetation over time? Yes ☐ No ☐

If yes, is it more vegetated now than 10 or 20 years back? _____

Questions about Shoreline Changes

GG. Have you seen any shoreline changes over time?

Yes ☐ No ☐

HH. What do you think caused the changes over time that you have seen?

……
……
……
……

II. Have you noticed any changes to your livelihood after changes to the shoreline?

What have been these changes? Kua taui ainei toou oraanga ngutuare no tei taui te turanga o te tapataa tai?

……
……
……
……
……

Recommendations for community action? Tetai uatu manako

2. List of participants –

NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

COOK ISLANDS RED CROSS SOCIETY

Penrhyn ISLAND RISK ASSESSMENT ON Weds 10th April (date)

Participants at the mini-workshop held on the Island of Penrhyn at the Administration house (venue)

Name/ Ingoa	Village/Organisation	Contact (phone number/email address)	Signature
Tuavake Andrew	AGRICULTURE	42/64	[illegible]
Ru Taime	Omoka	42176	R Taime
Bakorea Tapaitau	(Tetautua)	(423-37)	[illegible]
Nancy Marsters	Omoka	42164	[illegible]
Tuakana Toriuta	Omoka	42081	T Toriuta
Tererua Maketu	Omoka	42020	[illegible]
Metuakore Marsters	Omoka		[illegible]
Rev Basini Tekena	"	42-017	[illegible]
Areuma William	"	42/51	[illegible]
Tamu Tapitai (Tetautua)		(423-40	[illegible]
Tetou Matamaki (Ford)	Omoka	42013 tinie@oyster.net.ck	[illegible]
Matanua Marsters	Marine Resources	42095/42097 fmrcs@penrhyn.net.ck	[illegible]
Tata Toniuara	Admin.	teperoa@tifi net.ck 42031	T. Toniuara
Tini Ford	Omoka (Mayor)	Hm 42013 Ofc or 42111 42100	[illegible]
Jacob Tirango	Deputy Mayor	42134	Tirangi
Tiurua Tiaaine	Omoka (Boys Brigade)	42041 tibba@oyster.net.ck	
Tuku Marsters	Omoka CICC Youth	42626	[illegible]
Saitu. Marsters	Te Tautu Moyor Konisara	4200654	[illegible]

NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

COOK ISLANDS RED CROSS SOCIETY

Penrhyn – Omoka **Community Climate Change Awareness on**

11th April 2013 **(date)**

Held at the Administration Building **(venue)**

Name/ Ingoa	Village/Organisation	Contact (phone number/email address)	Signature
Tonga William	Omoka	tonga.william@yahoo.com, 42135	[signature]
Tiwa Turune	Omoka	42041 [illegible]@oyster.net.ck	[signature]
[illegible]	Omoka	42116	[signature]
Mar. Akatapuria	Omoka	42216	[signature]
Abela William	Omoka	42155	[signature]
David Teaurere	Omoka	42107	[signature]
Kaihui Kaihui	Omoka	42155	K Kaihui
Dina Rasmussen	Omoka	42003	[signature]
Paratainga Rasmussen	Omoka	42003	[signature]
Arerima William	Omoka	42151	[signature]
Tearoni William	Omoka	42151	[signature]
Rev. Bosini Tepuna	✓	42017	[signature]
Manata Akatapuria		42029	[signature]
H. Tinia Taine	Omoka		[signature]
Paul Nukere	→	42176	[signature]
Harapa Viniki	Omoka	42217	[signature]
Tini Ford	Omoka	42012	[signature]
Andrew Varan	Executive officer	42021	[signature]

NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

COOK ISLANDS RED CROSS SOCIETY

_______________ Community Climate Change Awareness on
_______________ (date)

Held at the _______________ (venue)

