

**Demand Management and Conservation Project
Field Investigations
Solomon Islands Water Authority
19-30 May 1998**

Ed Burke and Harald Scholzel

SOPAC Miscellaneous Report 284

Funded by the Government of Taiwan

Acknowledgments

We would like to acknowledge the assistance of the management and staff of the Solomon Islands Water Authority (SIWA) during our visit. SIWA staff are always very enthusiastic in learning new techniques to assist in their work.

Introduction

The objective of the visit was to promote water demand management and conservation practices to reduce system losses and conserve water usage. This would result in reduced pumping and chemical operational costs as well as the elimination or deferral of capital costs. Field investigations were carried out to assess water usage and to train staff in demand management technics. Specific requests were made by SIWA to assist staff carry out step testing (a method used to assess water losses in targeted areas) and to advise on problems being experienced with the Auki water supply system on the island of Malita.

This report records the various activities carried out during the visit that focused on practical staff training. Two other technical reports will be prepared on the results of the demand management investigations and on the findings of the Auki water supply investigations.

Diary

The following is a summary of the people met and activities carried out by the SOPAC team while in the Solomon Islands.

19 May 1998 Tuesday

Arrived at Honiara's Henderson's International Airport at 1700 and was met by Chris Meriko from SIWA. We checked into the King Solomon Hotel.

20 May 1998 Wednesday

Met with the following SIWA staff to discuss and develop a program for the remainder of our visit:

Donald Makini, General Manager
John Waki, Operations and Maintenance Engineer
Lemuel Siosi, Design and Planning Engineer

In general we discussed issues dealing with demand management, Pacific Water Association, water distribution modelling (noting that a workshop was run for PWD, Fiji, the previous week) and drought analyses using monthly rainfall data (similar to what we are doing for Cook Islands and Fiji). SIWA staff were keen to peruse all of the above.

The following program was developed:

20-21 May:	step testing of the Vura water zone
22 May:	Demand Management and Conservation presentation to SIWA staff
23 May:	One-day workshop on hydraulic principles required for system modelling
25-26 May:	step testing of the East Kolaa-Naha water zone
27-28 May:	Harald and John to visit and assess Auki water supply
27 May:	Ed to meet with Water Resources Section, Environmental Health Dept. and Rural Water Supply and Sanitation (RWSS) Project

In addition to the above, all water supply sources for the Honiara area were visited and where possible pipe flows measured made to assess night flows (that indicate water losses) plus other step testing. Staff training in practical investigation methods, basic hydraulic theory and the use of the measurement equipment was a major objective of our visit.

Donald explained that an AusAID funded Infrastructure Team from the Snowy Mountain Engineering Corporation (SMEC) was currently working at SIWA on the first phase of a three-phase project. The team consists of at least six members some based permanently in Honiara and others visiting for weeks/months at a time. An AusAID review team arrived during our visit to review the project to see if the next phase will be funded. The SMEC team was advising on corporate management, engineering, leak detection, GIS using MapInfo and in community education programs.

Copies of UNDP reports relating to leakage control carried out in the early 1980s were given to SIWA staff along with a list of other water-related UN water sector reports held at SOPAC.

Harald instructed staff in the use of a hand held GPS gear. This type of information collection system would be most useful for GIS data entries and network distribution modelling. There is a possibility that SOPAC could assist in assisting SIWA in gathering this importing information.

Site visit to the East Kolaa-Naha and Vura areas. The Portaflow 300 flow meter was used to measure the flow from one of the outlets of the East Kolaa reservoir (450 m³) at 200 gal/min (15 l/s) which was consistent with the in-line water meter. SIWA staff was instructed in the use of the SOPAC Portaflow 300 flow meter.

Visited new European Union funded community water supply scheme that included a borehole source, 4500 m³ reservoir, chlorination plant and pipeline. However due to problems with test pumping the borehole sources the scheme remains dry. A Japanese funded borehole scheme (in the same area) is to pump groundwater into the main that supplies water to the Panatina reservoirs. However pumping of new boreholes adversely affect existing community sources by drying them up. Until agreement is reached with the community the borehole sources are not used.

