



## **Republic of the Marshall Islands**

### **Majuro and Kwajalein Atoll Household Water Survey Report**

**February 2010**

Part of the EU/SOPAC Envelope B Water Mitigation Project, with additional financial and technical assistance provided by the World Bank/OECD, Secretariat of the Pacific Community (SPC), and the United Nations Development Fund (UNDP)

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As has been the case over the last several years EPPSO staff did a great job with organization, developing the survey instrument, completing paperwork, survey field work, updating maps, listing sheets, data editing, data entry, quality control, demonstrating initiative, solving problems without the need for micro management, and working many long days and hours in the sun and the rain walking house to house on Majuro and Kwajalein, as did staff from MWSC, OEPPC, MPW and several of our reliable contract surveyors.

## 2. Water and the Millennium Development Goals

MDG Targets by 2015	Contribution of Improved Water Resources Management and Access to Water Supply and Sanitation
<p><b>Poverty</b> To half the proportion of the people whose income is less than \$1/day</p>	<ul style="list-style-type: none"> <li>• Water is a factor of production for agriculture industry and other economic activities</li> <li>• Investments in water infrastructure/services as a catalyst for development</li> <li>• Reduced ecosystems degradation makes livelihoods systems of the poor more secure</li> <li>• Improved health increases productive capacities, reduces burden on those who care for the sick</li> </ul>
<p><b>Hunger</b> To half the proportion of people who suffer from hunger</p>	<ul style="list-style-type: none"> <li>• Water is a direct input to irrigation for expanded food productions</li> <li>• Reliable water for subsistence agriculture, home gardens, livestock tree crops</li> <li>• Sustainable production of fish, tree crops and other foods gathered, goods that can be sold for income</li> <li>• Reduced urban hunger are better able to absorb the nutrients in food than those suffering from water related diseases, particularly worms</li> </ul>
<p><b>Primary Education</b> Ensure that children complete a full course of primary education</p>	<ul style="list-style-type: none"> <li>• Improved school attendance from improved health and reduced water carrying burdens, especially for girls</li> <li>• Having separate, working, sanitation facilities for girls and boys in schools increases girls' school attendance</li> </ul>
<p><b>Gender Equality</b> Ensure that girls and boys have equal access to primary and secondary education</p>	<ul style="list-style-type: none"> <li>• Community based organizations for water management improve social capital for women</li> <li>• Reduced time, health and care giving burdens from improved water services give women more time for productive activities, adult education, empowerment activities and leisure</li> <li>• Water sources and sanitation facilities closer to home put women and girls at less risk for harassment while gathering water or searching for privacy</li> <li>• Higher rates of child survival are a precursor to the demographic transition toward lower fertility rates; having fewer children reduces women's reproductive responsibilities</li> </ul>
<p><b>Child Mortality</b> Reduce by two – thirds the death rate for children under five.</p>	<ul style="list-style-type: none"> <li>* Improved quantity and quality of domestic water and sanitation reduce main morbidity and mortality factors for children</li> <li>* Improved nutrition and food security reduces susceptibility to diseases</li> </ul>
<p><b>Maternal Mortality</b> Reduce by three – fourths the rate of maternal mortality</p>	<ul style="list-style-type: none"> <li>• Improved health and reduced labor burdens from carrying water reduce mortality risks</li> <li>• Improved health and nutrition reduce susceptibility to anemia and other conditions that affect maternal mortality</li> <li>• Sufficient quantities of clean water for washing pre and post birth cut down on life threatening infections</li> <li>• Higher rates of child survival are a precursor to the demographic transition toward lower fertility rates, fewer pregnancies per woman reduce maternal mortality</li> </ul>
<p><b>Major Disease</b> To half, halt and begin to reverse the spread of HIV, malaria and other major diseases</p>	<ul style="list-style-type: none"> <li>• Better water management reduces mosquito habitats</li> <li>• Better water management reduces incidence of a range of other water borne diseases</li> <li>• Improved health and nutrition reduce susceptibility to severity of HIV/Aids and other major diseases</li> </ul>

<p><b>Environmental Sustainability</b>          Stop the unsustainable exploitation of natural resources and to half the proportion of people who are unable to reach or afford safe drinking water</p>	<ul style="list-style-type: none"> <li>• Improved water management, including pollution control and water conservation is a key factor in maintaining local ecosystems</li> <li>• Development of integrated water management creates situation where sustainable ecosystem management is possible</li> <li>• Biodiversity conservation is furthered by sound water management</li> </ul>
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Source: Jonch – Clausen, Torkil; p 38, Annex 1; “...Integrated Water Resources Management (IWRM) and Water Efficiency Plans by 2005” Why, What and How?; Global Water Partnership; 2004

### **3. Key Results, Findings and Recommendations**

#### **Key Results and Findings**

1. Since 1999 the Republic of the Marshall Islands has gone through four extended dry periods. During this time (until end of 2006 – the latest health data available on water borne illness) there have alarming increases in the reported levels of gastroenteritis on Majuro and Ebeye. In addition in 2006 there was a typhoid outbreak on Majuro. In 2008 there were over 2,000 cases of Pink Eye on Majuro as a result of households not having enough water for sanitary purposes.
2. A review needs to be undertaken examining the current ability to respond to water related emergencies or ability to distribute water under emergency conditions. What are the gaps concerning equipment, water making, water distribution, needs for outer islands, urban areas, information and awareness raising. What are the costs to close these existing gaps? Again, the more preventative action that occurs in the near future the less costly it will be when a real emergency strikes.
3. 42.2% of all the homes surveyed (1,963 households) on both Majuro and Kwajalein were identified as not having suitable household water storage readily available. The current project will be able to distribute around 500 household water catchment units, covering only 25% of the identified need. After the completion of this project there will still be at least 1,463 households without any household water storage on Majuro and Kwajalein. Given this current situation how can we respond to a water emergency?
4. The total population surveyed was 38,322 people, with 14,474 people living in the 1,963 households with water catchments. This figure represents 37.5% of the survey population. On Kwajalein atoll the population survey was 5,463 who lived in households without a catchment or 51.4% of the population. On Majuro, 8,911 out of a total 27,699 or 32.2%, lived in households without water catchments.

The total combined population for all of the outer islands during the 1999 Census was 17,819 people, the total number of people on Kwajalein and Majuro who have no water catchment comprise 81.2% of the 1999 outer island population.

5. Total population below 15 years of age in households without a water catchment is 5,872 people or 40.8% of all people in households without a water catchment. On Kwajalein, this number of people below 15 years of age in households without a water catchment is 2,299 or 42.1% of the total surveyed population. The number of people on Majuro below 15 years of age in households without water catchments is 8,911 or 40.1% of the total population.
6. The current EU/SOPAC/RMI water project can only be viewed as a beginning of a more serious and larger effort to address the serious water needs facing households on Majuro, Kwajalein and the RMI in general. The need is much greater than currently available resources for water catchments, water quality testing, public health monitoring and educational or awareness information programs and projects.
7. The water scarcity situation on Ebeye and some islands on Kwajalein atoll (table 24) are more serious than Majuro; in fact the percentage of households without sufficient water storage on Kwajalein is almost double the rate on Majuro Atoll, with just over 63% of all households on Kwajalein not having a water catchment available.

8. Table 37 presents some alarming results on how households are reporting the frequency of water availability. Nearly 92% of all households reported that they faced a scarcity of drinking water either “sometimes” (42.7%) or “often” (49.2%).
9. Nearly 53% of all households on Kwajalein and Majuro report they do not have water available from their main source throughout the year. Again the situations on Kwajalein and Majuro show some significant differences.
10. According to the survey results 46.6% of all households on Majuro and Kwajalein earned less than \$10,000 annually. On Kwajalein, 30.5% of households earned less than \$10,000 and on Majuro the figure was reported at 51.1% earning less than \$10,000 annually. The most alarming element of this for Majuro is that 11.8% of households reported having no annual income at all. Many households are simply not in any financial condition to tackle major household water improvements by themselves.
11. All housing GIS housing maps and listings for Majuro and Ebeye were updated. This will be a great resource for the next RMI census, public health/disease surveillance, other community project and program development activities, if they are utilized. EPPSO will gladly work with any RMI agency and share the information in order to improve service delivery or for other analysis, ask and ye shall receive.
12. The Water Survey went to 5,320 homes on Majuro atoll and most parts of Kwajalein atoll (except Ebadon, Mejjatto and other westward islets). Surveys were completed for 4,652 homes for an 87% completion rate. Surprisingly on Majuro there were 417 vacant homes (9.8% of the total). The survey revealed that the current population on Ebeye was 9,360 people and 27,699 people on Majuro.
13. There were some interesting survey results with average household sizes for Majuro and Kwajalein. The combined average household size for the two atolls was 8.24 people; however the differences in household size are considerably different for Majuro (7.65 per HH) and Kwajalein (10.3 per HH). These average household sizes had an interesting impact on some of the income calculations and show the need concerning more water access for Ebeye households in particular.
14. For every \$20,000 that is expended on vehicles or other discretionary General Fund/Capital budget items, the opportunity cost results in 20 water catchment systems helping to provide access to water for 165 people. The approximate cost for providing water catchment systems to the remaining 1,463 households without water catchments, who are not affected by this current water project, on Majuro and Ebeye is nearly \$1,500,000. There would be additional budget costs surrounding personnel and logistics for these additional water catchment installations. Considering that the government is spending approximately \$700,000 annually to treat the effects of water borne illness this looks to be an efficient expenditure.
15. This type of public works project, if designed properly, could be developed into a economic stimulus project, helping local retailers, increasing local spending, taxes and more importantly providing several dozen unemployed households work for several months or longer.

## Recommendations

- 1. There is a critical need for more household water catchments based on the increasing levels of water borne illness reported on Majuro and Ebeye.**

After this project there will be 1,463 homes on Majuro and Kwajalein (does not include Mejatto and Ebadon islands on Kwajalein) without water catchments. Based on current project costs this will require at least \$1,500,000 for the remaining material and equipment and additional funds to support logistics and installation.

- 2. Conduct review of existing gaps in provision of current Public/Preventative Health model and ability of government to provide water in extended dry periods or other emergency situations.**

A review needs to be undertaken examining the current ability to respond to water related emergencies or ability to distribute water under emergency conditions. What are the gaps concerning equipment, water making, water distribution, needs for outer islands, urban areas, information and awareness raising

- 3. The need to pay attention to environmental health and its effects on the community through the use of better surveillance methods, particularly with use of GIS systems.**

The newly updated house listings and GIS maps should be utilized to better monitor public and environmental health.

- 4. Improve and Increase level of public awareness and basic public health education concerning water and other preventative health issues.**

This goes directly to the public health model that is being used in the urban areas. While there is good information in the newspaper and on the radio, we cannot be naïve enough to think that this is satisfactory given the extent of the information problem. The 2007 Demographic and Health Survey pointed out that nearly 40% of households do not come into regular contact with either the newspaper or news from the radio.

- 5. Expansion of Water Quality Testing Programs and Personnel**

There are some provisions for this under the current EU/SOPAC water project as there is a definite need to expand the number of people who are trained as water quality officers, particularly in Majuro and Ebeye, where the large majority of the RMI lives. Expansion of this training to include Ministry of Health Public Health Nurses, staff from NGOs, local governments and community representatives will go a long way toward halting the increase in water borne illness and empowering communities and households to more vigilant about water conservation and water quality.

- 6. Creation of a National Water Office, Develop New National Water Policies and Operational Plans**

Overall, water resource management in the RMI is more non-integrated than it is integrated. While there is some cooperation among water related agencies, overall collective management remains weak. All organizations with direct and indirect responsibilities for water and waste water management and the network that connects them need development. The absence of a formal National Water Office (or equivalent entity) and a current water strategy is resulting in a relatively unclear future concerning water.

#### 4. Introduction and Background

After the El Nino event of 1998, the RMI received assistance from the U.S. Federal Emergency Management Administration (FEMA) for the provision of household water catchments to the outer islands. This FEMA program distributed 1,068 fifteen hundred gallon household water catchments to the outer islands during 2001 and 2002, however, according the 1999 Census there were a total of 2,352 homes on the outer islands. The RMI government appropriated \$500,000 in the FY 2002 budget for the further provision of 760 catchments of the same type. During FY 2003 the RMI government appropriated an additional \$250,000 for catchments, as well as receiving a further \$25,000 from the Canada Fund. There were 173 homes on the outer island that needed water catchments and this was to be accomplished under the current EU/RMI Envelope B Water Project Program during 2009 and 2010. This previous outer island project served as the model for water catchment projects in the urban areas of Majuro and Ebeye.

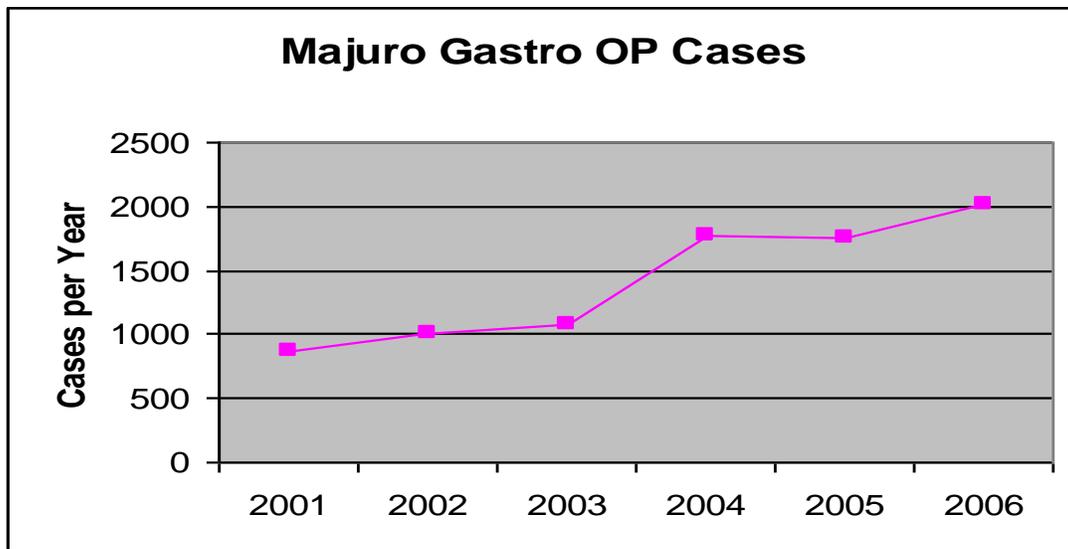
The Majuro and Ebeye household water survey started almost by complete accident, it was certainly not something in the plan of work. In preparing data for the EU Envelop B project, EPPSO paid some close attention to the water borne illness numbers being reported by the Ministry of Health (MOH) and the Environmental Protection Authority (RMIEPA). The data showed an increasing number of cases dealing with water borne illness, combined with the 2006 Majuro typhoid outbreak, that were a cause for alarm and an indication that water issues in the urban areas required more attention. The data showed that in 2006, one out of every fifteen people on Majuro were ill with gastroenteritis, these are only the cases reported to the Ministry of Health. The number of people who just rode out the illness and stayed at home is unknown. The situation on Ebeye was even more alarming with one out of every eight people coming down with gastroenteritis.

The out patient cost figure of \$119 per visit was calculated in 2007 using MOH performance budgeting data. Unless otherwise noted all of the following data and statistics are from MOH, EPPSO and RMIEPA.

