

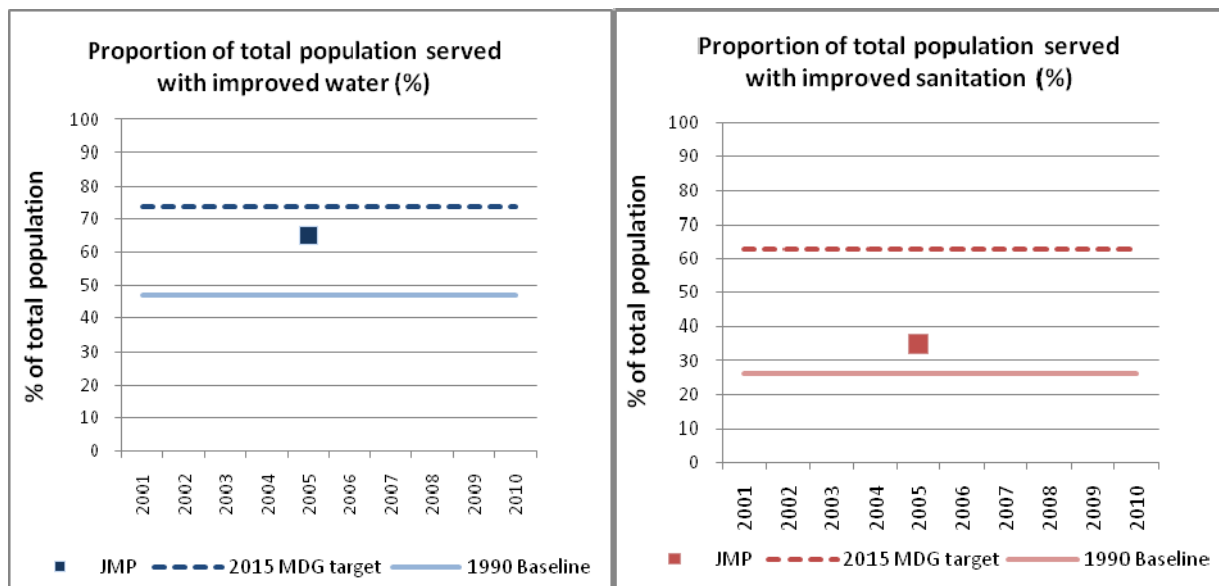
### Headline issues

- Severe water shortages threaten fast growing populations in South Tarawa and Kiritimati Island. Efforts are needed to manage both urban water supply and demand to ensure sustainability and equity as the urban population increases.
- Current rates of groundwater extraction from the freshwater lens are unsustainable.
- Inadequate sanitation is at crisis levels and pollution associated with sewerage systems and solid waste disposal threaten scarce water resources.
- Lack of capacity, especially in human resources, exists across the sector including in management, monitoring and evaluation and maintenance and operation of infrastructure.
- Climate change and sea level rise are expected to exacerbate existing stressors on water resources.

### Coverage and WASH related health statistics

According to WHO/UNICEF Joint Monitoring Program data,<sup>1</sup> 65% of the Kiribati population had access to an improved water source in 2005 (Figure 1). Sanitation coverage is worse, with only 35% of the population accessing improved sanitation in 2005, placing Kiribati below the regional average of 46%.<sup>2</sup> While these JMP figures are the best available, they should be interpreted with caution, as they are based on the 2000 national census and therefore out-dated.<sup>3</sup>

Figure 1: Access to improved water and sanitation



Source: WHO/UNICEF Joint Monitoring Program (JMP) (2010) data for 2008.<sup>1</sup>

More recent data from the 2005 national census found that almost 80% of rural people source their drinking water from open wells<sup>4</sup> (not classified as an improved source). This same source indicates that open defecation remained the most common form of sanitation across the country at that time.<sup>4</sup> Water supply is complicated by

the logistics of supplying water to 21 inhabited islands spread over 3 million km<sup>2</sup> of ocean.<sup>5</sup> There is no surface water on most of the islands and households rely on groundwater in the form of freshwater lenses.<sup>5</sup>

Water quality and scarcity are key issues in urban areas. Kiribati is facing severe water shortages from unsustainable over extraction of groundwater from the shallow freshwater lenses supplying growing urban centres. The Government recommends that piped water be boiled before consumption due to contamination issues from storage, backflow into the lines (caused by low pressure) and insufficient chlorination.<sup>5</sup>

There is significant scope to improve the efficiency of urban water supply systems, with losses in the form of non-revenue water estimated to be 50%.<sup>6</sup> Rainwater harvesting may also have potential to increase the supply of potable water in Tarawa, but the extent to which this could form a significant component of urban supply is uncertain. The Tarawa Water Master Plan released in 2010 indicates that raintanks have capacity to supply only 5L/person/day based on average household size and average roof catchment area without risk of excessive tank failures.<sup>7</sup> Furthermore, most i-Kiribati cannot afford the cost of rainwater tanks or are unable to meet the criteria to obtain a loan for a tank from the Kiribati Housing Corporation.<sup>8</sup> There is also some evidence that the i-Kiribati hold a cultural preference for groundwater over rainwater,<sup>9,10</sup> although in urban Tarawa many people prefer rainwater as a safer alternative to contaminated groundwater or even piped water.<sup>8</sup>

Sanitation in Kiribati is at crisis levels in terms of the risk it poses to public health and scarce groundwater supplies.<sup>11</sup> In the capital, South Tarawa, only 40% of the population is connected to the public sewerage system<sup>9</sup> which discharges untreated sewage through three outfall pipes to the southern side of Betio, Bairiki and Bikenibeu. The system is highly degraded and raises questions as to whether the introduction of this system has improved water quality.<sup>12,13</sup> The system's failure is reportedly due to insufficient maintenance, too few connections to households and the corrosive nature of the piped saltwater it uses which may have impeded the bacterial processes in the system.<sup>12</sup> The system was partially rehabilitated under an ADB-funded project, which was completed in 2008, however further improvements are strongly needed.<sup>14</sup> The Kiribati Housing Corporation has a loans scheme for householders on Tarawa wanting to construct toilets but its uptake has been poor.<sup>8</sup>

The remaining 60% of urban households and all rural households employ a combination of on-site solutions including improved pour-flush toilet (4%), pit latrines (8%) and most commonly toilets that empty directly into the lagoon or open defecation (75%).<sup>5,9</sup> On the outer islands there are no sanitation services and few septic tanks with open defecation and pit toilets being the dominant form of sanitation.<sup>5</sup> On-site septic tanks are often poorly maintained or insufficiently sealed and leak into groundwater.<sup>5</sup>

WASH related health indicators for Kiribati have improved slightly since 2000<sup>15</sup> but there remains need for significant progress (see Table 1). In 2002, 22% of under-five deaths were caused by diarrhoea, twice the East Asia Pacific regional average.<sup>16</sup> In the same year the national incidence of diarrhoeal disease was 776 people in 1,000.<sup>16</sup> Kiribati has one of the highest infant mortality rates in the Pacific region.<sup>17</sup> The rate of diarrhoeal disease is higher in South Tarawa than other parts of the country.<sup>18,19</sup>

**Table 1: Summary health statistics**

Infant mortality (deaths per 1000 births) <sup>20</sup>	46
WASH-related DALYs (% of all DALYs) <sup>21</sup>	7%
Total WASH related DALYs (Years) <sup>21</sup>	1,544
Total WASH related deaths per year <sup>22</sup>	44
WASH related proportion of deaths (%) <sup>22</sup>	6%

Sources: World Bank and WHO as shown in endnotes

## Finance trends

Current financing is insufficient to address the country's water and sanitation needs and the sector is financially dependent upon external development assistance to finance all major capital investments and for upgrading work on existing water and sanitation infrastructure.<sup>19</sup> Current planned donor investment total approximately US\$48M.<sup>6,23</sup> This includes contributions from the European Union (EU), New Zealand, the World Bank and most significantly the Asian Development Bank (ADB).<sup>6</sup> New Zealand is supporting a Betio and Bariki WASH improvement program and investing in solid waste management and rainwater harvesting.<sup>6</sup> The EU is providing funds for outer island water and sanitation projects.<sup>6</sup> The World Bank is continuing the Kiribati Adaptation Project to a third phase (KAP III),<sup>6</sup> with many of investments from the previous KAP II integrated into the Operational Plans of the Ministry of Public Works and Utilities (MPWU).<sup>18</sup> The ADB is supporting upgrading of sewerage infrastructure in South Tarawa through the Tarawa Sanitation Improvement Program.<sup>6</sup>