21 May 1998 Thursday

Discussed and planned step test by getting existing plans showing pipeline and valves. Reticulation systems plans exist on GIS based on MapInfo. Using existing plans we went into the field to verify the existence and location of valves and if they were opened or closed. This was a very interesting and worthwhile exercise for some valves were buried and other valves thought to be open were closed. If the step test was attempted without verification much time would have been wasted looking for valves at night plus the results would have been meaningless if valve settings are not known as planned. Thus step testing forces water supply operators to become intimate with their systems. Also in places the pipeline plans were inaccurate and again this would affect step test results.

The Vura zone was step tested from about 11PM Thursday to 2AM Friday. Two tests were conducted on the east and west sub zones. Both zones are small in area thus flow rates were small as well.

The following SIWA staff participated in the step test:

John Waki	<i>Operations and Maintenance Engineer</i>
Lemuel Siosi	<i>Design and Planning Engineer</i>
Chris Meriko	<i>Senior Works Officer</i>
Moses Ramo	<i>Works Officer</i>
Dickson Misimae	<i>Plumber</i>
Willie Ladofoa	<i>Carpenter</i>

22 May 1998 Friday

Down loaded and plotted step test data that was earlier collected in the morning. Appendix 1 shows the resulting time-flow rate plots of the two tests. With such low flow rates it's difficult to distinguish actuarial water usage (ie a shower or toilet flushing) with system losses. However the exercise was most worth while from a training point of view in that SIWA staff became familiar with procedures and work involved in preparing for a step test.

A presentation on demand management and conservation practices was given in the afternoon. The object was to make staff aware of the principles and benefit of good demand management practices. Many of the practices have already been implemented by SIWA. However, indications are that water losses well exceed 50% in the Honiara area. A copy of the presentation slides is in Appendix 2 and the SIWA staff attended the presentation:

Donald Makini	<i>General Manager</i>
Doni Manning	<i>Assistant Accountant (Billing)</i>
Charles Siosi	<i>Assistant Accountant (Expenditure)</i>
Royden Samuel	<i>Chief Accountant</i>
Geoff Carlson	<i>Corporate and Finance Adviser and Team Leader (SMEC)</i>
Carolyn Marsh	<i>Community Education and Consultation Adviser (SMEC)</i>
Jon Fitzgerald	<i>Conservation Adviser (SMEC)</i>
Glen Pearson	<i>Engineering Adviser (SMEC)</i>
Lemuel Siosi	<i>Design and Planning Engineer</i>
John Waki	<i>Operations and Maintenance Engineer</i>
Bently Collin	<i>Manager Corporate Services</i>
Dereck Kodo	<i>Senior Technical Officer (Provinces)</i>
Chris Meriko	<i>Senior Works Officer</i>
Allan Lilia	<i>Technical Officer</i>
Byan Pitakia	<i>Technical Officer (GIS)</i>
Moses Ramo	<i>Works Officer</i>
Eric Unga	<i>Works Officer</i>
Lonsdale Manase	<i>Personal Officer</i>

23 May 1998 Saturday

At the request of SIWA staff a one-day seminar was held to review hydraulic principles basic to the design and modelling of water distribution systems. Staff actively participated using spreadsheet design aids developed by Harald.

The following SIWA staff participated in the seminar:

Donald Makini	<i>General Manager</i>
Lemuel Siosi	<i>Design and Planning Engineer</i>
John Waki	<i>Operations and Maintenance Engineer</i>
Dereck Kodo	<i>Senior Technical Officer (Provinces)</i>
Chris Meriko	<i>Senior Works Officer</i>
Allan Lilia	<i>Technical Officer</i>

Visited the White River intake that is the major water source for Honiara area. Water is both pumped to a reservoir for gravity reticulation to a series of seven other reservoirs. There is also a gravity pipeline located just before the pump station. The pumping rate was measured using the Portaflow meter at 104 l/s, which was consistent with the 300mm in-line water meter. The Portaflow was left logging flow for about a full day.