**Table 1 . Combined Estimated Effect of Gastroenteritis Out Patient Indicators (OP) in RMI Urban Areas**

<b>Year</b>	<b>Gastro OP Cases Majuro + Ebeye</b>	<b>%Urban Pop Of 33,031 w/Gastro (99 Census)</b>	<b>Estimated Total Cost @ \$119 per Majuro OP Visit</b>
2001	1,989	6%	\$236,691
2002	2,234	6.8%	\$265,846
2003	2,426	7.3%	\$288,694
2004	3,011	9.1%	\$358,309
2005	2,991	9.1%	\$355,929
2006	3,720	11.3%	\$442,680
<b>Totals</b>	<b>16,371</b>		<b>\$1,948,149</b>

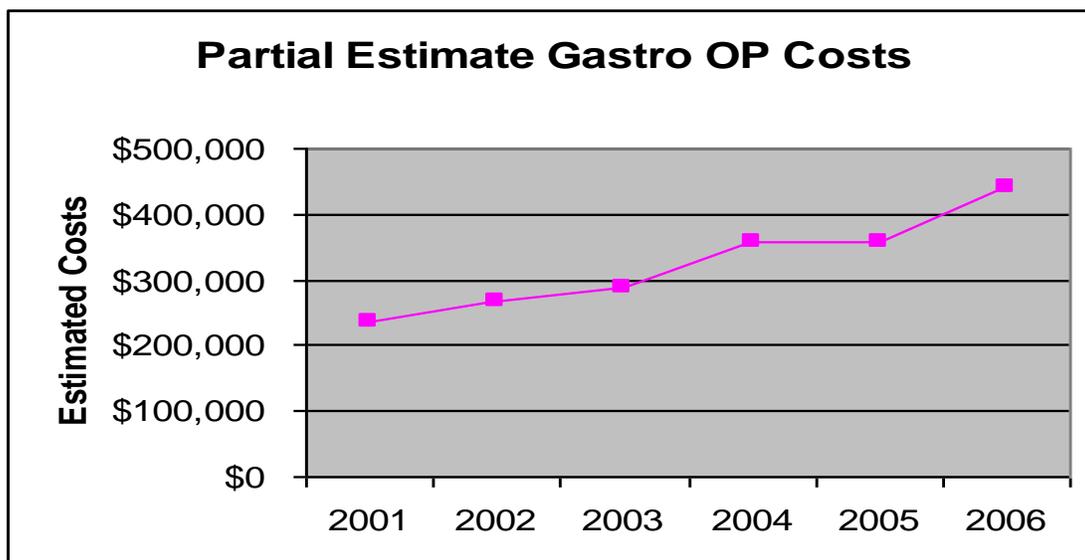
**Percent increase in Majuro and Ebye Out patient gastroenteritis cases  
2001 – 2006 = 87%**



**Table 2. Majuro – Gastro Out Patient Cases, 1999 Majuro Census Figures/Population Estimates and Estimated Cost to RMI Health System**

Year	Gastro OP Cases	% Majuro Pop w/Gastro (99 Census) <b>23,676</b>	Estimated Cost @ \$119 per Majuro OP Visit
2001	864	3.6%	\$102,816
2002	999	4.2%	\$118,881
2003	1078	4.6%	\$128,282
2004	1770	7.5%	\$210,630
2005	1750	7.4%	\$208,250
2006	2,013	8.5%	\$239,547
<b>Totals</b>	<b>8,474</b>		<b>\$1,008,406</b>

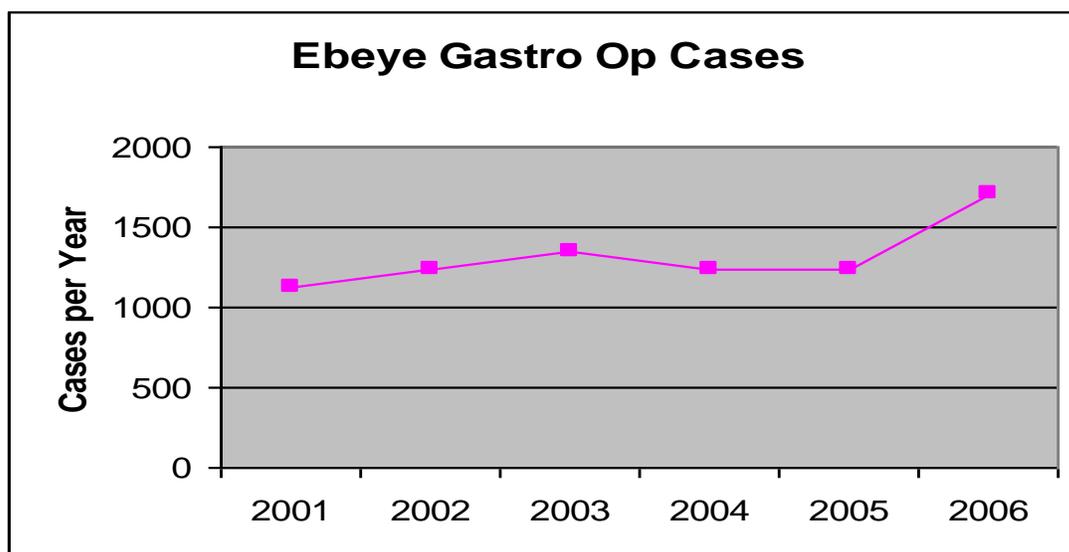
**Percent increase in Majuro Gastroenteritis cases 2001 – 2006 = 133%**



**Table 3. Ebeye – Gastro Out Patient Cases, 1999 Ebeye Census Figures/Estimates and Estimated Cost to RMI Health System**

Year	Gastro OP Cases	%Ebeye Pop w/Gastro (99 Census) 9,345	Estimated @ \$119 Cost of OP Visit
2001	1,125	12%	\$133,875
2002	1,235	13.2%	\$146,965
2003	1,348	14.4%	\$160,412
2004	1,241	13.3%	\$147,679
2005	1,241	13.3%	\$147,679
2006	1,707	18.3%	\$203,133
<b>Totals</b>	<b>7,897</b>		<b>\$939,743</b>

**Percent increase in Ebeye Gastroenteritis cases 2001 – 2006 = 52%**



**Majuro and Ebeye Hospitals: Estimated In Patient Admissions for Gastro**

The information in the table below represents the number of in-patients that were admitted into the hospitals because of gastroenteritis. Currently there are no figures from Ebeye, so a crude estimate was developed based on the percentage of in-patients cases and out patient cases on Majuro and then applied to estimate Ebeye out –patient cases. We also do not have any data on the average length of stay for these patients, so accurate expenditures for this in – patient cost category are not possible at this time.

However, it is safe to say that the RMI is conservatively paying at least \$700,000 annually from the Ministry of Health budget to treat just in – patient and out – patient gastroenteritis cases.

Year	Majuro Hospital	Ebeye Hospital*	Total*
2001	74	86*	160
2002	87	86*	173
2003	95	86*	181
2004	79	86*	165
2005	99	86*	185
2006	115	86*	201
<b>Totals</b>	<b>549</b>	<b>516*</b>	<b>1,065*</b>

As a result of these numbers EPPSO recommended to Cabinet in December of 2006 that a significant portion of the EU Envelope B funds be used to assist with water projects in the urban areas of Majuro and Ebeye. The Cabinet approved these recommendations for EU water projects by Cabinet Paper in December 2006.

Since 1999 the Republic of the Marshall Islands has gone through four extended dry periods (2001, 2006, 2008, and 2009/10). During 2006 the Centers for Disease Control (CDC) made several visits investigating a typhoid outbreak on Majuro, concerning about forty five documented cases. The 2000 cholera outbreak on Ebeye and Lae atoll affected several hundred people and involved the deaths of five people. During the 2008 dry period on Majuro there were 2,000 cases of Pink – Eye as a result of people not having enough water for sanitary purposes.

The need to look at the issues surrounding access to water, water quality testing, improving and increasing the amount of activities and awareness materials for communities and households requires review and coordination. This situation should also be a call to the Ministry of Health to also review its public health and disease surveillance models and make the changes needed to improve services, reduce impact of preventable diseases and provide more information directly to households and families. In addition there is also a need to review what plans or contingencies are in place to handle water emergencies; the types of equipment and procedures that are in place to handle more frequent or extreme dry periods. Are plans and equipment in place to sufficiently handle another 1997/98 El Nino event?

## **5. *Majuro and Ebeye Household Water Survey***

Under the EU Envelope B project a total of 350 1,500 gallon water catchment units would be made available for Majuro and 150 1,500 gallon units for Ebeye. It was understood at the beginning of the project that the need for water catchments in the urban areas would far out strip the units being brought on island. The need for some type of survey or assessment to better understand conditions on the ground was quickly apparent. As the survey went forward a major definition was agreed to as what defined not having a water catchment. Households with less than 350 gallons of household water storage were classified as not having a water catchment. Typically the smallest catchments that can be purchased in retail stores are about 400 gallons. In addition using accepted international definitions for improved water storage, the blue plastic water barrels many people use for water collection are not classified as proper or improved household water catchments. This is due to their small individual size, approximately 35 gallons.

A survey was developed using questions from standard household surveys and some additional questions were inserted after consultation and review by other interested government agencies and NGOs. During the course of the survey operations, it was soon recognized how much more was needed to conduct this project in the field over earlier sample surveys conducted by EPPSO. Much of the problem was the reliance on older 1999 Census information on the total number of households on Majuro. EPPSO had been looking at approximately 3,200 households total, not 4,300. The survey operation, as a result was much more extensive and expensive than anticipated and consequently significantly short of the budget required for house to house work. EPPSO was able to work with the EU/SOPAC project management and the World Bank/OECD to increase survey budgets, as an additional \$20,000 was provided by the World Bank/OECD. In addition there were technical assistance training inputs from the Secretariat of the Pacific Community (SPC) on data processing and SOPAC for GIS mapping.

The proposed budget developed by EPPSO was significantly less than what was required. Originally the budget for the survey was approximately \$30,000, this increased to about \$70,000 when completed. There was also a substantial element of “mission creep” as the project went on. Many legitimate requests were made to try and include different atolls, islands, and islets in the survey. EPPSO attempted to meet all requests, but could not provide for all that were made. As a result of budgets and time, EPPSO was just not able to reach all the islands of Kwajalein Atoll, these communities not surveyed being on Mejjato and Ebadon.

The Project was able to conduct a house listing on Jaluit Atoll. Jaluit Atoll was the one outer island that received the least amount of attention during the 2001 – 2004 Outer Island Water Catchment program. At that time it was received that approximately 60 households had not received water catchments under the program. In order to find out who and where these households were located on Jaluit it was decided that a team of two would be needed to go through Jaluit and record where the households without water catchments were located.

The results from Jaluit were surprising; over 100 homes had no water catchments, not 60. In addition there was a significant of vacant and abandoned homes. The project was able to deliver 65 water catchment units to Jaluit Atoll, but this has meant that over 40 households on Jaluit and Jabwor islands are still without water catchments, a problem that needs a remedy. Household listings will be conducted on Arno and Alinglaplap atolls, it is likely we will see a similar situation as was seen on Jaluit atoll, more households in need of water catchments than the records are indicating. This situation on the outer islands can be effectively addressed during the next Census of Housing and Population, hopefully to be conducted within the next year.

There were some important lessons and observations learned from this comprehensive house to house survey exercise and they are listed below:

1. The difference between time and resource requirements for house to house surveys versus random sample surveys are tremendous;
2. The expectation going into the survey was that there would be about 700 – 800 homes on Majuro identified as having some water access problem, instead the figure was over 1,300 with little, if any, water storage and several more households with very limited water storage. The extent of the problem was unexpected.
3. During the survey it was observed by almost all surveyors that many of the homes without water also had no electricity. Going to all the households on Majuro and Ebeye has revealed that there are a significant number of people who are finding it very difficult to meet many basic needs.
4. Using experienced people who worked on the 2007 Demographic and Health Survey was very beneficial, these people were highly trained and understood projects expectations;
5. Mission creep became a problem, because the size and extent of water issues were so universal. This made it very difficult to say no when requests came into EPPSO looking at additional work.
6. There is a definite need for a National Water Office, similar to the existing Energy Office, this project has literally consumed EPPSO time and Resources for nearly a year. Given the extent of the issues and problems, there needs to be some full time staff somewhere reviewing, providing recommendations for solutions, coordinating and looking at the future of water in the RMI.

There were two major outgrowths as a result of the survey; the first was a decision to take some videos of what the surveyors were seeing as they went from house to house. The thought was this video documenting some of the conditions that exist in many households would significantly compliment the results of the survey and provide a better picture of many household situations. EPPSO was able to work with the United Nations Development Fund (UNDP) under a current Millennium Development Goals (MDG) project to purchase the necessary video and sound recording equipment. The resulting video will include some interviews with NGOs, households, and government officials.

The second major develop from the survey was to make a serious attempt to participate in World Water Day on 22 March, 2010. EPPSO began working with NGOs and other relevant organizations to begin organizing the video, order t- shirts, developing informational material and coordinating with the government on venues and meetings. This is an important attempt to bring awareness to the problems, issues and extent of water issues to the general public, NGOs and the government. EPPSO is working with UNDP and the EU on supporting some different activities to raise awareness for World Water Day. Other government agencies and NGOs are working their regional partners in the same way.

## **6. Creation of House Listings and Updating of Maps**

The updating for map listings on Majuro and Ebeye were significant elements to the project and the next RMI Census. Majuro and Ebeye account for approximately 70% of the RMI population and considering costs for such exercises completing an updated house listing in the Majuro urban areas was too good an opportunity to pass up.

Majuro Atoll was divided into twenty – four enumeration zones. Zones one through twenty – two covered all areas between Rita and Laura. Zones 23 and 24 covered the smaller islands and islets of Majuro. Ebeye, on Kwajalein Atoll, was divided into five zones, with other islands on Kwajalein also designated as separate enumeration zones. The small islands on Kwajalein were also listed by their names instead of being primarily a Zone, as was done on Majuro and Ebeye. Each household in every zone was then given a number. In this way it was possible to find households on the maps and use the same house numbers on Excel spreadsheets, where more detailed listing and survey information was processed and recorded. This made it easy to cross reference map information for every household to their listing and survey information. Examples of some of these new Majuro and Kwajalein housing maps are provided in Appendix 2 of this report.

As each household was approached and the following actions occurred:

1. Location of household was captured on GPS equipment;
2. An information sheet explaining the purpose of the survey and relevant contact information was distributed. These were produced in Marshallese, English and a shorter Chinese translation;
3. Information on the Millennium Development Goals (MDGs) was distributed. Marshallese and English versions were available;
4. Water survey was then conducted.

The household information in the GPS units was downloaded at the end of each day at EPPSO. This information was then used to update older satellite/GIS maps that EPPSO had been using for the last several years.

The new housing maps were also accompanied with information for the surveys, so individual household characteristics could be captured by zone. This will allow for better analysis and description of conditions at the household level in areas of 100 – 200 households, rather than strictly by island, was the case in the 1988 and 1999 Census operations. This new approach will provide government and non – government agencies better information for which to target future projects and programs. This is of particular importance, since according to the 2007 Demographic and Health Survey (DHS), approximately % of households do not regularly come in contact with radio or newspaper information. Developing media campaigns in the future must take this fact into account if important information concerning health, education or other important messages need to be communicated with the public. The new maps and listings are a great resource for this type of future work.

## 7. Household Description

The Water Survey went to 5,320 homes on Majuro atoll and most parts of Kwajalein atoll (except Ebadon, Mejjatto and other westward islets). Surveys were completed for 4,652 homes for an 87% completion rate. Surprisingly on Majuro there were 417 vacant homes (9.8% of the total). This could be a reflection of out migration trends, which have been relatively high since 2000. The areas on Majuro with a considerable number of vacant homes were in Delap (Zone 9) and Batkan (Zone 12); each had forty or more vacant homes.