Name/ Ingoa	Village/Organisation	Contact (phone number/email address)	Signature
Teramapa Viki	Omoka	42131	
Wilkie Rasmussen	Omoka, MP	29033	
Jacob Tuiranga	Deputy	42184	
Fana Tuiranga	Omoka	42821	
Leida Tara	Omoka	42323	
Haumata Ninkere	Omoka	42170	
Tuakana Potini	Omoka	42151	
Alex Maretapu	QV	42020	
Kirikava Moeianga	Omoka		
Tuka Marina	Omoka	42676	
Napa Sonny	School Teacher	42188	
Suihua Marsters	Electrician	42085	
Metuakore Marsters		—	
Kaiatia Rongo	Admin	42188	
Marsters Tapi		42323	
Hna Taime Williams	Health	42777	

NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS

COOK ISLANDS RED CROSS SOCIETY

Tetautua Community Climate Change Awareness on Fri 12th April (date)

Held at the Sunday School hall (venue)

Name/ Ingoa	Village/Organisation	Contact (phone number/email address)	Signature
TAMA TAPAITAU	(TETAUTUA)	423-40	[illegible]
Johnnona - Tapai	TETAUTUA	42323	[illegible]
TUAKANA RIU	✓	[illegible]	[illegible]
Rio Teika	✓	423.27.	[illegible]
Kura Teika	✓	✓	[illegible]
Rose Teika	✓	✓	[illegible]
Narlang Solo	✓	423-03	[illegible]
TAIA TAIA	✓	423-28	[illegible]
BEN WILLIAM	✓	423-40	[illegible]
VERONICA WILLIAM	✓	423-40	[illegible]
Benj Taia	[illegible] ✓	424 00	[illegible]
Temo Taia	✓	424 00	[illegible]
REV T MARSTON	✓	[illegible]	[illegible]
TOROVATA MARSTON	✓	42360	[illegible]
RITE TAPUTAU	✓	423-40	[illegible]

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OTHER CONTRIBUTORS:

1. Mii Matamaki
2. Mac Mokoroa
3. Matthew Rima
4. Olaf Rassmussen
5. Arona Ngari
6. Ben Ponia
7. Rimmel Poila
8. Wilkie Rassmussen MP
9. Papa Andrew Vaeau.
10. Papa Mayor Tini Ford.
11. Papa Alex Maretapu.
12. Reboama Samuel
13. George de Bert Romilly
14. Louisa Karika