24 May 1998 Sunday

The Portaflow meter was removed for the pumping main at about 17:10 collecting about 24 hours of data. The meter was then attached to the 200mm diameter PVC gravity main after the pipeline was exposed by hand digging around the pipe. A flow rate of 49.3 l/s was measured. The meter was left on the main until the next day.

Thus the White River source was supplying over 150 l/s of water to the Honiara area. There was still a flow in river after the intake of a very rough estimated 100 l/s. Note that using a common domestic design demand rate of 250 liters/person/day the existing total abstraction would be enough to service a population of over 51,000. Current population of Honiara area is about 40,000.

Also note that a few years ago the White River intake flow drastically reduced by natural means. Thus this major water source for Honiara is susceptible to reduced flows. This should be concerted when planning for further development to the water supply system.

25 May 1998 Monday

A plan to step test the East Kolaa-Naha area was developed. The GIS unit (Byan Pitakia) produced a map of the area showing roads, houses, pipelines and valves. However due to an un-scheduled staff meeting the field location of the valves to be shut during the step test were not located thus the test was postponed until the next day.

The Australian GIS adviser showed us a demo copy of a pipe network modelling program call WASIS using Windows that we did not know existed. However we were unable to get a copy of the demo.

The Portaflow 300 flow meter was removed from the White River gravity pipeline that was measuring a flow of about 50l/s when removed at 17:25. A quick look at the data indicated a maximum flow rate of 56 l/s and a low rate of about 45 l/s. Thus it would appear that the unaccountable for water rate is about 80% from this system.

The Rove gravity system was the next location to install the Portaflow meter. It was installed at 19:15 on a 225mm diameter cast iron pipe downstream of the chlorination building. A flow of 14 l/s was measured.

26 May 1998 Tuesday

Removed meter from the Rove gravity system. The batteries ran flat at about 04:30 thus the mornings peak flow was missed but the minimum night flow was recorded. The Rove spring source was visited. The spring emerges from a large open area covered with water lilies and subject to surface pollution.

Recorded data from White River sources and from Rove was downloaded. The resulting graphs are discussed in the following section.

SIWA stores were visited and appeared to be well stocked to deal with routine pipe maintenance and for connections. However it is understood that there is a shortage of 15 mm water meters required to replace the estimate 1300 faulty installed meter.

Planned to conduct East Kolaa-Naha step test at night but one valve was unable to be located thus test postponed again.

27 May 1998 Wednesday

Auki Trip

Harald and Lemuiel travel to Auki to investigate possible improvements to the existing water supply system. They will return Thursday afternoon. A separate report will be produced on the findings of the investigations of the Auki water supply system.

Ministry of Energy, Water and Mineral Resources

Visited the Ministry of Energy, Water and Mineral Resources and briefly met with the Stephen Danidofea, SOPAC National Representative. Stephen was interested in our activities with SIWA. Also met with Donn Tolia, Director of Geology. Donn has worked closely with the Water Resources Division that was once under his responsibility.

Note that the Ministry is currently going through re-structuring review.

Met with Charlie Bepapa, Chief of the Water Resources Division, Ministry of Energy, Water and Mineral Resources. WASP has been providing support for this division over the last 4 years. We discussed the EU funded water supply project that facing problems with the groundwater source being able to supply water for the project. The existing project borehole have to be drilled to a deeper depth and is likely to producing less water than expected by the project report. The 40 l/s submersible pump-unit provided sucked the borehole dry after a few minutes pumping. Also it appears that pumping adversely affects the current water source that the community use thus this problem was be resolved as well. The current situation is that Charlie is waiting for a smaller pump-unit (already installed) to be connected to a power supply and switch board so a proper pump test may be carried out on the borehole. SIWA do not want to take over the water supply until everything is operating satisfactorily.