**Table 1. Total Number of households surveyed by Result and Atoll, 2009**

Result	Atoll		
	Total	Kwajalein	Majuro
Total	5,320	1,082	4,238
Completed	4,652	1,032	3,620
Partly completed	1	0	1
Refused	39	3	36
Vacant	445	28	417
Household not available	56	12	44
Other	127	7	120

Source: RMI Water Survey 2009

In Delap Zone 9, vacant homes represented 21% of all homes. The Relatively high number of vacant homes in Aenkan Zone 24 (outer islands of Majuro) is because many homes are either second homes or weekend homes that are not continuously occupied. There was an 85% survey completion rate for Majuro atoll.

The 1988 Census counted 2,228 households on Majuro and 3,080 households during the 1999 Census.

**Table 2. Total Number of households surveyed by Result, Majuro 2009**

Majuro Zones	Result						
	Total	Completed	Partly completed	Refused	Vacant	Household not available	Other
Total	4,238	3,620	1	36	417	44	120
1	240	219	0	0	11	6	4
2	264	254	0	3	4	0	3
3	132	122	0	0	6	2	2
4	270	254	0	0	13	2	1
5	196	167	0	1	15	2	11
6	141	119	0	1	13	1	7
7	194	172	0	3	16	1	2
8	139	125	0	3	8	2	1
<b>9</b>	232	156	0	9	<b>49</b>	5	13
10	251	214	0	1	17	0	19
11	286	244	0	4	25	7	6
<b>12</b>	264	209	1	2	<b>40</b>	3	9
13	109	82	0	0	23	1	3
14	235	188	0	5	26	7	9
15	170	144	0	1	15	2	8
16	197	168	0	1	19	3	6
17	192	168	0	1	17	0	6
18	158	129	0	0	25	0	4
19	97	88	0	0	8	0	1
20	79	68	0	0	10	0	1
21	159	143	0	1	12	0	3
22	109	102	0	0	6	0	1
23	50	44	0	0	6	0	0
24	74	41	0	0	33	0	0

Source: RMI Water Survey 2009

There was a 95% survey completion rate for the homes surveyed on Kwajalein atoll, an excellent result. There was nothing surprising about these numbers in Table 3.

The survey identified a total of 900 households on Ebeye, zones 7 – 11. In the 1988 Census there were 822 households and the 1999 Census counted 1,001 households. See Tables 5 & 6 in the Population Chapter of the report for details on the breakdown by zone and population.

**Table 3. Total Number of households surveyed by Result, Kwajalein 2009**

Kwajalein Zones	Result						
	Total	Completed	Partly completed	Refused	Vacant	Household not available	Other
Total	1,082	1,032	0	3	28	12	7
Enubirr	89	88	0	0	0	1	0
Gugeegue	60	49	0	0	5	4	2
Ebeye Zone 7	183	172	0	0	8	1	2
Ebeye Zone 8	168	165	0	0	2	1	0
Ebeye Zone 9	149	143	0	2	3	0	1
Ebeye Zone 10	159	153	0	1	3	0	2
Ebeye Zone 11	241	235	0	0	6	0	0
Enubuj	13	11	0	0	1	1	0
Carlos	20	16	0	0	0	4	0

Source: RMI Water Survey 2009

The vast majority of homes, Table 6, on Majuro and Kwajalein atolls were separate and detached homes, representing 88% of all dwelling types.

**Table 6. Type of Dwelling by Atoll, 2009**

Dwelling	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Residential	4,115	914	3,201
Residential/Commercial	86	32	54
Trailer	99	43	56
Condo/Duplex	4	-	4
Apartment	282	14	268
Government	31	18	13
Community	35	11	24
Not reported	-	-	-

Source: RMI Water Survey 2009

Of the 4,652 homes surveyed (Table 7), 1,016 were built since 2001, nearly 22% and nearly 34% of homes have been built since 1996. This does represent a significant number of new homes, although it cannot be assumed that all of these new homes have accompanying items, like water, toilets and electricity.

**Table 7. Year house/building was built by Atoll, 2009**

Year	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
2008	220	20	200
2007	151	24	127
2006	132	16	116
2005-2001	513	94	419
2000-1996	549	125	424
1995-1991	281	70	211
1990-1986	395	117	278
1985-1981	361	104	257
1980 or earlier	892	323	569
Don't know	1,158	139	1,019
Not reported	-	-	-

Source: RMI Water Survey 2009

One trend in household construction (Tables 8 & 8a) that is now clearly visible is the decrease in the number of homes constructed of wood. Down from 49.6% of all homes on Majuro and Ebeye in the 1999 Census to 32.7% in the current 2009 Water Survey. There has been some significant expansion of home loan and home grant programs under the US Department of Agriculture – Rural Development, administered through the Marshall Islands Development Bank. These programs have targeted construction of newer more modern homes, as well as funds for significant repair and renovations. These programs have been much more active on Majuro than Ebeye, as a result, proportionally many more homes on Majuro are made of concrete than on Ebeye.

**Table 8. Building outside walls by Atoll, 2009**

Outside walls	Atoll			
	Total	Total	Kwajalein	Majuro
Total	4,652	4,652	1,032	3,620
Concrete/Brick/Stone	52.2%	2,430	293	2,137
Wood	32.7%	1,519	488	1,031
Half concrete/brick/stone/half wood	11.8%	548	203	345
Galvanized iron/Aluminum	3.1%	143	46	97
Other	0%*	12	2	10
Not reported		-	-	-

Source: RMI Water Survey 2009

**Table 8a. Type of Walls Construction by Atoll**

	1999 Census	2007 Demo Health Survey	2008 Energy Survey
Majuro and Ebeye Only			
Total	3941	541	462
Wooden	49.6%	42%	35%
Thatched	0%*	0%*	0
Iron	2.6%	0	1.7%
Concrete	46%	57%	61.7%
Open	0%*	0%*	0%*

Nothing surprising in the construction of roofs in the RMI was seen, as evidenced by the survey results in Tables 9 and 9a. Tin and aluminum sheeting continues to be the predominate material over the years for roofing

**Table 9. Building roof materials by Atoll, 2009**

Roof materials	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Asbestos	271	109	162
Tin/aluminum	4,277	889	3,388
Plastic	20	6	14
Concrete	55	19	36
Thatched	4	1	3
Other	25	8	17
Not reported	-	-	-

Source: RMI Water Survey 2009

**Table 9a. Type of Roof Construction by Atoll**

	19999 Census	2007 DHS	2008 Energy Survey
Majuro and Ebeye Only			
Total	3532	552	462
Wooden	50	11	6
Thatched	5	0	1
Iron	3369	517	450
Concrete	85	11	5
Open	23	10	0

Conditions of roofs (Table 10) were a significant finding of the survey, with 37% of all homes needing either repair or replacing. Collection of rainwater is dependant on having a roof in satisfactory condition. This could be a fairly costly exercise, but could programs dealing with housing at USDA or MIDB assist in this area? This area alone directly affects 13,000 – 14,000 people and their ability for access to water.

**Table 10. Building roof condition by Atoll**

Roof condition	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Fully working	2,926	343	2,583
Needs repair	1,398	603	795
Needs replacing	328	86	242
Not reported	-	-	-

Source: RMI Water Survey 2009

**Table 11. Building Roof slope by Atoll**

Roof slope	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Flat (<2.5")	474	149	325
Low (2.5" - 20")	4,113	882	3,231
Steep (>20")	65	1	64
Not reported	-	-	-

Source: RMI Water Survey 2009

**Table 12. Percentage of trees covered building roof by Atoll**

% Tree cover	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
No tree cover	3,539	943	2,596
25% cover	604	57	547
50% cover	329	26	303
75% cover	110	5	105
100% cover	70	1	69
Not reported	-	-	-

Source: RMI Water Survey 2009

A very important finding from the survey (Table 13) is that 27.5% of homes on Kwajalein and Majuro do not have gutters for collecting rain water. Some homes do have catchments but not gutters. The project will try to make some funding available for households in this situation where they have a catchment but no gutters. Paying some attention to this issue will be cost effective in addressing some of these household water access issues.

**Table 13. Atoll by number of gutter available**

Gutter Available	Gutter Available		
	Total	Yes	No
Total	4,652	3,374	1,278
Kwajalein	1,032	606	426
Majuro	3,620	2,768	852

Source: RMI Water Survey 2009

The survey (Table 14) also pointed out there is a need for households to improve efficiency for capturing water. Nearly 77% of homes capture only rain from 50% or less of their roofs. Information materials or some other forms assistance could be provided to improve this situation. Action in this area would be very cost effective.

**Table 14. Roof Capture by Atoll**

Roof Capture	Atoll		
	Total	Kwajalein	Majuro
Total	3,374	606	2,768
0%	34	2	32
25%	1,186	344	842
50%	1,368	185	1,183
75%	108	28	80
100%	678	47	631

Source: RMI Water Survey 2009

According to findings from the survey, just over 25% of homes (Table 15) either need repair or replacing of gutters. Looking at ways to help people repair or replace gutters would be a cost efficient way to help improve some of the problems about access to water. This could be done with either materials with information, some type of self – help program or other forms of assistance, particularly if the households have low or very low levels of income.

**Table 15. Gutter condition by Atoll**

Gutter condition	Atoll		
	Total	Kwajalein	Majuro
Total	3,375	606	2,769
Fully working	2,516	345	2,171
Needs repair	599	180	419
Needs replacing	260	81	179
Not reported	-	-	-

Source: RMI Water Survey 2009

Tables 18 – 21 examine the condition of water collection equipment, particularly with downpipes, connecting the gutters to the water catchments. In Table 18, 54.6% of homes do not have down pipes connecting gutters to water catchments. In Tables 22 and 23, 42.2% of homes on Majuro and Ebeye do not have water catchments, so this means there are quite a few homes on Majuro and Ebeye that have water catchments, but have other problems with guttering and downpipes. There were 2,540 homes identified with downpipe and or guttering problems and 1,963 homes identified with no water catchment, that leaves 577 homes with catchment having these gutter or downpipe problems.

On Kwajalein, 79% of homes had no downpipe available, while on Majuro the figure was 47.7% of households not having downpipes.

**Table 18. Atoll by number of down pipe available**

Atoll	Down Pipe Available			Not reported
	Total	Yes	No	
Total	4,652	2,112	2,540	-
Kwajalein	1,032	217	815	-
Majuro	3,620	1,895	1,725	-

Source: RMI Water Survey 2009

In the households on Majuro and Ebeye where there were down pipes, 14.8% of households needed to have replacements or repairs. On Kwajalein, 21.7% of homes with downpipes needed replacement or repair, while on Majuro the rate was 14%. Getting these items repaired or replaced would be an efficient approach to improving some of the household water issues, there should be some information or programs that will encourage households to repair or replace these important rain water collection components.

**Table 19. Total Number of households by condition of downpipe by Atoll, 2009**

Down pipe condition	Atoll		
	Total	Kwajalein	Majuro
Total	2,112	217	1,895
Fully working	1,800	170	1,630
Needs repair	225	36	189
Needs replacing	87	11	76
Not reported	-	-	-

Source: RMI Water Survey 2009

**Table 20. Number of households with downpipe connected to catchments**

Atoll	Downpipe Connected			
	Total	Yes	No	Not Applicable
Total	2112	1859	35	218
Kwajalein	217	154	6	57
Majuro	1895	1705	29	161

Source: RMI Water Survey 2009

**Table 21. Number of households by number of water tanks connected to downpipe by Atoll, 2009**

Number of catchment	Atoll		
	Total	Kwajalein	Majuro
Total	1859	154	1705
1 Water Tank	1411	138	1273
2 Water Tanks	360	10	350
3 Water Tanks	57	5	52
3 Water Tanks	21	0	21
5+ Water Tanks	10	1	9

Source: RMI Water Survey 2009

42.2% of all the homes surveyed (1,963 households) on both Majuro and Kwajalein were identified as not having suitable water storage readily available. The current project will be able to distribute around 500 water catchment units, covering only 25% of the identified need.

**Table 22. Atoll by Water Catchment Available**

Atoll	Catchment Available			
	Total	Yes	No	Not reported
Total	4,652	2,689	1,963	-
Kwajalein	1,032	378	654	-
Majuro	3,620	2,311	1,309	-

Source: RMI Water Survey 2009

In Majuro (Table 23), Zones 19, 20, 21 and 22 (Arrak and Laura) are by far the worst affected by lack of household water storage. In these areas over 50% of homes have no effective household water storage and this, in turn, places more pressure on the Laura water lens as a significant number of households use the lens water for everyday household needs. More household water catchments can reduce this pressure on the Laura water lens, thereby reducing the potential damage to the Laura water lens. Overall, just over 36% of homes on Majuro are going without sufficient household water storage.

With Majuro increasing from 3,080 households during the 1999 Census and 3,620 households now, how can we respond in an emergency, say an extended drought, typhoon, and fire or wave action? If the disaster preparedness situation was difficult with 3,080 households during the 1998 El Nino, what would happen now? What is the status and availability of local emergency equipment and capacity? Will it be up to the task? This is an area that needs review, recommendations, plans and action.

**Table 23. Number of households by Water Catchment Availability, Majuro 2009**

Majuro Zones	Catchment Availability			
	Total	Yes	No	% No
Total	3,620	2,311	1,309	36.2%
1	219	161	58	26.5%
2	254	153	101	39.8%
3	122	87	35	28.7%
4	254	165	89	35%
5	167	106	61	36.5%
6	119	88	31	26%
7	172	118	54	31.4%
8	125	80	45	36%
9	156	99	57	36.5%
10	214	138	76	35.5%
11	244	168	76	31.1%
12	209	124	85	40.7%
13	82	53	29	35.4%
14	188	122	66	35.1%
15	144	98	46	32%
16	168	116	52	31%
17	168	118	50	29.8%
18	129	79	50	38.8%
<b>19</b>	<b>88</b>	<b>47</b>	<b>41</b>	<b>46.6%</b>
<b>20</b>	<b>68</b>	<b>34</b>	<b>34</b>	<b>50%</b>
<b>21</b>	<b>143</b>	<b>57</b>	<b>86</b>	<b>60.1%</b>
<b>22</b>	<b>102</b>	<b>41</b>	<b>61</b>	<b>59.8%</b>
23	44	37	7	16%
24	41	22	19	43.2%

Source: RMI Water Survey 2009

The situation on Ebeye and some islands on Kwajalein atoll (table 24) are more serious than Majuro; in fact the percentage of households without sufficient water storage on Kwajalein is almost double the rate on Majuro Atoll, with just over 63% of all households not having a water catchment available. The areas with the most significant problems are Enubirr, Ebeye Zone 9, Ebeye Zone 11 and Carlos.

The numbers in Table 24 support the data on incidence of water borne illness on Ebeye that were documented in 2007 and 2008. Between 2001 and 2006 there were about 1,100 - 1,300 reported cases of waterborne illness, effecting one out of every 8 Ebeye residents annually. By comparison, on Majuro the rate has been one in fifteen people effected by water borne illness annually. The lack of access to water at the household level on Ebeye could be a significant contributor to higher rates of water borne illness.

**Table 24. Number of households by Water Catchment Availability, Kwajalein 2009**

Kwajalein Zones/Villages	Catchment Availability			
	Total	Yes	No	% No
Total	1,032	378	654	63.4%
Enubirr	88	29	59	76%
Gugeegue	49	29	20	40.8%
Ebeye Zone 7	172	89	83	48.3%
Ebeye Zone 8	165	68	97	58.8%
Ebeye Zone 9	143	45	98	68.5%
Ebeye Zone 10	153	60	93	60.8%
Ebeye Zone 11	235	49	186	79.1%
Enubuj	11	7	4	36.4%
Carlos	16	2	14	87.5%

Source: RMI Water Survey 2009

In Table 25 below, 28.6% of households on Majuro and Kwajalein reported having more than one water catchment. On Majuro this figures 30.4% of households having more than one water catchment, while on Kwajalein the figure was 18%. Survey results are showing that there is simply more water available at the household level on Majuro than Kwajalein.