A lack of adequate cost recovery in urban and rural systems is identified by GoK as the key impediment to routine monitoring, maintenance and operations.<sup>19</sup> Due to the unreliability of the service, the piped water system on South Tarawa is not metered and households pay a flat monthly fee. In 2007, operation and management of existing water and sanitation capital was funded by Island and Urban Councils (US\$234,000), subsidies from central government (>US\$510,000) and external development assistance (US\$24,000).<sup>8</sup>

The GoK allocated only 2% of total government expenditure on infrastructure (including external support) to the water and sanitation subsectors.<sup>8</sup> Much of the MPWU's budget is expended on fossil fuels, requiring the government to subsidise water.<sup>7</sup> The current dependence on external partners for capital has created a disincentive for government to invest in maintenance and operation, as it is more rational for government to wait until infrastructure is at a point that it needs replacement, and hence external investment.<sup>8</sup>

Kiribati is not included in the Global Annual Assessment of Sanitation and Drinking-Water (GLAAS), which includes indicators for adequacy of funding. Further investigation of financing across different aspects of WASH service delivery would help identify levels of investment required to approach MDG targets.

## Sector governance

**Strategic framework:** The Kiribati Development Plan (2008-11) identified water supply, sanitation and sustainable water resource management as critical areas for the country's development.<sup>24</sup> Nevertheless organisation of the sector has been slow. Multiple government agencies have direct and indirect responsibilities there have been challenges achieving cooperation hampering sector coordination and accountability.<sup>18</sup> In response to this need, the EU-supported *Programme for Water Governance* (Pfwg) re-established the National Water Supply and Sanitation Committee (NWSSC) in 2007, previously established by the GoK in 1985.<sup>10</sup> The Committee is chaired by the Secretary of the Ministry of Public Works and Utility (MPWU), the designated lead national water agency in Kiribati.<sup>18,24</sup>

The 2008 Kiribati National Water Resources Policy (NWRP) and 10 year Implementation Plan (NWRIP) were first developed under the EU-funded *Programme for Water Governance* (Pfwg) and finalised under the World Bank-funded *Kiribati Adaptation Program Phase 2* (KAP II). The Kiribati National Sanitation Policy (NSP)<sup>17</sup> and 10-year Implementation Plan (NSIP)<sup>25</sup> followed in 2010.

**Land tenure and zoning:** The issues of water supply, sanitation and land ownership are highly inter-related in Kiribati.<sup>17</sup> Traditionally, land ownership has implied ownership of the groundwater.<sup>186</sup> However, individual land use activities and sanitation practices threaten to contaminate scarce freshwater supplies used by whole communities. The government (via the Public Utilities Ordinance (PUO) which establishes the Public Utilities

Board (PUB)) is therefore challenged with educating people on responsible practice, a difficult task given the existing tensions with landowners and backlash surrounding water reserves, legislation, zoning and links to water use and management.

**Community engagement:** Communities are spread across disparate islands and often rely on the government for service delivery. There are currently limited mechanisms allowing communities to participate in planning and management of communal water supply and sanitation services.<sup>24</sup> The National Water and Sanitation Policies prioritise community engagement and recommend the formation of village level committees to empower communities to manage their own resources and services.<sup>24,17</sup> The i-Kiribati hold strong cultural views on acceptable sanitation practices,<sup>17</sup> and consultation in sanitation system design is of critical for uptake. There is also a general lack of understanding of water quality issues.<sup>26</sup> The involvement of village communities in the protection and management of their water sources is essential in managing the nation's widely dispersed water resources.<sup>19</sup>

Kiribati's non-governmental organisation (NGO) sector comprises mostly local NGOs and is coordinated through the Kiribati Association of NGOs (KANGO), which began operating in 1986. The government, including the MPWU has been reluctant to share information with the NGO sector but donors are increasingly engaging and consulting with NGOs in developing projects for communities.<sup>10</sup> For example, representatives from NGOs were involved during Phase I of the Kiribati Adaptation Project. However, the NGO sector has not traditionally been invited to participate in the larger multi-sectoral committees whose membership is limited to Government representatives e.g., The National Climate Adaptation Steering Committee.<sup>10</sup>

**Regional cooperation** Kiribati is a signatory of the *Pacific framework for action on drinking water quality and health*, signed in 2005. In 2006 Pacific leaders agreed that the water, sanitation and hygiene challenges facing the region should be critical priorities of the Pacific Plan and directly addressed through implementation of the Pacific Regional Action Plan on Sustainable Water Management (RAP).<sup>27</sup>

## Subsector governance

In the following sections urban and rural populations have been distinguished based on population density. South Tarawa and Kiritimati Island are identified as 'urban' and all other island and atoll communities as 'rural.' It should be noted that the urban/rural distinction in Kiribati is unclear, with many areas considered to be 'urban' more peri-urban or semi-rural in character.

### Urban sanitation

The Public Utilities Board (PUB) within the Ministry of Public Works and Utilities (MPWU) is responsible for sanitation in South Tarawa, managing the central sewer system and operating a vacuum tanker for de-sludging its own facilities and on-site septic tanks for a fee.<sup>8</sup> The Ministry for Health and Medical Services (MHMS) oversees environmental health and health inspector services and the Minister for the Environment, Lands and Agricultural Development (MELAD) coordinates the environment, conservation initiatives and pollution management.<sup>17</sup> It is not clear what level of coordination of the sanitation sector occurs between these three agencies.

There is an urgent need to improve capacity and financing arrangements to provide sanitation facilities in densely populated urban areas. ADB reports that PUB and MPWU suffer from a shortage of skilled personnel to manage assets, and with sewerage services provided free to customers operation and maintenance is reliant on government transfers or external finance.<sup>28</sup> This has resulted in deferring maintenance until the system fails.<sup>28</sup>

Training and ongoing capacity building is required in all aspects of sanitation management including design, operation and maintenance of a variety of safe systems.<sup>29</sup>

The Kiribati Housing Corporation is charged with the provision and maintenance of the sanitary facilities for government houses,<sup>17</sup> but it is unclear what level of service is provided. The Water Supply Division is responsible for sanitation on Kiritimati, but in practice the organisation has no vacuum tanker to empty septic tanks.<sup>9</sup>

### Urban water

Forthcoming data from the 2010 census estimates the population of South Tarawa to be 50,000,<sup>6</sup> representing a significant portion of the national population. The city is situated on a land area of just 15km and suffers severe overcrowding.<sup>11</sup> Water supply for households connected to the piped network relies on treated groundwater pumped from infiltration galleries on neighbouring islands into water tanks or standpipes.<sup>30</sup> The supply is intermittent, sometimes limited to one hour per day<sup>13</sup> or several hours every second day.<sup>5</sup> Fewer than 65% of South Tarawa households are connected to this service and the number of connections is in decline due to dissatisfaction.<sup>5</sup> Private rainwater tanks provide supplementary water and most households have wells, which are used for non-potable purposes or as a stand-by source during periods of water shortage.<sup>8</sup>

The PUB provides water, sewerage and electricity for most of urban (south) Tarawa,<sup>30</sup> charging a flat rate for water and only a one-off sewerage connection fee. The Water Engineering Unit (WEU) within the MPWU is responsible for monitoring the groundwater quality of the water reserves (primary water sources) at Buota and Bonriki.<sup>9</sup> The PUB is completely subsidised by the government and an ADB review reported little evidence of accountability for service delivery and efficiency.<sup>14</sup>

Water supply on the island of Kiritimati is the responsibility of the Ministry of Line and Phoenix Development,<sup>30</sup> however there is a lack of legislative basis for water supply services operating in this growth centre.<sup>18</sup> All land on the island of Kiritimati is owned by the government, minimising the land tenure and zoning problems associated with water reserves found in South Tarawa.

The GoK has set targets to increase the number of households and public buildings with rainwater catchments by 15% by 2013 and 30% by 2018<sup>19,24</sup> and building permit regulations require tanks for all new domestic and public buildings, although this is not enforced.<sup>19</sup> Residents have insufficient resources to construct rainwater tanks large enough to store water during the dry season (which can last up to 10 months per year).<sup>13</sup>

### Rural sanitation

At the central government level the Environmental Health Division of the MHFP is responsible for water quality monitoring and the provision of sanitary facilities to villages, however, in practice its presence is limited.<sup>15</sup> Island Councils are responsible for providing outer islands communities with water and sanitation services but the Councils often lack the human and financial capacity to do so.<sup>10</sup> MHFP also provides outer islanders with subsidised bags of cement to construct pour-flush toilets.<sup>8</sup>

### Rural water

Untreated groundwater is the most common water supply in rural communities<sup>13</sup> and around 20% of rural households are connected to piped water (mainly on North Tarawa).<sup>16</sup> No treated water is available on the outer islands, although lower population densities mean that groundwater is less polluted than in South Tarawa.<sup>6</sup> Limited water quality monitoring is undertaken to confirm the results and Ministry of Health statistics indicate a high incidence of water-borne diseases for the outer islands.<sup>25</sup><sup>2</sup> Some communities benefited from communal

water pumping systems installed in the 1990s by UNDP,<sup>30Error! Bookmark not defined.</sup> however most of these are now in disrepair due to expensive replacement parts or designs that were unsuitable for the local conditions.<sup>15</sup>

The Water Engineering Unit (WEU) of the MPWU coordinates outer island water activities, water resource legislation and policy implementation, investigates new water supply schemes and leads the design and implementation of projects for outer island water supply projects.<sup>13</sup> WEU water technicians stationed on each outer island support the ongoing operation and maintenance of existing water supply systems.<sup>9</sup> Island Councils have by-laws related to public health and the protection of water resources, however many of these are outdated and were the product of the Colonial Administration.<sup>11</sup> Council Wardens are responsible for ensuring these by-laws are implemented within communities and thus undertake regular inspections of villages.<sup>8</sup>

As part of Kiribati's national goals and objectives for the outer islands, a 20-year water sector Roadmap was developed in 2004 as part of an ADB technical assistance project to provide milestones and targets for sector development in four key areas.<sup>18</sup> These include: (i) institutional arrangements and policy framework; (ii) water resource assessment and monitoring; (iii) community awareness, consultation and participation and (iv) water and sanitation development and management.<sup>18</sup>

The Government's *Policy on Outer Island Water Supply Systems* mandates a user fee of US\$2 per month paid to the Island Council. This revenue is expected to cover the ongoing operation and maintenance costs for pumps.<sup>9</sup> No revenue has been collected due to a number of factors, including limited consultation with communities during policy development and implementation as well as the communities' lack of trust in their Island Councils as gatekeepers of their fees.<sup>8</sup> The provision of outer island water supplies by UNDP in the 1990s was supplemented with training and the preparation of maintenance manuals written in both i-Kiribati and English;<sup>13</sup> however most of these systems are not in operation. The Government recognises that investments in rural and outer island infrastructure often fail due to insufficient training, low village ownership to community schemes (See Sector governance above) and inappropriate infrastructure.<sup>19</sup> A lack of engagement by the WEU with communities from the onset of designing and developing water systems has also been a contributing factor to lack of community ownership.<sup>8</sup>

## Health and hygiene

The Kiribati National Water Resources Policy identifies "the high rate of preventable deaths and illnesses due to water-borne diseases" as its number one concern for the sector.<sup>24</sup> The National Water Resources Implementation Plan sets national targets to reduce by 30% the number of diarrhoeal and dysentery cases from 2005 levels by 2013 and a 50% decrease by 2018.<sup>19</sup> The National Sanitation Policy (2010) outlines potential behavioural change programs for donors to finance. Aimed at the school and community sector, the policy provides a way of overcoming poor community awareness of hygiene issues.<sup>17</sup> The Ministry of Health monitors the cases of waterborne disease at the village level through their village clinics.

## Climate change and water resources

Primary responsibility for the sustainable management of Kiribati's natural water resources rests with the Water Engineering Section of MPWU. The *Tarawa Water Management Plan*, devised under KAP II, also assigns responsibilities to MELAD with regard to improved water quality management and monitoring. 22 of Kiribati's 23 inhabited atolls are small and low-lying, approximately 2km wide and <6m above sea level.<sup>13, 15</sup> The exception, Banaba, a raised coral island, reaches an elevation of 87m. The Government of Kiribati has produced climate change profiles for each of the atolls as part of KAP II<sup>31</sup> and KAP III, which is set to begin in September 2011 with a total investment of US\$10.8M over 5 years.



Freshwater lenses rely principally on precipitation for recharge and are therefore highly vulnerable to variations in rainfall. Rainfall varies between the wet northern islands and the chains that straddle the dry equatorial belt, which are susceptible to droughts lasting up to 16 months.<sup>15</sup> Consequently, one of the greatest short to medium threats of climate change is the decline in predictability of rainfall patterns,<sup>10</sup> which is expected to exacerbate the impact and regularity of droughts (See Table 2 for Vulnerability data). Kiribati's very shallow aquifers (often less than 2m) are also highly vulnerable to the effects of human caused contamination as well as climate change related sea level rise and saltwater intrusion.<sup>10</sup> Freshwater lenses on the most populated island (South Tarawa) are polluted by faecal matter from inappropriate sanitation practices, animal waste, graves in close proximity to wells etc. and are unsuitable for potable use.<sup>27</sup> Sea-level rise, coupled with variations in rainfall patterns, stand to exacerbate many of the existing stressors on water resources.<sup>32</sup>

**Table 2: Status of water resources and climate vulnerability**

Renewable water (ML/population) <sup>33</sup>	Not available
Overall Climate Vulnerability factor 2010 <sup>34</sup> <i>(on scale of acute, severe, high, moderate, low)</i>	High
Overall Climate Vulnerability Factor 2030 <sup>34</sup> <i>(on scale of acute, severe, high, moderate, low)</i>	Acute
Environmental Vulnerability Status <sup>35</sup> <i>(on scale of extremely vulnerable, highly vulnerable, vulnerable, at risk, resilient)</i>	Extremely vulnerable

## Donor environment

Kiribati has a long history of donor funding to support water and sanitation projects, mainly through Technical Assistance with limited focus on the socio-political structures that give rise to inequalities in access to water and sanitation services.<sup>36</sup> The GoK recommends that future project proposals are developed in response to the priorities outlined in the NWRP and NSP<sup>17, 24</sup> and briefs for these potential projects are included in the Background to National Water Resources Policy and Implementation Plan.

At the 2010 Development Partnership Forum, donors agreed to establish a coordination mechanism for the WASH sector which led to the formation of an umbrella program – the South Tarawa Program for improved Water, Sanitation and Solid Waste Management (ST WS&SW) – and a coordinating task force to allocate activities under existing donor-funded programs.<sup>37</sup> These programs include Kiribati Urban Development Programme (NZ), the Kiribati Adaptation Program (KAP) (World Bank) and the Sanitation Improvement Project (ADB).

Major donors in this subsector include AusAID, JICA, World Bank, NZAID, ADB and EU. The 2009 Pacific Region Infrastructure Facility (PRIF) Kiribati Infrastructure Sector Review found that during 2003-7 total donor reported funding for water supply infrastructure was US\$1.1M and sanitation infrastructure US\$149,000, with a further US\$1.2M for combined water/sanitation/solid waste projects.<sup>9</sup> The total figure for donor contributions is likely much higher, as between 2003 and 2005 the ADB Sanitation Public Health and Environmental Improvement (SAPHE) project alone invested more than US\$13M.<sup>6</sup> For both water supply and sanitation investments cited in the Sector Review, approximately 91% of assistance was for capital outlay and 9% for recurrent costs.<sup>9</sup> The EU-funded *Water & Sanitation Project* to improve water and sanitation for the outer islands of the Gilbert Group is due to commence in mid 2011 as a continuation of previous work financed by the EDF10.<sup>9,37</sup> The World Bank is overseeing the *Kiribati Adaptation Policy and Implementation Plan* (KAP) a multi-stage programme that receives funding from a host of donors. Seven out of the top ten priorities identified by KAP I were water and sanitation-related;<sup>18</sup> KAP II is due for completion in June 2011 and KAP III is expected to commence September 2011 with focusing on: i) improving water resource use and management (reticulated water supply and rainwater harvesting); ii) increasing coastal resilience and protection of community and public infrastructure; and iii)

strengthening the capacity of the Government of Kiribati, Islands Councils and local communities to manage the effects of climate change and natural hazards.