New Star data loggers (mainly for water level and rainfall) have been provided to the Division to replace the aging French loggers. However the new loggers are more sophisticated and training is required for the Division to install and use the new loggers. Training option include:

- The Australian supplier has offered to provide training but trainees must travel to Australia.
- Travel to NIWA in NZ for training.
- If NIWA agree, swap new loggers with ones already to function.
- SOPAC to assist

The first option will be to try to swap the loggers with NIWA that have developed the logger of water level and rainfall data collection. This may be the least cost option.

Ideally someone should travel to the Solomon Islands to train staff on site. For SOPAC to assist first we must become familiar with the logger ourselves.

Charlie will get back to us if NIWA cannot swap loggers.

Charlie specifically requested SOPAC to provide assistance in reviewing legislation currently being drafted on water resources. This is following on from an attempt by a UN specialist back in the 1980's to draft legislation. SOPAC are not experts on water resource legislation but would be happy to review any draft document.

Also met with Isaac Lekelalu, Hydrogeologist, regarding his work with groundwater resources. Isaac gave me a copy of a report on a recent borehole and resistivity measurement. David and Giovanni will comment on the report.

Rural Water Supply and Sanitation Project

Met with the following members of the AusAID funded RWSS Project:

- Robinson Fugui, Director of Environmental Health
- Mike Beauchamp, Project Coordinator/Australian Team Leader

The project has been running for about 2 years with about 100 rural water supply systems installed each year. Requests for sanitation systems have been much less. Villages must contribute to all phases of the work through cash and/or labour contributions.

I asked if it was possible to include nationals from other countries to participate in their national water and sanitation training programs. As long as there is room to accommodate others and that they have their own funding participation is possible. Mike is to send SOPAC the future training program. Mike was interested in getting copies of our Solar Pumping Workshop Report and Source Book. A copy of our Small Island Sanitation Guidelines was given to him at the meeting.

NZ High Commission

Met with NZ High Commissioner, Mr Ryes Richards. The Commissioner was briefed about SOPAC in general and specially about the Water Resources Unit activities. Ryes noted that only current involvement with the water sector was complementing the RWSS Project in providing water and sanitation education in the rural areas.

28 May 1998 Thursday

Met with Ms Freda Unusi, SIWA Community Education and Consultation Officer and Ms Carolyn March, Community Education and Consultation Adviser (SMEC) and discussed public education about the water sector. SIWA has a very active program including weekly radio programs and village visits plus the distribution of pens, mugs, rulers, bags, etc with SIWA logos and a conservation message. See Appendix ?? for some of the educational materials. I told Freda that SOPAC may be able to fund a small promotional task that could be used regionally.

Mataniko/Tuvaruhu Supply Area

Visited the Mataniko pumping station where SIWA have three boreholes each pumping about 10 l/s. The Portaflow X flow meter was tested on a 200 NB cast iron pipe at the main pump station that booster pumps the bore water to the Lower East Kolaa reservoir. The

Portaflow X gave no signal thus no flow was measured. The in-line meter was measuring 32 l/s.

Note that five Japanese boreholes also exist adjacent to the Mataniko River and the water is booster pumped to the Skyline Reservoir. However the scheme is not operated on a full time bases.

Panatina Supply Area

The Panatina water supply area was visited with John Waki. A flow rate of 14.3 l/s (measured from the in-line meter) was entering the two steel reservoirs (approximately 450 m³ each) origination from the Kombito Spring source. The water is chlorinated as it enters the storage tanks. We could not locate all the metered outlets from the tanks so we could let the outflows. About 2.5 hours later a flow in the 200 NB PVC main just downstream from the spring intake at 21.7 l/s using the Portaflow X meter. Thus between the intake and the storage tanks 7.4 l/s or about one third of the water is missing. It is understood that there are several standpipes taken of the 200 mm main to provide water to people living near the pipeline.

Dodo Creek Supply Area

Water is pumped from a shallow borehole direct into the reticulation main. The flow was measured with the Portaflow X meter at 1.7 l/s which is about the capacity of the pump-unit. The water is chlorinated upstream of the borehole. The water smelled of rotten eggs and the site was generally untidy. The metal clamp used to hold the submersible pump-unit in place was badly rusted and should be replaced as soon as possible. Other metal components of the supply also require attentions.

This water supply needs urgent attention including water quality testing for pH and hydrogen sulfide.

Step Test at East Kolaa-Naha Area

A step test was carried out on the East Kolaa-Naha area between 23:35 Thursday night to 02:00 Friday morning. Both the Portaflow 300 and Portaflow X flow meters were installed at the same location on 150 mm NB PVC pipeline in the inspection chamber of the in-line flow meter. The Portaflow X meter was consistently reading higher them the Portaflow 300 meter by about 3-5%. The resulting time VS flow plot is shown in Appendix ??.

Again the step test showed that some valves were thought to be open were closed as shown by an increase in flow at about 00:47 on the plot.

The following SIWA staff participated in the step test:

John Waki	<i>Operations and Maintenance Engineer</i>
Lemuel Siosi	<i>Design and Planning Engineer</i>
Chris Meriko	<i>Senior Works Officer</i>
Moses Ramo	<i>Works Officer</i>
Dickson Misimae	<i>Plumber</i>
Willie Ladofoa	<i>Carpenter</i>

The Portaflow 300 meter was left in place after the test was finished to enable the minimum night and maximum morning flows to be recorded.

The results of the step testing and minimum and maximum flows will be discussed in a separate report on demand management and conservation.

29 May 1998 Friday

Data collected in Auki and for the second step test was downloaded, plotted and discussed with SIWA staff. The Auki plots showed some interesting results on the operation of the scheme that will be discussed in a separate report.

A presentation was made to the SIWA General Manager on the Auki investigations and other matters such as the possibility of a 2-3 week fellowship for a SIWA staff member to come to the SOPAC office to further develop skills related to hydraulic design and modelling of water supply systems.

The Portaflow 300 meter was installed on the same 200 mm NB cast iron pipe at Mataniko where the Portaflow X failed to receive a signal. The Portaflow 300 measured a flow of 30.4 l/s compared to 33.3 l/s measured on the in-line meter.

30 May 1998 Saturday

SIWA staff took us to the Henderson International Airport from our hotel.

Departed Honiara at about 15:30 after a short delay.

Arrived in Nadi at about 19:30 and in Suva at 21:00.

Observations and Comments

Noting that two separate reports, one on Demand Management and Conservation and the one on the Auki Water Supply System will be prepared the following general observations and comments are made:

- 87% of the White River gravity supply appears to be unaccountable for (ie about 45 l/s).
- It appears that the White River pumping system continues to pump water into the Upper Tasahe reservoir after the reservoir is full thus wasting water and energy.
- At current measured flow rates from the White River Pump (about 104 l/s) and gravity (about 50 l/s) schemes, there should be enough water to supply over 51,000 people assuming a demand rate of 250 litres/person/day.
- Free flowing boreholes from the groundwater resource that is to supplement the White River supply when required should be stopped.
- The Auki water supply can be made to operate more efficiently.
- Step testing is beneficial in getting to know how your system operates as well as targeting areas of suspected high water losses.
- The Dodo Creek water supply needs upgrading.

Follow Up Actions

- Produce report on water demand management and conservation in the Honiara area.
- Produce report on the investigations into the Auki water supply system.
- Provide backup support for SIWA engineering staff.
- Seek funding for continued training in hydraulic design and modelling of water supply systems.

APPENDIX 1

VURA WEST ZONE STEP TEST AND NIGHT TIME FLOWS

APPENDIX 2
PRESENTATION ON DEMAND MANAGEMENT

APPENDIX 3

**FLOWS FOR WHITE RIVER PUMP MAIN AND WHITE RIVER
GRAVITY**

APPENDIX 4
FLows FOR THE ROVE GRAVITY SYSTEM

APPENDIX 5

EAST KOLAA-NAHA ZONE STEP TEST AND NIGHT TIME FLOWS

APPENDIX 6
EXAMPLES FOR EDUCATIONAL MATERIAL