**Table 25. Number of water tank by number of household by Atoll**

Number of catchment	Atoll		
	Total	Kwajalein	Majuro
Total	2,689	378	2,311
1 Water Tank	1,919	310	1,609
2 to 3 Water Tanks	695	59	636
4+ Water Tanks	75	9	66
Not reported	-	-	-

Source: RMI Water Survey 2009

On Majuro and Kwajalein 46.7% (Table 26) of households reported having catchments larger than 1,000 gallons. Looking at Kwajalein, this figure was 32.1%, while on Majuro almost 51%. Having less households with larger water catchments, combined with other data from this survey, it is not surprising that the incidence rates for water borne illness are significantly higher on Kwajalein than on Majuro.

**Table 26. Total Number of households by Total Catchment (s) Capacity in Gallons by Atoll, 2009**

Atoll	Total Capacity (in Gallons)						
	Total	0	351 to 799	800 to 999	1000 to 4999	5000 to 9999	10000 +
Total	4,652	1,963	355	162	1,779	219	174
Kwajalein	1,032	654	40	7	269	35	27
Majuro	3,620	1,309	315	155	1,510	184	147

Source: RMI Water Survey 2009

See Table 24, the Table below provides some additional information on availability of water per zone on Kwajalein. Given the level of congestion on Ebeye, we should expect to see many more water catchments 351 – 1,000 gallons. This is something that should be looked into for the future.

**Table 28. Total Number of households by Total Catchment (s) Capacity in Gallons by Zone/Village, Kwajalein 2009 (See also table 24)**

Atoll	Total Capacity (in Gallons)						
	Total	0	351 to 799	800 to 999	1000 to 4999	5000 to 9999	10000 +
Total	1,032	654	40	7	269	35	27
Enubirr	88	59	3	0	25	1	0
Gugeegue	49	20	2	2	23	2	0
Ebeye Zone 7	172	83	10	2	56	12	9
Ebeye Zone 8	165	97	9	0	49	9	1
Ebeye Zone 9	143	98	3	2	23	1	16
Ebeye Zone 10	153	93	5	1	47	6	1
Ebeye Zone 11	235	186	8	0	38	3	0
Enubuj	11	4	0	0	6	1	0
Carlos	16	14	0	0	2	0	0

Source: RMI Water Survey 2009

**Table 29. Number of water tanks, completed households and population by Atoll**

Number of catchment	Atoll		
	Total	Kwajalein	Majuro
Total Catchments	3,777	476	3,301
Total Completed Households	4,652	1,032	3,620
Total Population	38,322	10,623	27,699

Source: RMI Water Survey 2009

Table 30 below, indicates all of the different types of water catchments by material. Plastic/polyethylene tanks are by far the most popular with 55.1% of all tanks, followed by concrete tanks accounting for 26.7% of the total.

On Kwajalein, plastic tanks make up 55.9% of water tanks and concrete accounting for 36.1%. The situation on Majuro is 55% of water tanks made of plastic and concrete making for 25.3%. Majuro has a more diverse make up of water tank materials.

**Table 30. Types of water tank by Atoll**

Number of catchment	Atoll		
	Kwajalein	Majuro	Total
Total	476	3,301	3,777
Concrete	172	835	1,007
Tin/Aluminum	28	459	487
Plastic	266	1,815	2,081
Fiber Glass	10	187	197
Barrel	0	0	0
Other	0	5	5

Source: RMI Water Survey 2009

The over all condition of water storage tanks appears to be satisfactory, with only 6.6% of all tanks reported needing repair or replacing. On Kwajalein this figure was 8.6% and on Majuro 6.3% of water tanks needing repair or replacing.

**Table 31. Condition of Tanks by Atoll**

Number of catchment	Atoll		
	Total	Kwajalein	Majuro
Total	3,777	476	3,301
Fully Working	3,528	435	3,093
Needs Repair	181	36	145
Needs Replacing	68	5	63

Source: RMI Water Survey 2009

Based on the survey and video field work the results in Table 35 are not and should not be surprising, where 30% of households on Majuro and 56.5% of households on Kwajalein use the water catchments of neighbors as their main source of drinking water, particularly with results from Tables 23, 24, 36 – 40. The culture of sharing can be seen easily as a result, but this places a lot of additional stress on all households as a result of water scarcity and lack of access to fresh water.

Rain catchments are 42.3% of households main source on drinking on Kwajalein and Majuro, on Kwajalein, rainwater catchments provide only 17.7% of households with drinking water, this figure seems much too low given the situation with water borne illness on Ebeye. On Majuro rain water catchments are 49.3% of homes main source of drinking water. This is a significant difference between Kwajalein and Majuro.

**Table 35. Main source of drinking water by Atoll**

Drinking Water	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Public piped water	208	173	35
Rain catchment	1,966	183	1,783
Bottled water	811	93	718
Well	2	-	2
Neighbor's	1,632	583	1,049
Others	33	-	33
Not reported	-	-	-

Source: RMI Water Survey 2009

In Table 36 below, there is a significant increase in the use of Rain Water Tanks as a source of drinking water. In the 1988 Census Rainwater Tanks were identified as a source of drinking water in only 20.5% of homes, by the 1999 Census this figure had increased to 63.1% of homes. In addition in other household surveys since the 1999 Census, this trend upward trend has continued ranging between 51% and 61% of homes reporting using Rain Water Catchments as a main source of drinking water.

**Table 36. Source of Drinking water by Atoll**

	1988 Census	1999 Census	2006 Community Survey	2007 Demo Health Survey	2008 Energy Survey
Majuro and Ebeye Only					
Total Households	3178	4287	901	552	462
Own Well	41	36	6	3	0
Rain Water Tank	652	2706	465	335	274
Public Tap or Well	999	509	137	70	66
Piped Water into house from Public Sys	1423	361	163	0	7
Other	63	675	130	144	115

In Table 36a, just over 59% of all households on Majuro and Ebeye reported that there are periods of no water availability throughout the course of a year. On Ebeye, over 65% of households reported not having water available and the figure was just over 57% On Majuro. Again with these high numbers having problems with access to water is probably a significant contributor to the rates of water borne illness.

**Table 36a. Atoll by Water available from main source throughout the year**

Atoll	Main Water Source					
	Total	Yes	% Yes	No	% No	Not reported
Total	4,652	1,902	40.9%	2,750	59.1%	-
Kwajalein	1,032	358	34.7%	674	65.3%	-
Majuro	3,620	1,544	42.7%	2,076	57.3%	-

Source: RMI Water Survey 2009

Table 37 presents some alarming results on how households are reporting the frequency of water availability. Nearly 92% of all households reported that they faced a scarcity of drinking water either “sometimes” (42.7%) or “often” (49.2%). The situations on Majuro and Ebeye were not significantly different in these areas, with nearly 50% of all households reporting they often face a scarcity of drinking water. Again, this self reported situation can help explain some of the high rates of water borne illness.

**Table 37. Atoll by Number of households often face most scarcity of drinking water**

Atoll								
	Total	Often	% Often	Sometimes	% Sometimes	Not much	% Not Much	Not reported
Total	2,750	1,352	49.2%	1,174	42.7%	224	8.9%	0
Kwajalein	674	339	50.3%	302	44.8%	33	4.9%	0
Majuro	2,076	1,013	48.8%	872	42%	191	9.2%	0

Source: RMI Water Survey 2009

Tables 38 and 39 look Main Source of Water for Everyday use. In Table 38, 38.4% of households on Majuro and Ebeye use rain catchments as main source of water and 37.6% of households use public piped water. However, there are some significant differences between Kwajalein and Majuro in the use of rain catchments and public piped water.

On Kwajalein, 70.5% of households said they use public piped water as their main source of water, while only 17% said they use rain catchment as their main source. On Majuro 44.5% of households reported using rain catchments as a main source of water, with another 28% using public piped water and another 18.7% using wells as main source of water. Given the incidence of water borne illness and operational issues with water supply on Ebeye, more water catchments on Ebeye could improve the water access situation there significantly.

**Table 38. Main source of water for everyday use by Atoll**

Source	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Public piped water	1,747	728	1,019
Rain catchment	1,787	176	1,611
Bottled water	13	6	7
Well	699	23	676
Others	406	99	307
Not reported	-	-	-

Source: RMI Water Survey 2009

Nearly 53% of all households on Kwajalein and Majuro report they do not have water available from their main source throughout the year. Again the situations on Kwajalein and Majuro show some significant differences. On Kwajalein, 82.4% of households reported having a problem with availability of water during the year, while on Majuro this figure was 44.4%, nearly twice as bad on Kwajalein. Increasing the number of water catchments on Kwajalein could reduce this very high percentage of homes having problems with access to water during the year.

**Table 39. Atoll by water available from your main source throughout the year**

Atoll	Water Available			
	Total	Yes	No	Not reported
Total	4,652	2,193	2,459	-
Kwajalein	1,032	182	850	-
Majuro	3,620	2,011	1,609	-

Source: RMI Water Survey 2009

The self reported results in Table 40 also support the findings in Tables 36 and 37. 93% of homes on Majuro and Ebeye reported that they “often” or “sometimes” face problems due to scarcity of water for everyday household uses. Over half of all households that answered this question reported that they “often” face water scarcity for everyday use. The problem appears to be more severe on Ebeye than on Majuro, this can also be seen on some previous tables.

**Table 40. Atoll by Number of households face most scarcity of water for everyday use**

Atoll	Scarcity							
	Total	Often	% Often	Sometimes	% Sometimes	Not much	% Not Much	Not reported
Total	2459	1251	50.9%	1044	42.4%	164	6.7%	0
Kwajalein	850	491	57.8%	322	37.9%	37	4.3%	0
Majuro	1609	760	47.2%	722	44.8%	127	7.9%	0

Source: RMI Water Survey 2009

Another trend that is noticeable over the years is the dramatic increase of homes that are reporting gas/propane as their primary source of cooking fuel (Tables 41 & 41a). This is very noticeable beginning in 2006/2007 with the results from the Community Survey and Demographic and Health Survey. This is more readily apparent on Majuro than on Ebeye. In 2009, where 48.3% of homes reported using gas/propane on Ebeye 34.5% used gas/propane. During the 1999 RMI Census only 2.1% of all RMI homes reported using gas/propane as their primary source of cooking fuel.

**Table 41. Main source of fuel for cooking by Atoll**

Fuel	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Kerosene	1,116	466	650
Electricity	641	140	501
Gas/Propane	2,104	356	1,748
Wood	779	69	710
Others	12	1	11
Not reported	-	-	-

Source: RMI Water Survey 2009

<b>Table 41a. Main Cooking Fuel used by Atoll</b>					
Majuro and Ebeye Only	1988 Census	1999 Census	2006 Community Survey	2007 Demographic and Health Survey	2008 Energy Survey
Total Households	3178	4286	901	550	462
None	0	8	0	3	2
Wood	58	219	0	15	55
Charcoal	0	3	64*	1	3
Kerosene	1361	2386	433	206	102
Gas	36	91	78	132	174
Coconut husks or shells	0	8	0	37	38
Electricity	1715	1571	319	156	88

There has been a downward trend (Tables 42 & 42a) since 1988 of households reporting using beach/forest/bushes as their toilet. In the 1988 Census 11.5% of households reporting using bushes, forest/beach for natures calling. During the 1999 Census this number was down to 6.8% of households. In 2009 this edged downward slightly to 6.4%, is this stalled indicator due to lack of access to water or other reasons, say geography?

**Table 42. Kind of toilet use by the household members by Atoll**

Toilet facility	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Flush toilet inside dwelling	2,406	619	1,787
Flush toilet outside dwelling	1,384	214	1,170
Water sealed	320	93	227
Pit latrine	33	7	26
Beach/bushes	297	66	231
Using Neighbor's	212	33	179
Not reported	-	-	-

Source: RMI Water Survey 2009

<b>Table 42a. Type of Toilet Facility by Atoll</b>					
Majuro and Ebeye Only	1988 Census	1999 Census	2006 Community Survey	2007 Demographic and Health Survey	2008 Energy Survey
Total	3178	4288	901	552	462
Water Sealed or flush toilet with the house	2524	3871	786	518	425
Pit Latrine with the house	246	82	27	6	5
Facilities shared with other HHs	0	0	54	2	8
Beach or forest	367	293	34	22	3
Other	41	42	0	4	21

## 8. Population Description

There is a near perfect 50/50 split of households on Majuro and Kwajalein with households being made up either of extended or immediate families. However there are significant differences between Kwajalein and Majuro. On Kwajalein households made up of extended families comprise 77.4% of all households, while on Majuro this figure is only 42%. There could be some other interesting differences arising from this situation between Kwajalein and Majuro.

**Table 1. Number of households by Type of Family by Atoll**

Type of Family	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Immediate Family	2,333	233	2,100
Joint/extended	2,319	799	1,520
Not reported	-	-	-

Source: RMI Water Survey 2009

According to results in Table 2, 9.2% of households on Majuro and Kwajalein are people other than ri – Majol, meaning that 91.8% of RMI households are ri – Majol. The largest ethnic group is Philipino (3.4% of households) followed by Americans (1.5% of households). On Majuro there were 391 non ri – Majol households, coming to 10.8% of Majuro households, on Kwajalein non ri- Majol households accounted for only 3.7% of Kwajalein households.

**Table 2 Number of Households by ethnicity or race by Atoll**

ethnicity	Atoll		
	Total	Kwajalein	Majuro
Total	4,652	1,032	3,620
Marshallese	4,223	994	3,229
Micronesian	39	4	35
Australian	6	-	6
New Zealander	3	-	3
Chinese	40	-	40
Japanese	18	-	18
Philipino	159	27	132
USA	69	5	64
Other	95	2	93
Not reported	-	-	-

Source: RMI Water Survey 2009

Women were the primary respondents for the water survey in 60.3% of Majuro households.

**Table 3. Majuro Zone/Village by Number of respondent by sex**

Zone/Village	Gender		
	Total	Male	Female
Majuro			
Total	3,620	1,437	2,183
1	219	91	128
2	254	104	150
3	122	48	74
4	254	77	177
5	167	52	115
6	119	47	72
7	172	85	87
8	125	63	62
9	156	65	91
10	214	66	148
11	244	100	144
12	209	69	140
13	82	25	57
14	188	95	93
15	144	55	89
16	168	73	95
17	168	69	99
18	129	49	80
19	88	33	55
20	68	25	43
21	143	55	88
22	102	38	64
23	44	21	23
24	41	32	9

Source: RMI Water Survey 2009

Women were primary respondents on 58.7% of the water surveys on Kwajalein Atoll

**Table 4. Kwajalein Zone/Village by number of respondent by sex**

Zone/Village	Gender		
	Total	Male	Female
Total	1,032	426	606
Enubirr	88	26	62
Gugeegue	49	21	28
Ebeye Zone 7	172	71	101
Ebeye Zone 8	165	80	85
Ebeye Zone 9	143	44	99
Ebeye Zone 10	153	65	88
Ebeye Zone 11	235	100	135
Enubuj	11	8	3
Carlos	16	11	5

Source: RMI Water Survey 2009

In Table 5 below, households with respondents over age 60 were 13.7% of the total households without water catchments. Some additional analysis will be done in this area as there are some special housing programs, supported by the US Department of Agriculture Rural Development, that can provide some modest grant funding to help renovate and improve housing and assist with the provision of water.

