

SECTOR ASSESSMENT (SUMMARY): WATER SUPPLY AND OTHER MUNICIPAL INFRASTRUCTURE AND SERVICES (WATER SUPPLY AND SANITATION)

A. Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. **Water resources.** Most water supply systems in Palau rely on surface water sources, including the Koror–Airai water supply system, which relies on the Ngerikil and Ngerimel rivers. Babeldaob Island has 15 small water systems. One has a groundwater supply source while all the others use stream flow. Storage volumes in tanks and at the low head dams for stream intakes are small and not sufficient to substantially supplement stream shortfalls during dry periods. As a result, the stream sources must provide the system’s full consumptive use on a daily basis.

2. Experience since 1990 indicates that the reliable yield of the current water sources for Ngerikil and Ngerimel rivers is substantially less than the current demand of 3.8 million gallons/day¹ in Koror and Airai. Stream flow analysis indicates the reliable yield of the existing Koror–Airai water supply system is approximately 1.0 million gallons/day during a 25-year drought (a drought that is expected to occur once in 25 years). Disruptions to the water supply, affecting approximately 14,000 people, are experienced during severe droughts, as in 1983, 1997, and 2003. The government is concerned that the frequency of severe droughts may increase due to climate change, and has identified the need to improve water supply security for the Koror–Airai area.

3. **Anticipated water supply shortfall.** Demand for water from the Koror–Airai water supply system is rapidly approaching the water production capacity which is forecast to increase to 4.4 million gallons/day by 2020. The existing production capacity of the Koror–Airai water supply system is 4 million gallons/day. Demand for treated water will exceed supply by 2015 unless measures are implemented to reduce system losses and the high per capita demand.²

4. **High water use.** The Koror–Airai water supply system produces an average of 3.8 million gallons/day of treated water. This equates to a daily per capita production rate of approximately 230–240 gallons.³ This rate is higher than in any other Pacific country (typically 120–150 gallons/day) and higher than Asian countries by factors of 5–10. Even with the high system losses, per capita demand for water is very high and is attributed to limited consumer appreciation of the value of water and inadequate tariffs.

5. **System fragmentation and inefficiency.** The national water supply systems, including water treatment plants, have been substantially improved over the past 15 years and the water supply networks expanded, particularly in Airai state. However, operations are still inefficient: losses are high (estimated at about 43%). Unmetered connections remain and a flat fee tariff is applied for water and sewer until 100% metering is in place. A program is in place to achieve this.

6. Until recent, the Koror–Airai and water supply systems and the Koror and Melekeok sewage systems were operated and maintained by the Bureau of Public Works (BPW). In July 2013, Palau Public Utilities Corporation Water and Wastewater Operations became responsible for the delivery of these services. The water system services about 98.9% of the urban population and 86.2% of the rural population—or 96% of the total population.

¹ 1 US gallon is 3.785 liters.

² The forecast demand for 2020 is based on a medium-growth scenario for population and tourist arrivals.

³ Due to system losses, the production of 908 liters/ day equates to consumption of 632 liters/day.

7. **Sanitation Services.** Koror has a centralized sewerage system which services more than 80% of the Koror population. The network comprises 40 kilometers (km) of gravity mains, 13 km of force (pumped) mains, 46 pump stations, and sewage tertiary treatment plant located on the island of Malakal. Koror sits over a ridge falling to the coast on either side. For the most part, the commercial sector is located at the crest of the ridge and the residential hamlets stretch down to the coast. Sewage is pumped up to the ridge and flows to the sewage treatment plant (STP). Two other islands, connected by causeways, are also part of the network. The Koror sewerage system network and STP is over was built in the mid 1970's and is in poor condition. The STP was refurbished around 2001 but limited funds for maintenance and limited technical skills mean that much of the plant is unable to operate as designed. The current sewerage flow already exceeds the design capacity of the network and the STP.

8. The poor state of the network and STP leads to system blockages resulting in overflows at the low lying pump stations and discharges of raw sewage to the surrounding environment. The problem is exacerbated by (i) poor maintenance, (ii) an inadequate emergency response capability, (iii) ground water infiltration, and (iv) illegal storm water connections. When overflows occur, the effluent rising through the pump stations discharges through people's yards, basements, taro patches, and into the lagoon. The frequency of overflows is increasing as the network deteriorates and tourist numbers increase.

9. With the exception of Koror, the other 15 state sewerage and wastewater systems are predominately on-site sewerage systems. The Melekeok sewerage treatment works services the Capital Building and the surrounding village. For the majority of states, septic tanks are an appropriate technology for the very low population density. Increases in population in Airai are beginning to create a health and safety problem in that block sizes are declining and the soil types are inappropriate for septic tanks. The major housing development in Airai (Kesebelau) can no longer maintain septic systems without weekly pumping.

10. **Sewerage treatment plants.** The sewage treatment plant in Koror utilizes a settling pond, trickling filters, and finishing ponds before being pumped to an ocean outfall. The plant at Melekeok has reverse osmosis membrane technology to treat the raw waste before it is discharged to the sea. Septic tank standards do exist but there is no mechanism to ensure they are connected properly to the system. Septic tank pumping only takes place if the resident arranges it or the Environmental Quality Protection Board (EQPB) receives a complaint and investigates.

11. **Health issues.** The Belau Hospital records all cases of infectious diseases and has been monitoring the incidence of gastroenteritis since 2008. From 1 April 2011 to 31 March 2012, the hospital recorded 862 cases in Koror⁴, of which 429 (50%) occurred during 3 months from November 2011 to January 2012 when sewerage overflows were the greatest. Hospital records show that during the worst month, 1.25% of Koror's population was treated for gastroenteritis. Given the number of people who do not seek treatment, the actual number of cases is estimated at 6.25% of the total. The risk of a much more serious water borne disease outbreak such as cholera is high. Therefore, the greatest and most immediate concern is the health and safety risks to the people.

⁴ ADB. 2013. *Report and Recommendation to the President, Republic of Palau: Koror-Airai Sanitation Project, Initial Environmental Examination*. Manila.

12. **Impact on economic growth.** The maximum supply of 4 million gallons/day cannot be increased without a large investment in new water supply infrastructure. A new dam is estimated to cost \$30 million. Less expensive alternatives are either not drought-proof or will impact the fresh-water lens that serves as Palau's water source, and have longer-term climate change risks. Alternatively, measures to reduce demand and improve supply system efficiency can lead to the sustainable use of available infrastructure through to 2026. Preparatory assessments indicate that without maintenance investment and pricing controls to dampen demand, the supply will fall to below 72% of demand by 2026.

13. In addition, significant economic costs to Palau are a consequence of the current sewerage network and STP infrastructure. These include (i) direct and indirect health related costs, (ii) overflow clean up costs, and (iii) potential loss of tourism revenue from the impact of a serious disease outbreak. The long-term reputational risk to Palau's tourism industry from reports of a major disease outbreak among its population cannot be underestimated. Fifty percent of Palau's gross domestic product is derived from tourism, mainly from Asian countries which are particularly sensitive to international reports of disease outbreaks.

14. **Financial sustainability.** The government has implemented a policy to achieve full cost recovery for the delivery of water and sewer services by the end of 2015. In 2011 the cost of providing water and sewerage services was approximately \$3.8 million with a government subsidy of 74%. A framework of tariffs and tariff increases to achieve full cost recovery has been agreed and is being implemented. In 2011, the first increase in tariffs was applied since 1986. The tariff structure includes volumetric water and sewer tariffs for domestic and non-domestic connections and includes life line blocks, to protect the poor and vulnerable that are below the cost to treat and deliver water to consumers. Life blocks are on the first 5,000 gallons/month and represent 4.1% of income for those in the 5th quintile of income earners.

15. **Legal and policy framework inadequacy and fragmentation.** Palau's sewerage systems and on-site wastewater treatment and disposal systems are regulated through the Individual Sewage Disposal Act, 1971 (administered by the Ministry of Health), Sewer Use Act, 1984 (administered by the EQPB), and the Environmental Quality Protection Board Regulations Toilet Facilities and Wastewater Disposal Systems Regulations, 1996 (also administered by the EQPB). Through the creation of the Palau Water and Sewer Corporation (PWSC) in September 2011, the Government has integrated water and sewerage services into a single state-owned enterprise responsible for the delivery of water supply and sewerage services. PWSC was subsequently merged into the Palau Public Utilities Corporation (PPUC), Palau's power utility, in June 2013 to form the Palau Public Utilities Corporation Water and Wastewater Operations (WWO).⁵ WWO was declared operationally effective in July 2013. