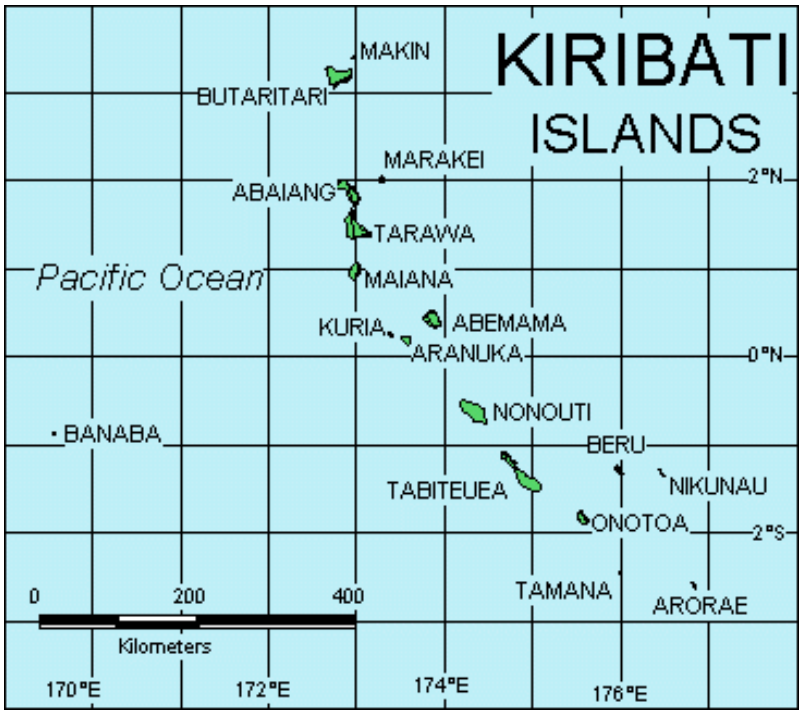
Republic of Kiribati

A PROPOSAL FOR LOW COST MEMBRANE FILTRATION TREATMENT OF DRINKING WATER IN BANABA, REPUBLIC OF KIRIBATI

MINISTRY OF PUBLIC WORKS AND UTILITIES
Betio, Kiribati

This proposal was originally prepared as part of the EU Pacific Water Governance Project and has been reactivated under the Kiribati Adaptation Project Implementation Phase II, KAPII, by Ian White, Australian National University. It has involved inputs from Mourongo Katatia and Moiua, Water Engineering Unit, Ministry of Public Works and Utilities, Kiribati, Tony Falkland, Island hydrology Services, Marc Overmars and Matthias Klepper, SOPAC, Magnus Moglia, CSIRO and Marella Rebgetz, KAPII.



Atolls and Islands in the most heavily populated Gilbert Group, Republic of Kiribati

1. Background

Small island countries (SIC) in the Pacific have very high incidences of water-borne diseases due to both the consumption of contaminated water and to flawed hygiene. The resultant rates of deaths and illnesses due to water-borne diseases in Pacific SIC are unacceptably high and have major social and economic costs. Water treatment methods to remove microbiological contaminants are readily available to treat drinking water to acceptable standards, such as chlorination, ozone treatment, UV sterilisation or reverse osmosis. Some are difficult to implement in SIC, particularly in outer island situations where problems in supplying chemicals or power or maintaining membranes can lead to intermittent treatment or failure of equipment. To be successful in SIC, treatment systems need to be as robust as possible.

2. Special Needs of Banaba

The island of Banaba (see Fig. 2) in the small islation nation of the Republic of Kiribati has no surface and minimal groundwater resources and is one of the few islands in the Pacific to totally rely on the capture of rainwater or desalination for the survival of its population of 300 people. A desalination plant installed during the 1998-2000 La Niña drought had had major maintenance problems and the outer island population cannot afford the diesel to run the plant.

As a former phosphate island under the British Phosphate Commission, BPC, Banaba was well supplied with rainwater catchment facilities. Over the years, these have fallen into disrepair. Banaba has an estimated 6 ML of stored water in large concrete rainwater tanks which are now exposed to the air. This has allowed green algae to grow in the water and it is not used. Banaba has now run out of potable water and the situation is desperate.

The purpose of this proposal is to use a low-cost, simple water treatment technology, Skyhydrant (www.skyjuice.com.au/downloads/skyhydrant.pdf) to treat the stored water and relieve the water needs in Banaba. This project is directly aimed at meeting the Millenium Development Goals for improving the supply of safe drinking water and is consistent with the draft Kiribatiti National Water Resources Policy and the draft 10 Year National Water Resources Implementation Plan.

3. The Skyhydrant Membrane Treatment System

Skyhydrant (Butler and Gock, 2006 www.skyjuice.com.au/downloads/skyhydrant.pdf) is a compact, high volume membrane filtration system designed for use in treating drinking water in developing nations and in disaster relief. Its Memcor filtration barrier is a microporous membrance that removes suspended materials down to 0.1 micron including bacteria. Protozoa, helmiths and some viruses. The highly portable Skyhydrant operates with as little as 1m hydraulic head and is capable of treating up to 10,000 L/day. The maximum design feed turbidity is 500 NTU and the typical turbidity of the product water is 0.1 NTU. A typical Skyhydrant unit is shown in Fig. 1

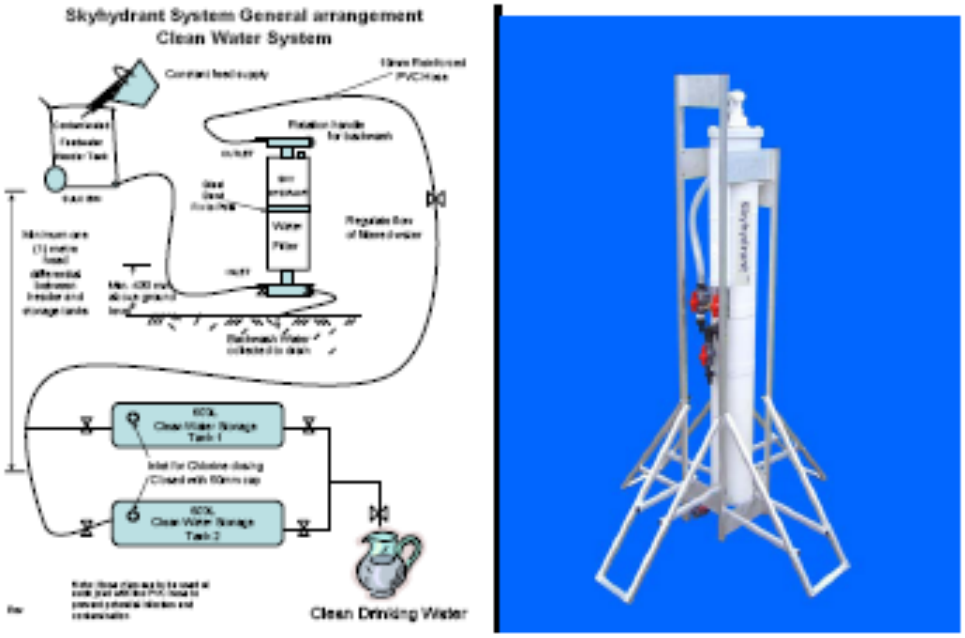


Fig.1. A typical configuration for the Skyhydrant unit (Butler and Gock, 2006)..

Skyhydrants have been installed in Sri Lanka, Indonesia and India. In India Ganges water with 79,000 cfu/100 ml was treated to 0 cfu/100ml. The secret of the success is claimed to be its simple membrane cleaning process. This involves a 90 second manual wash procedure carried out by the operator. The frequency of cleaning depends on the feed water turbidity and flowrate and can vary from every 1 to 2 hours to once every 12 hours.

4. Freshwater Supply in Banaba, Kiribati

The former phosphate mining island, Banaba (Fig. 2), the westernmost island in the Republic of Kiribati has particular problems with the drinking water (Overmars and Butler, 2001). Banaba, a raised coral island, relies almost totally on the collection of rainfall for its water supply. There, however, the sophisticated rainfall collection and storage scheme installed in the 1960's under the British Phosphate Commission is in urgent need of restoration (see Fig. 3). The population in Banaba was around 300 people in the 2005 census and they have distinct disadvantages due to infrequent shipping and water supply problems.

Banabans get freshwater from the rainfall collection system and from three large steel 4,500 m^3 storage tanks (see Fig. 4) filled with water shipped into Banaba during phosphate exporting. It also has a 10 m^3/day desalination plant although one of its two pumps has broken down. The rainwater harvesting scheme was designed in 1965 by the British Phosphate Commission. Water from groups of houses is gravity fed into a series of concrete storage tanks (see Fig. 3) that overflow into other tanks. Some of the roof rainwater harvesting schemes have failed. Water can be pumped from low tanks up to the highest point and the hospital. The problem is that the roofs covering these tanks have either been borrowed or have fallen in. Leaves and organic debris can now fall into the tanks and with sunlight algal blooms are present in the concrete tanks. People do not like drinking this water. In addition, the water in the large steel tanks (Fig. 4) is red from rust and is largely unused.

There are two issues in Banaba, the first is meeting the immediate water needs of the Banaban community by making current storages safe for drinking, the second is refurbishment of a well-designed rainwater system.

Fig.2. The island of Banaba, the western most island in the Gilbert Group, Kiribati.

Fig. 3 Ferrocement rainwater collection tank in Banaba with algal blooms resulting in unuse of the water (Photo Moiua, WEU, MPWU).

Fig. 2. Large 4,500 m^3 water storage tank (one of three) used during the phosphate exporting period from Banaba. These tanks were filled from water shipped in by the phosphate boats. There is still water in these tanks but it is red from iron oxides and people do not use it.

5. This Proposal

5.1 Project Goal and Objectives

The overall project goal is to:

Use a simple, low cost, low maintenance water treatment system for increasing the supply and safety of drinking water supplies in the small island of Banaba

The project objectives are to:

1. Train staff from the Water Engineering Unit, MPW&U and Banaba Island Council in the operation and maintenance of the Skyhydrant system.
2. Install the Skyhydrant system for purifying algal-rich stored groundwater in the Outer Island of Banaba, Republic of Kiribati.
3. Report on the results of the treatment trial.

5.2 Brief Project Description

5.2.1 Training Component 1

It is proposed to send staff from the Sydney Headquarters of Skyhydrant to the Water Engineering Unit Ministry of Public Works in Betio, Tarawa for one week's training on the operation and maintenance of the system.

5.2.2 Purchase of Equipment

It is proposed to purchase three Skyhydrant systems for Kiribati with two to go to Banaba and one to stay behind in South Tarawa for backup training purposes. These will be freighted to Tarawa. Suitably disinfected 5000 – 6000 L tanks will be used for feedstock and product water storage.

5.2.3 Training Component 2

As part of the South Tarawa training program, an Outer Island Water technician from Banaba will be brought to the Tarawa trial site to be trained along with WEU staff.

5.2.4 Banaba Installation

Two Skyhydant units together with associated storage tanks (5-6,000 L) and plumbing will be shipped to Banaba along with WEU technicians for instllation. Samples of water from the will be taken for future analysis. Water from the ferrocement rainwater tanks will be used as gravity feed for the Skyhydrant systems. A record will be kept of approximate flowrates and required frequency of cleaning.

5.2.5 Reporting

A report will be produced detailing the outcomes of the installation the units in Banaba.

5.2.6 Collaborating Agencies and Organisations

Water Engineering Unit, Ministry of Public Works and Utilities,
Environmental Health Unit, Ministry of Health and Medical Services,
Public Works Division, Ministry of Line and Phoenix Island Development
Rural Planning Unit, ministry of Internal and Social Affairs
Environment and Conservation Division, Ministry of Environment Lands and Agricultural Development,
SkyJuice Foundation, Sydney Australia
SOPAC
Australian National University