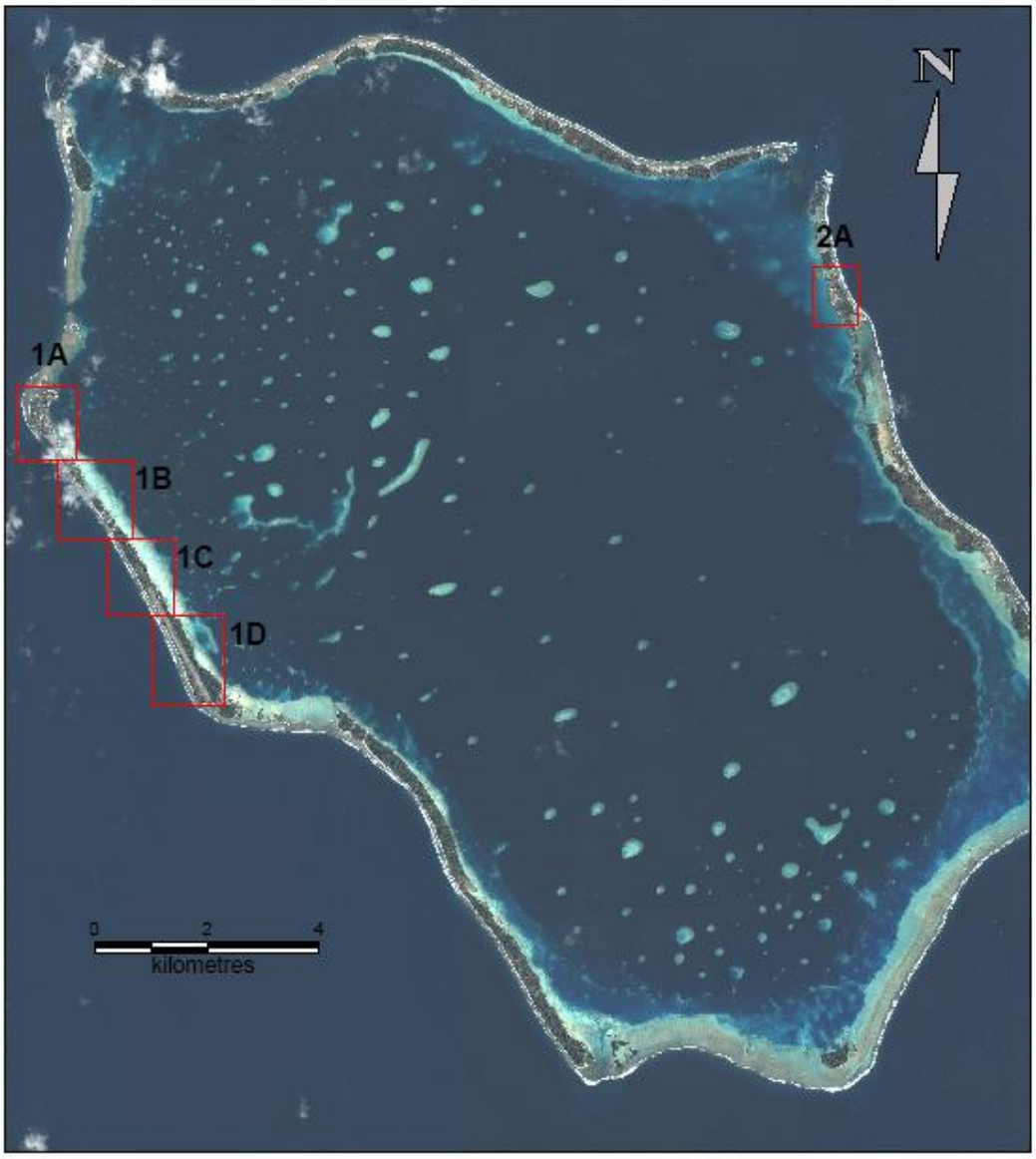
ISLAND FACT SHEET – PENRHYN

Physical features	Area: 9.84km^2 Elevation: <4m above MSL Island Type: Atoll Proximity: 1,365 km from Rarotonga 354 km from the nearest island (Rakahanga) Settlements: 2 villages Omoka and Tetaua separated by 10.5km of lagoon
Demographics	Population: (2011) 203 Households: 53
Environment	Lush Environment, mainly dominated by coconut trees
Health	• Clinic in Tetautua and a Hospital in Omoka with a nurse practitioner • High levels of NCD's • Fish is the main diet
Local Economy	• Handicrafts – hats and fans
Air Transport	• 1,300m long landing strip • Air service only by occasional chartered flights • Fuel storage facility
Sea transport	Cargo at least once every 2 to 3 months
Road transport	No sealed road, dirt and sandy road
Water Supply	HH water tanks or Community water tanks
Sanitation	40HH with flush toilets, 5 with Pour-flush toilets
Solid Waste	Dumpsite located at the edge of the two villages
Electricity supply	Diesel generators for each village – Omoka 68 kW, Te Tautua 48kW Power is on 18 hours of the day
Telecommunications	• No newspaper, public notice boards used or read out at church services • FM Radio station that can pick up AM Radio station in Rarotonga • Satellite TV • Email & Internet facilities accessible using broadband.
Cyclone shelters	Community Halls
Maintenance facilities	Hardly anyone to assist, expertise are sometime sourced from Rarotonga.