NZAID is leading the *Kiribati Urban Development Program (UDP)*, formerly the *Sustainable Towns Programme*, which includes a focus on the WASH subsector including the provision of rainwater harvesting facilities.<sup>37</sup>

Other donors active in the urban subsector include AusAID who funded the Kiritimati Water and Sanitation Project on Kiritimati island and the ADB's Sanitation, Public Health and Environment Project in Tarawa (SAPHE). Both donors include community education as an integral part to their water supply improvement work.<sup>27</sup> The ADB are also funding a 15-month consultancy to develop a water and sanitation roadmap and associated investment plans for South Tarawa and undertaking concurrent capacity building in government.<sup>5</sup>

SOPAC (Applied Geoscience and Technology Division of the Secretariat of the Pacific Community) launched its *Sustainable Integrated Water Resources and Wastewater Management Project in Pacific Island Countries* in Kiribati (2008-2013), including a Hot Spot Analysis and Demonstration Project. This program was designed to introduce concepts of integrated water resource management into governance structures at the national and local level.<sup>29</sup> As part of KAP III, the World Bank will incorporate a number of priority activities for water resource management and protection of the water lenses.<sup>37</sup>

UNICEF Pacific's Health and Sanitation programme (2008-12) includes WASH activities in the Solomon Islands, Kiribati and Vanuatu.<sup>16</sup> The main objectives for Kiribati are to focus on providing water supply and sanitation infrastructure in primary schools and households near schools and hygiene promotion.<sup>16</sup> An ADB report on its hygiene promotion activities in Kiribati stated that future work in this area should not underestimate the "fundamental conflict between... established customs and the relatively new behaviours needed to share and protect water resources and to sustain urban services".<sup>13</sup>

## Sector monitoring

The KWSSC reports to cabinet annually on progress towards the sector's two policies and the state of the nation's water resources,<sup>24</sup> however it is not clear what indicators are used or the degree of resources dedicated to this activity.

MPWU monitors water quality of the various wells in South Tarawa, however can only do so once a month due to budgetary constraints.<sup>37</sup> The Ministry of Health previously monitored the quality of piped (PUB) water, well water and lagoon water however, as of July 2010, microbiological monitoring ceased due to insufficient budget.<sup>37</sup> The Environment Division also undertakes environmental incident monitoring of pollutants that may impact the groundwater e.g., oil spills. The government will also track the link between water service provision and public health improvement using hospital and clinic databases and Environment Health Unit records on water-borne diseases<sup>24</sup> although it is expected that this is dependent upon continued capacity to conduct microbiological testing. No initiatives have been undertaken to involve local communities in water quality monitoring programmes.<sup>38</sup>

Hydrological monitoring is a priority focus area of the National Water Resource Policy and Implementation Plan<sup>19,24</sup> however, in practice there is insufficient data and monitoring capacity to facilitate sound water resource management.<sup>12</sup> In particular, the country lacks a mechanism to warn of the potential onset of drought and thereby trigger emergency water resource measures for urban or rural areas.<sup>9</sup> The Kiribati Meteorological Division conducts the country's longest national monitoring program with both upper air and surface observing systems in Tarawa.<sup>39,38</sup> Rainfall prediction in Kiribati is complicated by the fact that the islands straddle across a



vast area of the dry equatorial zone with distinct rainfall patterns. Improved climate monitoring and data gathering is proposed under the Kiribati Adaptation Project activities. On many of the outer islands there is no long-term record of climate data or limited capacity to analyse and interpret climate data. In the absence of long-term data, greater emphasis is placed on traditional knowledge.<sup>39,38</sup>

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- <sup>21</sup> Disability-adjusted life year (DALY) measures the years of life lost to premature mortality and the years lost to disability. Source: 2004 update of the Table 1 and Annex of the publication 'Safer water, better health', by Prüss-Ustün et al, WHO, Geneva, 2008. Available at [http://www.who.int/quantifying\\_ehimpacts/publications/saferwater/en/index.html](http://www.who.int/quantifying_ehimpacts/publications/saferwater/en/index.html) Accessed 24 June 2011.
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- <sup>34</sup> Source: Climate Vulnerability Monitor 2010 <http://daraint.org/climate-vulnerability-monitor/climate-vulnerability-monitor-2010> Accessed 24 June 2011. Countries are classified according to: ACUTE+, ACUTE, ACUTE-, SEVERE+, SEVERE, SEVERE-, HIGH+, HIGH, HIGH-, MODERATE, LOW. For information on included datasets and methodology for aggregation and categorising, see [http://daraint.org/wp-content/uploads/2010/12/CVM\\_Methodology.pdf](http://daraint.org/wp-content/uploads/2010/12/CVM_Methodology.pdf)
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