**Table 5. Number of Household respondents by five years age-group without water catchment by Atolls and by sex,**

	Total			Kwajalein			Majuro		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	1,789	719	1,070	546	225	321	1,243	494	749
15 - 19	33	12	21	14	6	8	19	6	13
20 - 24	152	61	91	33	15	18	119	46	73
25 - 29	216	80	136	62	33	29	154	47	107
30 - 34	261	94	167	77	30	47	184	64	120
35 - 39	240	102	138	70	26	44	170	76	94
40 - 44	262	90	172	96	35	61	166	55	111
45 - 49	204	85	119	67	21	46	137	64	73
50 - 54	160	59	101	54	21	33	106	38	68
55 - 59	130	63	67	38	17	21	92	46	46
60 and over	131	73	58	35	21	14	96	52	44

The population figures for the households surveyed on the two atolls were a combined 38,322 people. The total population of Ebeye, Kwajalein Atoll zones 7 – 11, is 9,360 people and on Majuro Atoll the total population was 27,699 people. The population for Ebeye during the 1999 Census was 9,345 people and for the 1988 Census 8,324 people. The population for Majuro during the 1999 Census was 23,676 people and for the 1988 Census 19,664 people.

**Table 6. Zone/Village by Number of Population by Atoll**

Zone/Village	Atoll		
	Total	Kwajalein	Majuro
Total	38,322	10,623	27,699
1	2,315	747	1,568
2	2,112	-	2,112
3	1,440	328	1,112
4	2,358	-	2,358
5	1,114	-	1,114
6	888	-	888
7	3,192	1,752	1,440
8	2,942	1,832	1,110
9	2,467	1,321	1,146
10	3,838	1,988	1,850
11	4,246	2,467	1,779
12	1,454	-	1,454
13	561	-	561
14	1,265	67	1,198
15	1,315	121	1,194
16	1,100	-	1,100
17	1,272	-	1,272
18	931	-	931
19	611	-	611
20	464	-	464
21	1,061	-	1,061
22	842	-	842
23	304	-	304
24	230	-	230

Source: RMI Water Survey 2009

There were some interesting survey results with average household sizes for Majuro and Kwajalein. The combined average household size for the two atolls was 8.24 people, however the differences in household size are considerably different for Majuro and Kwajalein. During the 1988 and 1999 Censuses, the average household sizes in the RMI were 8.7 and 7.8 people per household respectively.

On Kwajalein the average household was 10.3 people, with a range of 6.1 to 12.99 people per household depending on the zone or island. On Ebeye itself, the average size per household was 10.8 people. Other Ebeye figures showed in 1988 the average household size was 10.1 people and in 1999 9.3 people. These average household sizes had an interesting impact on some of the income calculations and need for more water access for Ebeye households in particular.

On Majuro there were only 7.65 people per household and the range was much tighter than on Kwajalein, ranging from 5.61 people, at the end of Laura, to 9.28 people in Jenrok village. Majuro had average household sizes of 8.6 people and 7.7 people in 1988 and 1999.

**Table 7 Average Kwajalein and Majuro HH Size by Zone**

Zone/Village	Total		Total Avg HH Size	Kwajalein population	# of HH	Kwaj Avg HH Size	Majuro	# of HH	Majuro Avg HH Size
	Total Pop	Total HH							
Total	38,322	4652	8.24	10,623	1,032	10.3	27,699	3,620	7.65
1	2,315			747	88	8.49	1,568	219	7.16
2	2,112			-			2,112	254	8.31
3	1,440			328	49	6.69	1,112	122	9.11
4	2,358			-			2,358	254	9.28
5	1,114			-			1,114	167	6.67
6	888			-			888	119	7.46
7	3,192			1,752	172	10.19	1,440	172	8.37
8	2,942			1,832	165	11.10	1,110	125	8.88
9	2,467			1,321	143	9.24	1,146	156	7.35
10	3,838			1,988	153	12.99	1,850	214	8.64
11	4,246			2,467	235	10.50	1,779	244	7.29
12	1,454			-			1,454	209	6.96
13	561			-			561	82	6.84
14	1,265			67	11	6.10	1,198	188	6.37
15	1,315			121	16	7.56	1,194	144	8.29
16	1,100			-			1,100	168	6.55
17	1,272			-			1,272	168	7.57
18	931			-			931	129	7.22
19	611			-			611	88	6.94
20	464			-			464	68	6.82
21	1,061			-			1,061	143	7.42
22	842			-			842	102	8.25
23	304			-			304	44	6.91
24	230			-			230	41	5.61

Source: RMI Water Survey 2009

**Table 8. Number of Population by 5yrs Age-Group and by Atoll, 2009**

Age group	Atoll					
	Total	Tot %	Kwajalein	Kwaj %	Majuro	Majuro %
Total	38,322	100	10,623	100	27,699	100
0-4yrs	5,569	14.5	1,605	15.1	3,964	14.3
5-9yrs	5,084	13.3	1,519	14.3	3,565	12.9
10-14yrs	4,119	10.7	1,220	11.5	2,899	10.5
15-19yrs	3,984	10.4	1,102	10.4	2,882	10.4
20-24yrs	3,985	10.4	962	9	3,023	10.9
25-29yrs	3,351	8.7	861	8.1	2,490	9
30-34yrs	2,717	7.1	721	6.8	1,996	7.2
35-39yrs	2,284	5.9	667	6.3	1,617	5.8
40-44yrs	1,956	5.1	589	5.5	1,367	4.9
45-49yrs	1,631	4.2	467	4.4	1,164	4.2
50-54yrs	1,204	3.1	342	3.2	862	3.1
55-59yrs	1,075	2.8	288	2.7	787	2.8
60 yrs +	1,363	3.5	280	2.6	1,083	3.9

Source: RMI Water Survey 2009

**Table 9. Population in households without water catchment**

Total Population	Pop in HH without water catchment	% Total pop in HH without water catchment	Total Kwajalein	Kwaj Pop in HH without water catchment	% Kwaj pop in HH without water catchment	Total Majuro	Majuro Pop in HH without water catchment	% Majuro pop in HH without water catchment
38,322	14,374	37.5%	10,623	5,463	51.4%	27,699	8,911	32.2%

Total population below 15 years of age in households without a water catchment is 5,872 people or 40.8% of all people in households without a water catchment.

On Kwajalein, this number of people below 15 years of age in households without a water catchment is 2,299 or 42.1% of the total surveyed population.

The number of people on Majuro below 15 years of age in households without water catchments is 8,911 or 40.1% of the total population.

**Table 10. Household population by five year age-group without water catchment by Atoll, 2009**

	Total	% Total	Kwajalein	% Kwaj	Majuro	% Majuro
Total	14,374	100%	5,463	100%	8,911	100%
0 - 4 yrs	2,262	15.7%	858	15.7%	1,404	15.8%
5 - 9 yrs	2,032	14.1%	791	14.5%	1,241	13.9%
10 - 14 yrs	1,578	11%	650	11.9%	928	10.4%
15 - 19 yrs	1,384	9.6%	557	10.2%	827	9.3%
20 - 24 yrs	1,473	10.2%	478	8.7%	995	11.2%
25 - 29 yrs	1,236	8.6%	451	8.2%	785	8.8%
30 - 34 yrs	1,042	7.2%	359	6.6%	683	7.7%
35 - 39 yrs	828	5.8%	340	6.2%	488	5.5%
40 - 44 yrs	734	5.1%	290	5.3%	444	5%
45 - 49 yrs	607	4.2%	248	4.5%	359	4%
50 - 54 yrs	441	3.1%	181	3.3%	260	2.9%
55 - 59 yrs	351	2.4%	133	2.4%	218	2.4%
60 and over	406	2.8%	127	2.3%	279	3.1%

## 9. Income Description

According to the survey results 46.6% of all households on Mauro and Kwajalein earned less than \$10,000 annually. On Kwajalein, 30.5% of households earned less than \$10,000 and on Majuro the figure was reported at 51.1%. The most alarming element of this for Majuro is that 11.8% of households reported having no annual income at all.

According to the survey results 18.4% of all households earned between \$10,000 and \$16,000 annually. On Kwajalein this figures was 21.3% and on Majuro this was 17.5%. So on Kwajalein 48.9% of all households earned less than \$16,000 annually and on Majuro the was 72.4% of households earned less than \$16,000 annually. Based on these income figures and what has been reported in the past about the very high level of household and consumer debt in the RMI, it is not feasible to expect most households are in a position to purchase water catchment systems unless there is some type of specialized assistance with loans, grants or donor sponsored projects made available to households for this purpose.

**Table 1. Total annual income grouping by Number of household by Atoll**

Income	Atoll					
	Total	Total %	Kwajalein	Kwaj %	Majuro	Majuro %
Total	4,652	100%	1,032	100%	3,620	100%
No Income	488	10.5%	62	6%	426	11.8%
Less than 1000	17	0.3%	10	1%	7	0*%
1000 - 2999	102	2.2%	20	2%	82	2.3%
3000 - 4999	428	9.2%	38	3.6%	390	10.8%
5000 - 6999	481	10.3%	67	6.5%	414	11.4%
7000 - 9999	655	14.1%	118	11.4%	537	14.8%
10000 - 12999	472	10.1%	128	12.4%	344	9.5%
13000 - 15999	385	8.3%	94	9.1%	291	8%
16000 - 18999	331	7.1%	92	8.9%	239	6.6%
19000 - 29999	639	13.7%	208	20.1%	431	11.9%
30000 - 49999	500	10.7%	153	14.8%	347	9.6%
50000 - 69999	98	2.1%	28	2.7%	70	1.9%
70000 and Over	56	1.2%	14	1.3%	42	1.1%
Not Reported	0		0		0	

Source: Water Survey 2009

There were some interesting results with household income, with average households on Kwajalein having 29.4% income (\$18,933 vs \$14,632) than the average Majuro household. However, with the average Kwajalein household being 10.3 people compared to Majuro's 7.65 people per household this would come to \$1,838 per person on Kwajalein and \$1,913 per person on Majuro. Given that consumer prices consistently range between 20% - 30% higher on Ebeye than Majuro, many households on Ebeye will face some challenges meeting basic household needs than on Majuro.

**Table 2. Zone/Village by Average HH Income for both Kwajalein and Majuro, 2009**

Zone/Village	Kwajalein		Majuro		Both Atolls	
	No. of Households	Average HH Income	No. of Households	Average HH Income	All households	Total Average HH Income
<b>Total</b>	<b>1,032</b>	<b>\$ 18,933</b>	<b>3,620</b>	<b>\$ 14,632</b>	<b>4,652</b>	<b>\$15,586</b>
1	88	\$17,326	219	\$21,309	307	\$20,167
2			254	\$14,711	254	\$14,711
3	49	\$11,663	122	\$14,464	171	\$13,662
4			254	\$15,623	254	\$15,623
5			167	\$14,511	167	\$14,511
6			119	\$18,436	119	\$18,436
7	172	\$23,800	172	\$16,556	344	\$20,178
8	165	\$22,248	125	\$13,928	290	\$18,662
9	143	\$20,611	156	\$16,731	299	\$18,587
10	153	\$20,577	214	\$14,866	367	\$17,247
11	235	\$14,804	244	\$12,731	479	\$13,748
12			209	\$12,731	209	\$12,731
13			82	\$15,670	82	\$15,670
14	11	\$1,227	188	\$16,865	199	\$16,000
15	16	\$5,621	144	\$15,927	160	\$14,897
16			168	\$15,984	168	\$15,984
17			168	\$12,858	168	\$12,858
18			129	\$12,147	129	\$12,147
19			88	\$10,050	88	\$10,050
20			68	\$13,354	68	\$13,354
21			143	\$ 8,846	143	\$8,846
22			102	\$ 9,788	102	\$9,788
23			44	\$13,356	44	\$13,356
24			41	\$ 6,399	41	\$6,399

**Table3. Majuro Income Groups by enumeration zone**

Area	Total	No Income	Less than 1000	1000 - 2999	3000 - 4999	5000 - 6999	7000 - 9999	10000 - 12999	13000 - 15999	16000 - 18999	19000 - 29999	30000 - 49999	50000 - 69999	70000 and Over	NR
Total	3,620	426	7	82	390	414	537	344	291	239	431	347	70	42	0
Zone 1	219	31	0	7	20	25	23	19	13	15	23	32	5	6	0
Zone 2	254	33	0	3	29	25	41	23	17	19	32	27	0	5	0
Zone 3	122	16	0	0	15	10	18	13	8	11	11	18	1	1	0
Zone -4	254	21	0	1	15	30	30	26	31	26	44	24	4	2	0
Zone -5	167	17	0	3	16	16	28	21	12	13	21	16	2	2	0
Zone -6	119	11	0	3	8	7	11	13	13	5	24	19	4	1	0
Zone -7	172	23	0	3	19	14	25	16	17	13	19	15	5	3	0
Zone -8	125	9	1	3	14	14	24	9	11	16	10	11	2	1	0
Zone -9	156	15	0	6	19	15	19	11	19	10	22	15	4	1	0
Zone -10	214	11	0	2	20	28	39	20	26	10	31	23	3	1	0
Zone -11	244	26	0	1	19	35	49	28	23	11	30	17	4	1	0
Zone -12	209	27	0	4	26	34	27	19	12	16	28	6	9	1	0
Zone -13	82	5	0	0	6	8	13	13	7	8	10	9	2	1	0
Zone -14	188	26	0	2	17	15	21	19	18	11	20	31	5	3	0
Zone -15	144	13	0	3	10	24	27	11	7	12	16	12	6	3	0
Zone -16	168	20	0	7	20	24	14	15	10	7	19	23	6	3	0
Zone -17	168	18	0	5	31	17	24	21	11	8	13	14	3	3	0
Zone -18	129	21	0	2	19	14	21	10	11	3	14	11	2	1	0
Zone -19	88	18	0	3	14	7	15	11	3	3	9	3	2	0	0
Zone -20	68	7	0	2	9	10	8	6	6	6	6	6	1	1	0
Zone -21	143	31	3	9	19	22	21	7	5	5	14	6	0	1	0
Zone -22	102	17	1	6	12	11	21	8	10	4	5	7	0	0	0
Zone -23	44	1	2	1	4	6	10	3	1	7	7	1	0	1	0
Zone -24	41	9	0	6	9	3	8	2	0	0	3	1	0	0	0

**Table 4 Kwajalein and Majuro Atolls HH Income and Water Catchment Size**

Income	Catchment Size						
	Total	0	351 to 799	800 to 999	1000 to 4999	5000 to 9999	10000 +
Total	4,652	1,963	355	162	1779	219	174
No Income	25	7	4	1	8	3	2
Less than 1000	17	13	1	0	2	1	0
1000 - 2999	102	57	8	5	30	2	0
3000 - 4999	428	207	41	20	146	8	6
5000 - 6999	481	246	36	13	157	17	12
7000 - 9999	655	331	46	23	222	21	12
10000 - 12999	472	218	44	15	157	26	12
13000 - 15999	385	158	30	16	153	15	13
16000 - 18999	331	140	27	10	134	8	12
19000 - 29999	639	224	58	26	280	31	20
30000 - 49999	500	119	23	22	252	44	40
50000 - 69999	98	19	2	0	53	13	11
70000 and Over	56	9	1	1	33	7	5
Not Reported	463	215	34	10	152	23	29

Source: Water Survey 2009

Of the 1,309 homes, on Majuro identified in Table 5 below, as having no water catchment 51% (669 households) of these households reported earning less than \$10,000 annually. Of the 1,309 total, 68.7% (899 households) of households with no reported water catchment earn less than \$16,000 annually. Given the extremely high levels of household and consumer debt in the RMI, combined with the average retail costs of \$1,200 - \$1,400 for a 1,500 gallon water catchment system, this type of purchase would require some type of financial intervention from government and/or donors. 13.4% of households on Majuro that had no reported water catchment were not matched with any income grouping.