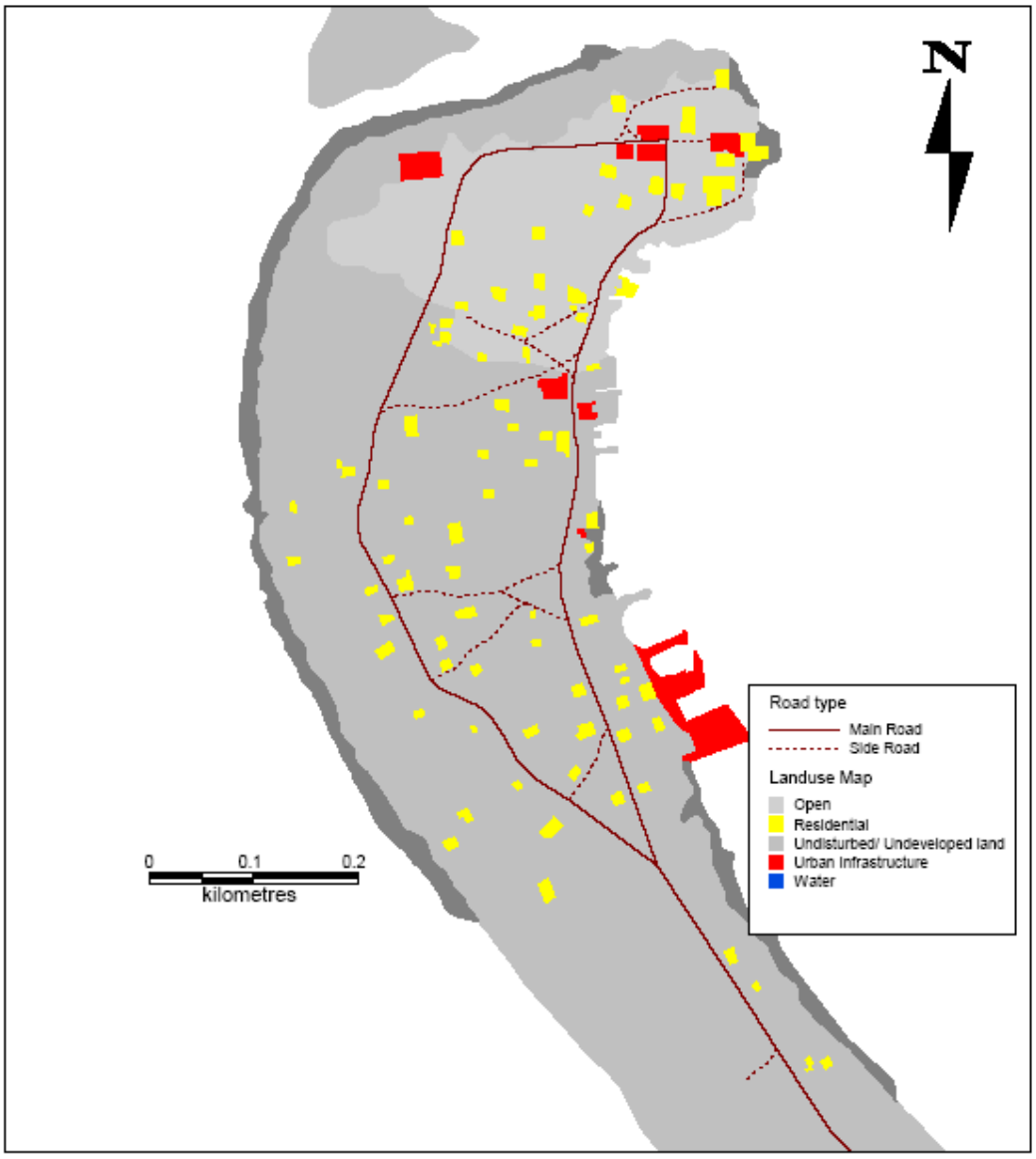
KEY ISSUES – PENRHYN

Issues	
Environment preservation	Threat to local biodiversity, Raui in place
Economic development	Handicrafts – hats and fans sold to market in Rarotonga Pipi pearls and shells

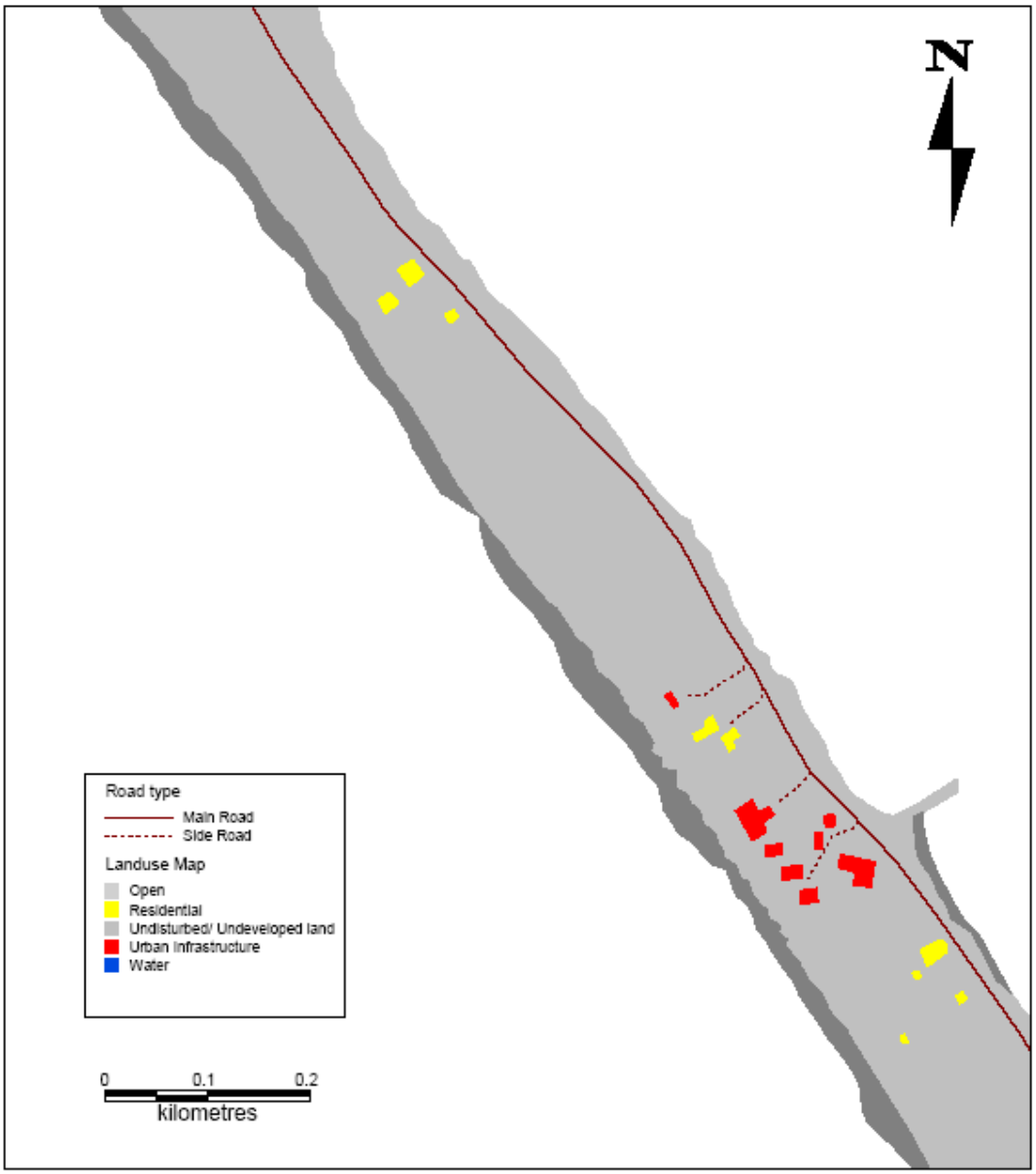
Penryhn Island: Satelite Image and Areas to be Magnified



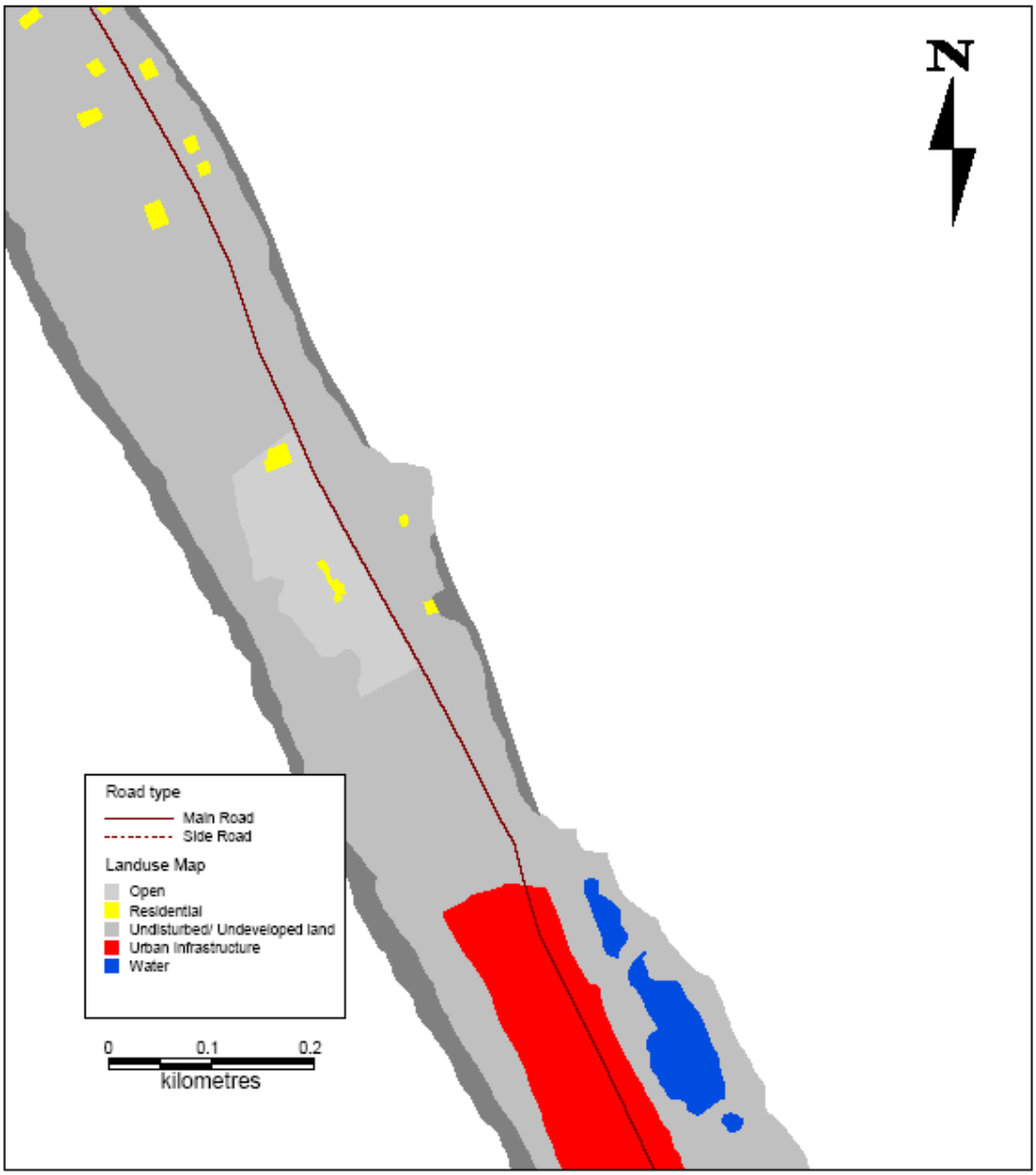
Penrhyn Island: Landuse - 1A Section



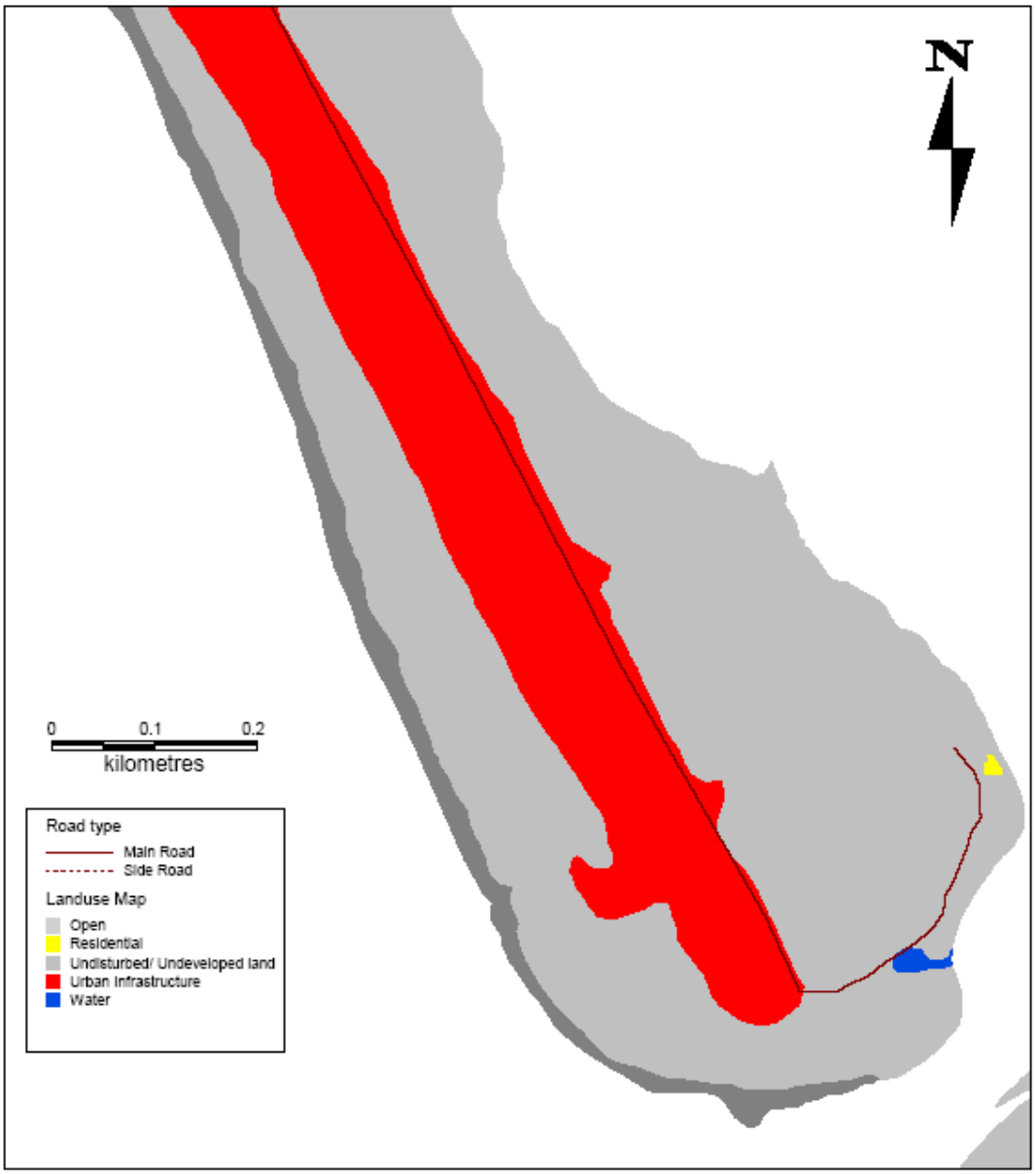
Penrhyn Island: Landuse - 1B Section



Penrhyn Island: Landuse - 1C Section



Penrhyn Island: Landuse - 1D Section



Penrhyn Island:Tetautua Village - Landuse 2A Section