In Table 5 the smaller water catchment category (351 – 700 gallons) 41.6% (131 households) of the 315 identified were with homes that earned less than \$10,000 annually. Additionally a total of 62% households in this category are in household earning under \$16,000 annually. The percentage of homes without water catchments in each of the income groups does not begin to decline in a significant manner until after the \$10,000 level. Based on the survey findings households earning under \$10,000 certainly appear to be more likely to face problems with household water storage. Considering debt and retail costs for such equipment, the level of household income appears to make a difference, meaning the lower the income the more likely the household is to have either none or inadequate household water storage.

**Table 5. Annual Income by Total Capacity of Catchment (in gallons), Majuro 2009**

Income	Total Capacity (in Gallons)							
	Total	0	% hh w/o	351 to 799	800 to 999	1000 to 4999	5000 to 9999	10000 +
Total	3,620	1,309	36.2%	315	155	1510	184	147
No Income	24	6	25%	4	1	8	3	2
Less than 1000	7	6	85.7%	1	0	0	0	0
1000 - 2999	82	43	52.4%	8	4	26	1	0
3000 - 4999	390	178	45.6%	40	20	138	8	6
5000 - 6999	414	193	46.6%	35	13	146	16	11
<b>7000 - 9999</b>	<b>537</b>	<b>243</b>	<b>45.3%</b>	<b>43</b>	23	197	20	11
10000 - 12999	344	132	38.4%	36	15	134	16	11
<b>13000 - 15999</b>	<b>291</b>	<b>98</b>	<b>33.7%</b>	<b>28</b>	14	131	10	10
16000 - 18999	239	77	32.2%	23	9	113	7	10
19000 - 29999	431	104	24.1%	44	26	214	26	17
30000 - 49999	347	41	11.8%	19	20	201	37	29
50000 - 69999	70	7	10%	2	0	41	13	7
70000 and Over	42	6	14.3%	0	1	24	6	5
Not Reported	402	175	43.5%	32	9	137	21	28

Source: Water Survey 2009

On Kwajalein (Table 6) the same pattern exists, the lower the income level the more likely the household is to be without household water storage. However the situation on Kwajalein is much more severe in terms of the number of households that do not have water storage. Given the congestion on Ebeye innovative approaches would be required to achieve universal provision of water catchments. In addition congestion would also mean the size of the water catchments would likely have to be smaller than units used on Majuro and the Outer Islands.

**Table 6. Annual Income by Total Capacity of Catchment (in gallons), Kwajalein 2009**

Income	Total Capacity (in Gallons)							
	Total	0	% hh w/o	351 to 799	800 to 999	1000 to 4999	5000 to 9999	10000 +
Total	1,032	654	63.4%	40	7	269	35	27
No Income	1	1	100%	0	0	0	0	0
Less than 1000	10	7	70%	0	0	2	1	0
1000 - 2999	20	14	70%	0	1	4	1	0
3000 - 4999	38	29	76.3	1	0	8	0	0
5000 - 6999	67	53	79.1%	1	0	11	1	1
7000 - 9999	118	88	74.6%	3	0	25	1	1
10000 - 12999	128	86	67.2%	8	0	23	10	1
13000 - 15999	94	60	63.8%	2	2	22	5	3
16000 - 18999	92	63	68.5%	4	1	21	1	2
19000 - 29999	208	120	57.7%	14	0	66	5	3
30000 - 49999	153	78	51%	4	2	51	7	11
50000 - 69999	28	12	42.6%	0	0	12	0	4
70000 and Over	14	3	21.1%	1	0	9	1	0
Not Reported	61	40	65.6%	2	1	15	2	1

Source: Water Survey 2009

## **10. Conclusions and Recommendations**

### **1. There is a critical need for more household water catchments based on the increasing levels of water borne illness reported on Majuro and Ebeye.**

After this project there will be 1,463 homes remaining on Majuro and Kwajalein (does not include Mejatto and Ebdon islands on Kwajalein) without water catchments. Based on current project costs this will require at least \$1,500,000 for the remaining material and equipment and funds to support logistics and installation. Considering that the government is spending approximately \$700,000 annually to treat the effects of water borne illness this looks to be an efficient expenditure.

The government should take a view of using some portion of existing capital budgets from the Compact and Taiwan and use that amount as a match to try and induce additional donor funding. This could be done over a 2 – 3 year period to take into account fiscal and installation realities. If some time is put into some project design and planning this type of public works project could be viewed as an economic stimulus activity putting several dozen unemployed people for several months or longer. Two million or more dollars pumped into the local economy through increased local retail activity, increased consumer activity and putting some paychecks into lower income households would be worth consideration.

Are you aware that for every \$20,000 that is expended on vehicles or other discretionary budget items, the opportunity cost results in 20 water catchment systems helping to provide access to water for 165 people?

In addition, other work should be considered on the outer islands. After the Outer Islands Water Project halted in 2004, Jaluit Atoll was identified as having approximately 60 households in need of a water catchment. Upon completion of the Jaluit listing in August – September 2009, the actual number was over 100 households in need of a water catchment. It is likely that this type of issue exists on many of the outer islands. If so this will also require additional financial resources. Because of the cost and availability of transportation it would probably prove to be more cost effective and efficient to wait until the next RMI Census covers all of the outer islands so a better picture of household water situation can be produced. This would allow for a more comprehensive financial and strategic solution

### **2. Conduct review of existing gaps in provision of current Public/Preventative Health model and ability of government to provide water in extended dry periods or other emergency situations.**

Since 1999 the Republic of the Marshall Islands has gone through four extended dry periods. During this time (until end of 2006 – the latest health data available on water borne illness) there have alarming increases in the reported levels of gastroenteritis on Majuro and Ebeye. In addition in 2006 there was a typhoid outbreak on Majuro and in 2008 over 2,000 cases of Pink Eye as a result of households not having enough water for sanitary purposes. Provision of the cure is becoming very expensive, need to look at prevention in areas of water and sanitation has arrived.

With Majuro increasing from 3,080 households during the 1999 Census and 3,620 households now, how can we respond in an emergency, say an extended drought, typhoon, and fire or wave action? If the disaster preparedness situation was difficult with 3,080 households during the 1998 El Nino, what would happen now? What is the status and availability of local emergency equipment and capacity? Will disaster response system be up to the task? This is an area that needs review, recommendations, plans and action.

A review needs to be undertaken examining the current ability to respond to water related emergencies or ability to distribute water under emergency conditions. What are the gaps concerning equipment, water making, water distribution, needs for outer islands, urban areas, information and awareness raising. What are the costs to close these existing gaps? Again, the more preventative action that occurs in the near future the less costly it will be when a real emergency strikes.

### **3. The need to pay attention to environmental health and its effects on the community through the use of better surveillance methods, particularly with use GIS systems.**

The newly updated house listings and GIS maps should be utilized to better monitor public and environmental health.

A public and environmental health surveillance system or process needs to be created and established, so health professionals and environmental officials can better monitor, act and react to public health events in a timely manner, before becoming a health emergency. CDC has made too many recent visits to the RMI because of issues dealing with cholera, measles and typhoid – these are all preventable. Not to mention the various alarming reports from Hawaii and the US mainland about the poor health of many new ri-Majol immigrants.

- Improve disease and public health surveillance programs with help of GIS systems that are currently in place at RMIEPA and EPPSO;
- Reform RMI public health model, water and sanitation activities and monitoring of water and sanitation improvements are needed;
- Need to better understand the effects of increasing urbanization and what that means for public and environmental health planning. Availability of water and sanitation for increasing population, economic activity and tourism.

This will involve training of health staff to use and work with GIS and statistics. During intake and after diagnosis by health staff, aerial maps can be marked to show where the person lives and could reveal patterns, leading to a quicker reaction and development of solutions by health or environment officials.

Some ideas that need to be discussed are the need for fully staffed public health clinics in Laura and possibly Rita, services need to be accessible to people and not just at the hospital. Mobile public health clinics could be used and in addition rat/vermin control needs to become an element of the system. These are activities that are being used in other Pacific islands. Having activities centralized at the hospital is not working for public and preventative health. Those who believe otherwise need only to review the data.

### **4. Improve and Increase level of public awareness and basic public health education concerning water and other preventative health issues**

This goes directly to the public health model that is being used in the urban areas. While there is good information in the newspaper and on the radio, we cannot be naïve enough to think that this is satisfactory given the extent of the information problem. The 2007 Demographic and Health Survey pointed out that nearly 40% of households do not come into regular contact with either the newspaper or news from the radio. Many of these households are the ones who do not have electricity or water and they are the households that need to be reached with information. The MIJ runs about 2,000 copies a week, there are about 3,200 households on

Majuro and 1,100 on Ebeye. The crowded and increasingly troublesome urban water and sanitation issues are causing a lot of preventable public health and budget problems and the existing data supports this view.

A different approach is going to be needed to get more information on water, sanitation and other public health awareness, training and education activities into the hands of urban households. There are some ways for NGOs and the government to work together in some of these areas, so costs can be shared. The model can work is one that offers more direct intervention into households with public health nurses and NGOs bringing information and services directly to the people. This will help contribute to better public health policy, better preventative health programs and ultimately better RMI health and budget outcomes.

## **5. Expansion of Water Quality Testing Programs and Training Personnel in government and NGOs**

There are some provisions for this under the current EU/SOPAC water project as there is a definite need to expand the number of people who are trained as water quality officers, particularly in Majuro and Ebeye, where the large majority of the RMI lives. Expansion of this training to include Ministry of Health Public Health Nurses, staff from NGOs, local governments and community representatives will go a long way toward halting the increase in water borne illness and empowering communities and households to more vigilant about water conservation and water quality. Increasing the number of water quality officers would provide much more flexibility for the delivery of projects and programs, such collaboration between government, NGOs and communities would also be very attractive for donors.

During the course of the field, many of the surveyors reported they were repeatedly asked by households for more information, for ways they could improve or clean their water, how they could receive training and assistance. The demand for service in this area requires some attention and development of information and programs.

## **6. Creation of a National Water Office, Develop New National Water Policies and Operational Plans**

Effective development and management of water resources are essential for sustainable growth and poverty reduction and this office will provide national oversight on the various elements that define Integrated Water Resources Management (IWRM).

Overall, water resource management in the RMI is more non-integrated than it is integrated. While there is some cooperation among water related agencies, overall collective management remains weak. All organizations with direct and indirect responsibilities for water and waste water management and the network that connects them need development. The absence of a formal National Water Office (or equivalent entity) and a current water strategy is resulting in a relatively unclear future concerning water.

The establishment of the new National Water Office will make it easier for the government to coordinate important water programs, projects and technical assistance, very similar to the recent work carried out by the Energy Office and Energy Task Force

The RMI needs to pursue a number of measures to address these major issues and concerns and through the establishment of a National Water Office the following issues could be more effectively addressed:

- A new water resources strategy should be considered; one that ties together all of these

issues, addressing all water resources in all RMI regions (urban and rural), identifies a common vision and lays out simple, agreed-to objectives on how to move forward.

- Strengthening water resources management requires continued strengthening of the key organizations that are tasked with this responsibility. Across the board capacity building and institutional strengthening is required.
- Clarification of roles and responsibilities is another must to ensure that overlap, duplication and confusion are minimized.
- More effective vertical (from high levels of government all the way to community groups) as well as lateral (between agencies and ministries and civil society organizations) collaboration is required to champion water issues. This, however, requires one entity to serve as the catalyst and champion of integration.
- A legislative and policy review of laws and regulations governing water resources should be conducted so as to clarify the rules of the game and minimize conflicts.
- A multi-party water safety plan (or similar document) should be considered to help protect water assets and resources.
- A policy of inclusion must be taken with respect to the institute of traditional authority. More involvement and buy in from traditional leaders and landowners will only help establish integrated processes.
- Stronger emphasis must be placed on enforcement of and compliance with general rules and regulations related to water resources. This requires more involvement of local police forces.
- NGOs and civil society groups can sometimes add immense value to public initiatives and programs, as they are often more in tune with communities than are government organizations. As such, these groups should also be utilized more effectively, especially for outreach and awareness type activities.

## **11. Appendix**

### **Appendix 1 – Acknowledgement of Water Project Staff and Personnel**

#### **EPPSO and Water Project Staff**

Hemline Ysawa – GIS Maps, House listings & surveyor

John Henry - Data Processing & surveyor

Joyceline Melan – Statistician & Surveyor

Carol Neamon – Statistician & Surveyor

Maybelline Andon – Bing – Statistician & Water Survey Video Project

Augustine (Rudy) Rilang

Kayo Cotton – Ministry of Finance

Benson Langdrik - Ass't Water Project Manager & former DHS

Russell Langrine – Water Project Manager & surveyor

Carl S. Hacker – EPPSO Director

#### **Majuro Surveyors**

Helenson Motlok – former DHS

Hemity Dooley – former DHS

Nithia Kios – former DHS

Jelly Rubon – College of the Marshall Islands (CMI) Student

Banton Nathan – Majuro Water & Sewage Co. (MWSC)

Danovan Morris – Majuro Water & Sewage Co. (MWSC)

Ransen Hansen Jr

Erlain Milne – Office of Environmental Policy & Planning Coordination (OEPPC)

Netha Gideon – Ministry of Public Works

Whitney DeBrum – former DHS

Clinton Kattil – former DHS

#### **Kwajalein Surveyors**

Claudia Lanwi

Christopher Maika

Malolo R. Malolo

Summer K. Lanwi

Whitney DeBrum – Former DHS and Field Supervisor

Hemity Dooley – Former DHS

#### **Survey Data Processing**

Johnson Louis

Joshua Kattil

Ransen Hansen Jr.

#### **Majuro & Outer Islands Water Catchment Installation**

Junior Beio

Eski Anitak

Isai Latoir

Dan Langrine

Norris Joklur

David Clanry

Johnson Louis

Mark Thomas

Langrik Lang

Hone Morbe

Junios Louis

Nelson Andon

Ted Aikuj

# Appendix 2 Water Survey Form

WATER PROJECT SURVEY 2009

REPUBLIC OF THE MARSHALL ISLANDS  
ECONOMIC POLICY, PLANNING AND STATISTICS OFFICE

IDENTIFICATION																						
NAME OF ATOLL _____	<table border="1" style="margin: auto;"> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table>																					
ZONE/VILLAGE _____																						
HOUSEHOLD NUMBER . . . . .																						
GPS UNIT NUMBER . . . . .																						
GPS WAYPOINT NUMBER . . . . .																						
LATITUDE (N) . . . . .																						
LONGITUDE (E) . . . . .																						
NAME OF HOUSEHOLD HEAD _____	<table border="1" style="margin: auto;"> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </table>																					
CAMERA NO. _____																						
PHOTO ID _____																						

INTERVIEWER VISITS											
	1	2	3	FINAL VISIT							
DATE	_____	_____	_____	DAY <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td></tr></table> MONTH <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td></tr></table> YEAR <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td><td></td></tr></table>							
INTERVIEWER'S NAME	_____	_____	_____	INT. NUMBER <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td></td><td></td></tr></table>							
RESULT	1. Completed 2. Partly Completed 3. Refused 4. Vacant			5. Household Not Around 6. Other, Specify _____							
START TIME	_____	_____		TOTAL NUMBER OF VISITS <input type="checkbox"/>							
FINISH TIME	_____	_____									
TEAM SUPERVISOR				OFFICE EDITOR							
NAME _____				<table border="1" style="display: inline-table;"><tr><td></td><td></td></tr></table>							
DATE _____	<table border="1" style="display: inline-table;"><tr><td></td><td></td></tr></table>					<table border="1" style="display: inline-table;"><tr><td></td><td></td></tr></table>					

**Interviewer Introduction**

Hello, my name is \_\_\_\_\_, and I work for Economic Policy, Planning and Statistics Office (EPPSO). We are currently conducting a survey on Drinking Water in \_\_\_\_\_. This questionnaire has been prepared by EPPSO in conformity with the Statistical Act 1986, which protects the CONFIDENTIALITY of its contents. No individual or household will be identified in subsequent analysis. May I speak to an adult member of the household?

**Instruction to Interviewer: Please use blue pen and write the code in legible handwriting in the box/line provided for responses. "GOOD LUCK!!"**

Q1 to Q9 are to be answered by the respondent	
<b>Section 1. Demographic Question</b>	
<b>1. Name of Respondent</b>	_____
<b>2. Gender of respondent</b>	<input type="checkbox"/>
1 Male	
2 Female	
<b>3. What is your age?</b>	<input type="text"/> <input type="text"/>
<b>4. Type of family</b>	<input type="checkbox"/>
1 Immediate	
2 Joint/extended	
<b>5. What is the ethnicity or race of the hh member?</b>	<input type="text"/> <input type="text"/>
27 Marshallese	52 Japanese
30 Micronesian	54 Phillipino
41 Australian	65 USA
42 New Zealander	66 Other
51 Chinese	
<b>6. No. of People living in the house?</b>	<input type="text"/> <input type="text"/>
Male	<input type="text"/> <input type="text"/>
Female	<input type="text"/> <input type="text"/>
<b>7. State the number of people in the following age-groups live in the household most the year?</b>	
0 - 4 yrs .....	<input type="text"/> <input type="text"/>
5 - 9 yrs .....	<input type="text"/> <input type="text"/>
10 - 14 yrs .....	<input type="text"/> <input type="text"/>
15 - 19 yrs .....	<input type="text"/> <input type="text"/>
20 - 24 yrs .....	<input type="text"/> <input type="text"/>
25 - 29 yrs .....	<input type="text"/> <input type="text"/>
30 - 34 yrs .....	<input type="text"/> <input type="text"/>
35 - 39 yrs .....	<input type="text"/> <input type="text"/>
40 - 44 yrs .....	<input type="text"/> <input type="text"/>
45 - 49 yrs .....	<input type="text"/> <input type="text"/>
50 - 54 yrs .....	<input type="text"/> <input type="text"/>
55 - 59 yrs .....	<input type="text"/> <input type="text"/>
60 and over.....	<input type="text"/> <input type="text"/>
<b>8. How many members in the household are currently working (earning a paycheck) either part-time or full time?</b>	<input type="text"/> <input type="text"/>
<b>9. What is the total annual income for all members of the household?</b>	_____

Q9 to Q10 are to be answered by the respondent and by observation		
<b>Section 2. Building Status</b>		
<b>10. Type of Dwelling</b> <input type="checkbox"/> 1 Residential 2 Residential/commercial 3 Trailer 4 Condo/duplex 5 Apartment 6 Government 7 Community	<b>19. Gutter Condition</b> <input type="checkbox"/> 1 Fully working 2 Needs Repair 3 Needs Replacing	
<b>11. Year Building/House was Built</b> <input type="checkbox"/> <input type="checkbox"/> 1 2008                      7 1990-1986 2 2007                      8 1985-1981 3 2006                      9 1980 or earlier 4 2005-2001              10 Not applicable 5 2000-1996              11 Don't know 6 1995-1991	<b>20. Gutter Materials</b> <input type="checkbox"/> 1 Asbestos 2 Plastic 3 Other (specify) _____	
Q12 to Q28 are to be answered by mere observation if doubtful, ask the respondent		
<b>12. Construction Materials of the Outer/Outside Walls</b> 1 Concrete/Brick/Stone 2 Wood 3 Half concrete/brick/stone/half wood 4 Galvanized iron/Aluminum 5 Other (specify) _____	<b>21. Gutter Type</b> <input type="checkbox"/> 1 Half pipe 2 Rectangular 3 Other (specify) _____	
<b>Section 3. Roof</b>		
<b>13. Roof Materials</b> <input type="checkbox"/> 1 Asbestos 2 Tin/aluminum 3 Plastic 4 Concrete 5 Thatched 6 Other (Specify) _____	<b>22. Down Pipe Available</b> <input type="checkbox"/> 1 Yes 2 No    ➔ <i>If "NO" skip to Q24</i>	
<b>14. Roof Condition</b> <input type="checkbox"/> 1 Fully Working 2 Needs Repair 3 Needs Replacing	<b>23. Down pipe condition</b> <input type="checkbox"/> 1 Fully working 2 Needs Repair 3 Needs Replacing	
<b>15. Roof Slope</b> <input type="checkbox"/> 1 Flat (< 2.5") 2 Low (2.5" - 20") 3 Steep (>20")	<b>Section 4. Water Catchment</b>	
<b>16. % Tree Cover</b> <input type="checkbox"/> 1 No tree cover 2 25% 3 50% 4 75% 5 100%	<b>24. Water Catchment/Storage Tank Available</b> <input type="checkbox"/> 1 Yes 2 No    ➔ <i>If "NO" skip to Q29</i>	
<b>17. Roof capture</b> <input type="checkbox"/> 1 0%                      4 75% 2 25%                    5 100% 3 50%	<b>25. If Yes, capacity of Water Tank (in gallon)</b> _____	
<b>18. Gutter Available</b> <input type="checkbox"/> 1 Yes 2 No <i>If "NO" Skip to Q22</i>	<b>26. Down pipe connected to Storage Tank</b> <input type="checkbox"/> 1 Yes 2 No    ➔ <i>If "NO" skip to Q29</i>	
<b>27. Water Catchment/Storage Tank Materials</b> <input type="checkbox"/> 1 Concrete 2 Tin/aluminum 3 Plastic 4 Fiber glass 5 Barrel 6 Other (Specify) _____		
<b>28. Water Catchment/Storage Tank Condition</b> <input type="checkbox"/> 1 Fully working 2 Needs Repair 3 Needs Replacing		

Q29 to Q33 are to be answered by the respondent

**Section 5. Water Supply**

**29. What is the main source of Drinking Water?**

- 1 Public piped water
- 2 Rain catchment
- 3 Bottled water
- 4 Well
- 5 Other (Specify) \_\_\_\_\_

**30. Is water available (from your main source) throughout the year?**

- 1 Yes      ➔      *if "YES" Skip to Q32*
- 2 No

**31. How often do you most face scarcity of drinking water?**

- 1 Often
- 2 Sometimes
- 3 Not much

**Section 6. Household Characteristics**

**32. What is your main source of Fuel for cooking?**

- 1 Kerosene
- 2 Electricity
- 3 Gas/Propane
- 4 Wood
- 4 Other (Specify) \_\_\_\_\_

**33. What kind of toilet use by the hh member ?**

- 1 Flush toilet, inside dwelling
- 2 Flush toilet, outside dwelling
- 3 Water sealed
- 4 Pit latrine
- 5 Beach/bushes

**Roof Calculation**

Length (ft)	Width (ft)	Area (sq ft)

Comments

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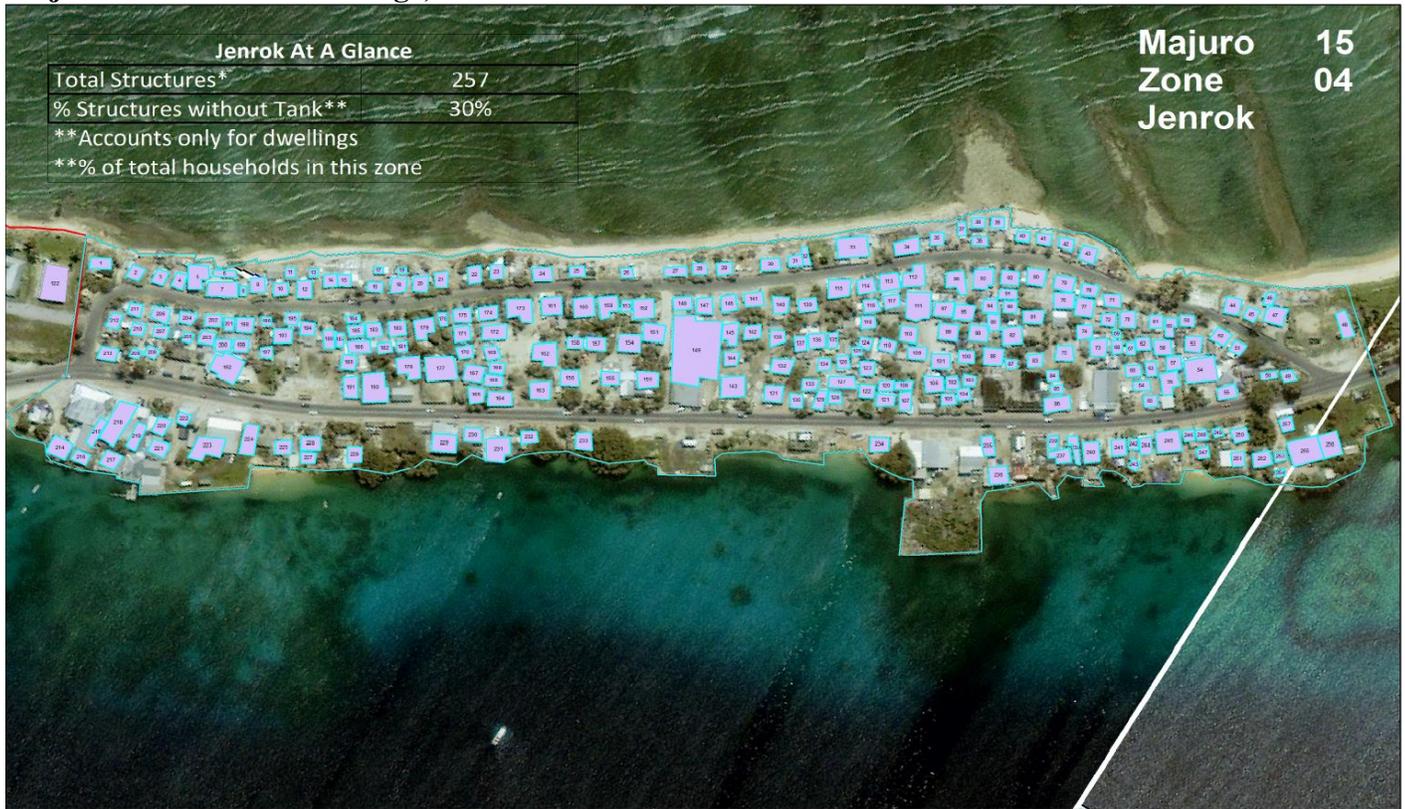
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### Appendix 3. Examples of updated GIS Maps for Majuro and Ebeye

#### Majuro Atoll – Jenrok Village, Zone 4



#### Majuro Atoll – Delap Village, Zones 8 & 9



# Kwajalein Atoll - Ebeye – Zone 11



# Kwajalein Atoll - Ebeye – Zone 7



## Appendix 4 - Outer Island Water Catchment Program

The following table summarizes the progress of the project from 2001 - 2004. During 2009, 173 1,500 gallon catchments were purchased as part of the EU/SOPAC Water Project. Catchments were delivered to Jaluit and Namdrik Atolls as well as Kili Island. Catchments still need to be delivered to Arno, Alinglaplap and Mili atolls under the EU/SOPAC Water Project.

The 2009 Jaluit House listing showed that there were 104 households that needed water catchments, not the 60 that was listed by the former Disaster Mitigation Office. 64 Catchments were delivered to Jaluit in 2009, but not to Jaluit and Jabwor islands. This situation is likely to be the same on Arno and Alinglaplap.

Location	FEMA Funded	RMI Funded	Canada Funded	Total	# Of Households 1999 Census	Catchments Outstanding
Lae	32	0	0	32	32	0
Ujae	57	5	5	67	67	0
Lib	15	0	0	15	15	0
Mejatto	41	0	0	41	41	0
Aur	86	0	0	86	86	0
Utrik	65	0	0	65	65	0
Mejit	60	0	0	60	60	0
Ailuk	70	9	9	88	88	0
Likiep	40	37	5	82	82	0
Namdrik	44	54	0	98	118	20
Ebon	120	2	0	122	122	0
Arno	221	0	0	221	244	23
Wotje	26	77	5	108	108	0
Mili	52	74	0	126	136	10
Maloelap	0	138	0	138	138	0
Jaluit	0	169	0	169	229	60
Jabat	6	4	5	15	15	0
Kili	24	47	0	71	90	19
Enewetak	30	79	0	109	109	0
Wotho	6	6	6	18	18	0
Kwajalein	26	68	0	94	94	0
Alinglaplap	0	224	0	224	236	12
Namu	35	92	0	127	127	0
Majuro (islets)	0	11	0	11	40	29
<b>TOTALS</b>	<b>1,068</b>	<b>1,096</b>	<b>35</b>	<b>2,187</b>	<b>2,360</b>	<b>173</b>
<b>Funding Totals</b>	<b>\$745,000</b>	<b>\$732,864</b>	<b>\$25,000</b>	<b>\$1,502,864</b>		

## Appendix 5 – Determining the Importance of Water



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### Determining the Importance of Water

#### I. Matrix of Problems and Critical Issues

<b>Problem Type</b>	<b>Evidence</b>	<b>Source</b>	<b>Relative Importance</b>
<b>Supply – demand Imbalance</b>	Majuro, Ebeye and Outer Islands, future trends	Population dynamics, per capita demand, climate change, overuse of lens water....	
<b>Level and quality of service provision</b>	Proportion of population now and in the future with no or inadequate provision of safe water, affordable irrigation supply, sanitation and waster water disposal; consumption per head, reliability of supply....	Shortage of investment funds; high rates for connections; rapid growth in urban areas; poor maintenance; shortage of funds for water treatment....	
<b>Inadequate Water quality</b>	Water quality indicators at key sites, incidence of water borne illness, rising cost of treatment by water users.....	Growth of polluting commercial activities; spreading urbanization; lax legislation, enforcement and penalties; poor irrigation practices; rising national and international standards....	
<b>Costs of future provision</b>	Unit costs of projected plans for supply, rehabilitation treatment, sewerage, compared to current and past levels, future costs relative to public investment budget; costs of environmental mitigation...	Exhaustion of easy options in the face of growing demand; insufficient examination of alternatives; insufficient demand management, poor cost recovery...	
<b>Inefficient use</b>	Performance measures such as system efficiency, economic value of water, spread of water efficient consumer devices, proportion of UFW in water systems...	Absence of incentives to conserve water, poor system maintenance, low pubic awareness of water situation, limited access to new technologies...	
<b>Growing conflict among users</b>	Competition for limited supplies, growing environmental stress, litigation over water	Growing imbalance of water supply and demand, absence of means to settle water disputes amicably or efficiently; failure of planning and forecasting...	

Source – IWRM and SOPAC

## II. Useful general indicators for the water sector could include:

1. Size of water intensive sectors in the national economy, agriculture, processing, commercial activity, water based tourism and recreation, sectors sensitive to environmental quality , such as health care;
2. Significance of agriculture and irrigation to national food security, GDP and exports;
3. Cost to the budget and public investment programs of providing and subsidizing water resources. Proportion of donor funds earmarked for water sector;
4. Relative importance of water related diseases in national health status, estimates of their economic and financial costs;
5. Balance of payments implication of water sector, debt servicing of water projects, cost of importing food due to internal water deficit, national and local food security, cost of using R/O equipment/operations to provide water;
6. Estimates of national economic costs of water pollution.

These general indicators should present the current situation and take a forward look to some relevant future dates, say 10 – 15 years ahead. This is especially important under the following conditions;

- Rapid population growth and/or urbanization;  
*1999 Majuro 3,080 households, 2009 4,333 households, from approximately 24,000 people to 33,000 people.*
- Where the balance among sectors is likely to change;  
*Demand on Laura water lens for agriculture and domestic use vs. transfer to airport reservoirs*
- Where changes in housing patterns and consumer tastes are foreseen;  
*Internal migration patterns, demand for western/processed food vs. traditional food*
- Where there is a large backlog of service provision to be made up or;  
*Only 25% - 30% of Majuro homes hooked up to MWSC. Results from current Water Survey yet to be analyzed*
- Where large investments in new supply, quality improvements, rehabilitation of systems and similar infrastructure needs are likely.  
*Need to repair sewage outflow pipe, can sewage services be extended, cost of repairs and rehabilitation, cost of airport reservoir expansion.*

## III. Identify Options

1. *Planning and analysis*

Examine data systems and analytical frameworks; this could include strategy documents, water resource assessments, data, monitoring systems, modeling or other research.

2. *Legal and institutional reforms*

Examine formation of management structures and regulations. These actions could include the reform of water and/or land legislation, agreeing on water quality standards and passing supporting legislation, the creation of new authorities or systems of coordination, empowering water user groups. Setting up regulatory framework.

3. *Economic Policies*

Aim at providing a suitable enabling environment for sustainable water use. General economic policies should be examined and adjusted to their effects on water (farming, food self-sufficiency, economic promotions, tourism). Specific incentives to persuade users to treat water as the scarce resource it is.

4. *Projects and programs*

Levels of support in the budget, information and education campaigns, programs to encourage water conservation and efficiency.

#### **IV. Formulate Water Strategy**

The following are some of the strategic examples that can be made;

- Inter sectoral priorities
- Self Sufficiency in Food
- Mode of Management
- Supply oriented and demand managed activities

#### **V. Define Implementation plans, policy management and monitoring plan**

The strategy provides the outline for the implementation of policy at different levels of administration. Policy management will benefit from the monitoring of policy actions, with cross references among objectives, consideration of priorities, time frames, responsible level and agency.

## **Appendix 6 Example of contents for an RMI Water Management Plan**

### **Taken from the Honolulu Board of Water Supply Master Plan**

#### **RMI Water Management Plan Overview**

- Ov.1 Authority and purpose
- Ov.2 Committee's mission
- Ov.3 RMI water management plan framework
- Ov.4 RMI water use and development
- Ov.5 Plan implementation

#### **Executive summary**

- Es.1 Introduction
- Es.2 The water management plan and the sustainable communities plan
- Es.3 The planning process
- Es.4 RMI – key facts and findings
- Es.5 Stakeholder consultations
- Es.6 Goals and objectives of the water management plan
- Es.7 Elements of the RMI water management plan
- Es.8 Implementation of the plan
- Es.9 Conclusions

#### **1. Overview of RMI hydrogeology**

- 1.1 Setting
- 1.2 Climate
- 1.3 Water cycle
- 1.4 Geology
- 1.5 Hydrogeology
- 1.6 Sustainable water resources

#### **2. RMI water profile (Majuro, Ebeye, Outer Islands)**

- 2.1 Introduction
- 2.2 Physical setting
- 2.3 Water resources
- 2.4 Terrestrial ecosystems
- 2.5 Cultural resources and traditional practices
- 2.6 Settlement history
- 2.7 Demographic characteristics
- 2.8 Land use
- 2.9 Stakeholder consultations
- 2.10 Implications for water planning

#### **3. Water use and projected demand**

- 3.1 Water use in RMI: Majuro, Ebeye, Outer Islands
- 3.2 Projecting future water demands – methodology
- 3.3 Three future scenarios
- 3.4 Two methodologies: *per capita* and end use inventory
- 3.5 Future water demand

- 3.6 Selected demand scenarios
- 3.7 Implications for water supply planning

#### **4. Objectives, sub-objectives, and strategies**

- 4.1 Objective 1: Promote sustainable water use
- 4.2. Objective 2: Protect and enhance water quality and quantity
- 4.3 Objective 3: Respect traditional and customary water management practices
- 4.4 Objective 4: Facilitate public participation, education, and project implementation
- 4.5 Objective 5: Meet future water demands at reasonable costs

#### **5. Water management projects and programs**

- 5.1 Water projects and programs
- 5.2 Project descriptions

#### **6. RMI Water management implementation plan**

- 6.1 Implementation plan
- 6.2 .RMI water supply – 15-year summary
  - Majuro
  - Ebeye
  - Outer Islands
  - Summary of assumptions

## Appendix 7

# Overview of National Integrated Water Resources Management (IWRM) Plans (From the Global Water Partnership)

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### Characteristics

Policies and decisions regarding water resources management flow are determined at the national level. National governments and water agencies influence international cooperation on transboundary water bodies and develop the national framework of policies, legislation and institutions within which water resources management at basin and sub-basin level takes place (See [A1](#)). Depending on basin boundaries and scales, nations are often part of international basins, such as seen in the Nile River Basin and Mekong River Basin. At the same time these nations have basins, which are fully within national borders and thus sub-ordinate to the national level. The boundaries of groundwater aquifers seldom coincide with those of the river basins. The management of such aquifers often requires collaboration across national river basin boundaries and in some cases international cooperation is required.

A National IWRM plan will be set within this geographical and political context, and will take into account all activities and developments requiring water or influencing the water resource. Among these are ecological requirements, water supply and sanitation, irrigation, land use and forestry, fisheries, hydropower and industrial use.

A good IWRM Plan includes a prioritised series of programmes for implementing the framework. The sequel to an IWRM plan is a development plan. Implementation of the management plan is a prerequisite for implementation of the development plan and ensures that the development takes place in a balanced fashion with due consideration of the national policies and strategies – operational aspects are explicitly addressed.

The formulation of a National IWRM Plan follows a distinct four phase approach:

- Identify the range of water resources issues that occur across the country and assessment of their severity, mutual dependence and frequency of occurrence. A "user requirement issue" results from an inadequate matching of user requirements (demand) and water resources availability and quality (supply) while an "impact issue" derives from human activities that negatively affect the quantity or quality of the water resource or from natural causes in the case of floods and droughts. International issues should also be taken into account, for instance upstream-downstream issues.
- Identify the management interventions at all levels – national, basin, local - necessary to address the issues identified. From the interventions required identify the management functions at each level. Management functions include such items as policy development, planning and coordination, water allocation, discharge regulation, monitoring, enforcement and information dissemination. Tran boundary problems may require concerted international interventions.
- Analyze the present institutional capacities at all levels – national, basin, local - potentials and constraints in the perspective of the issues to be dealt with and functions to be undertaken.

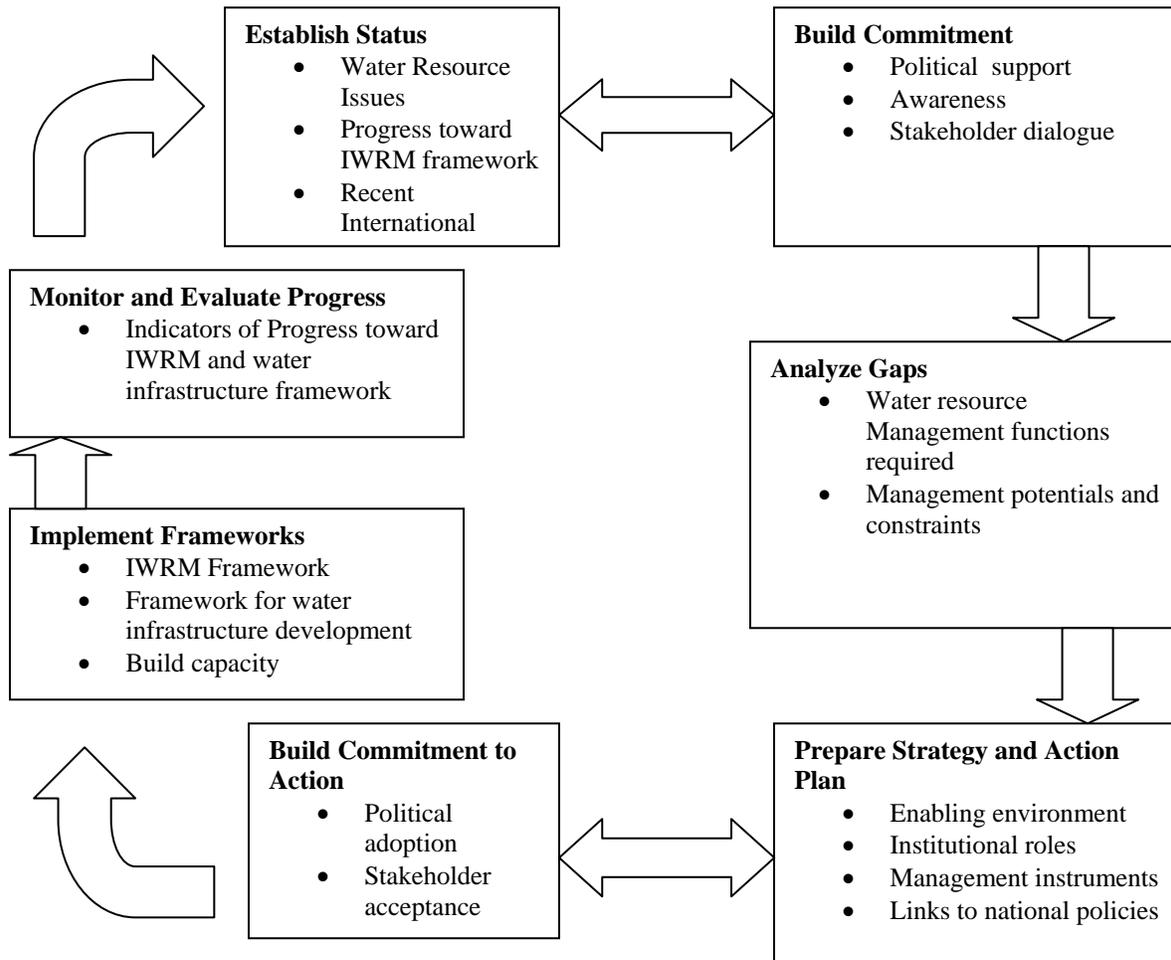
The capacities relate to factors such as efficiency of institutional structures and adequacy of human and financial resources and of policies and legislation. International structures and agreements may be required to supplement the national institutions.

- Prepare strategies for development of deficient parts of the framework of national policies, legislation and regulations for IWRM, for development of institutional roles that allow a coordinated implementation of IWRM and for development of the required management instruments and associated skills. International strategies have to be developed in collaboration with other riparian nations

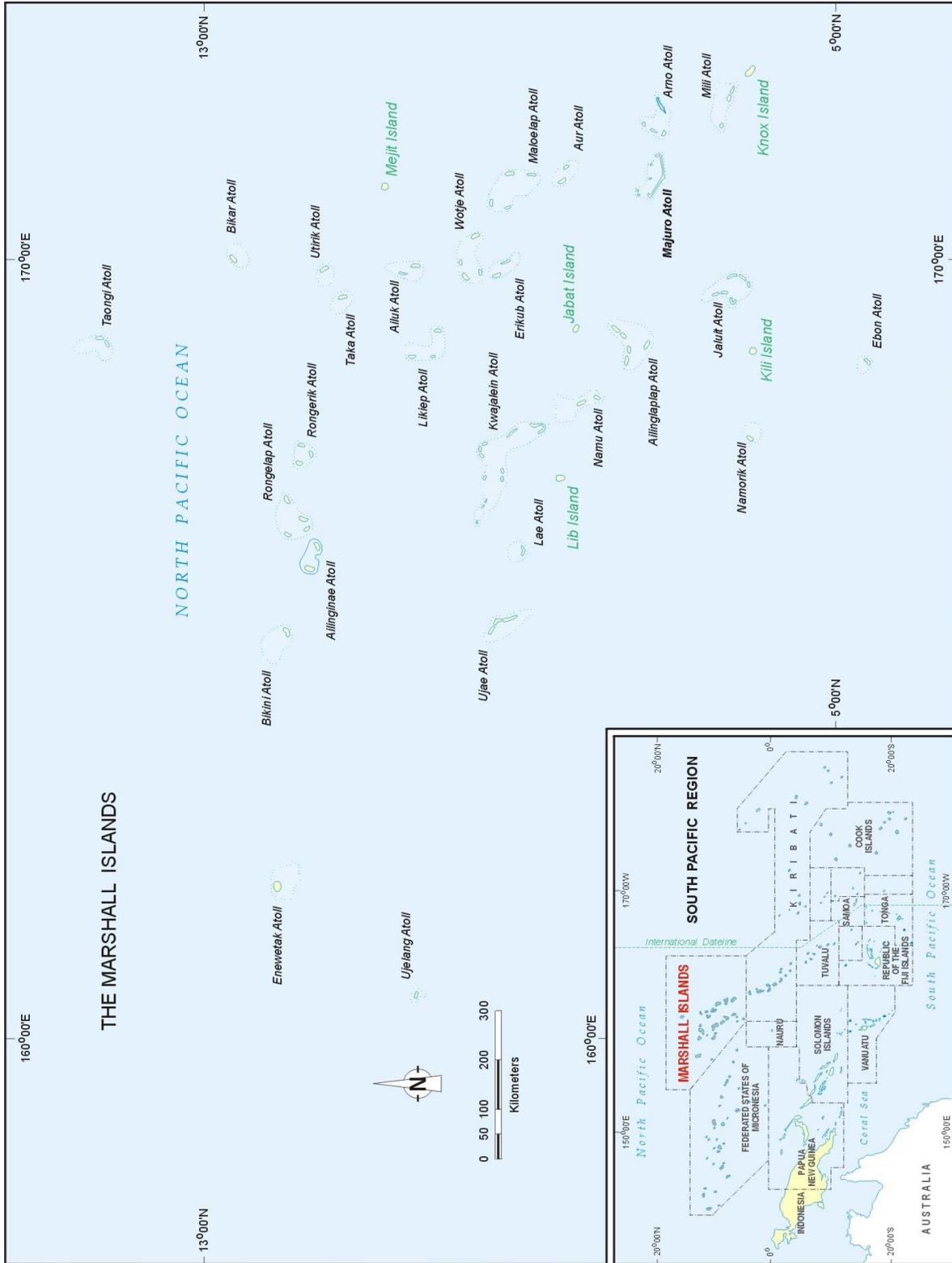
## **IWRM Lessons learned**

- A realistic IWRM Plan requires the design of functions, structures and procedures to take into account the financial and human resource constraints, the existing institutional structures, the management capacity and the capacity for change
- Structures should be designed as need arises and should be flexible enough to meet immediate needs and leave the possibility for expansion open whenever appropriate
- Multi-stakeholder involvement in the decision processes are essential for the acceptability of the outcome
- Ecosystem requirements and water quality management are often largely neglected but need to be given full emphasis in the planning process
- Decentralized water resources management is often part of water reforms but implementation is often constrained by central agencies' reluctance to share power and resources

# The Integrated Water Resources Management Cycle



# Appendix 8 – Map of RMI and Majuro Atoll



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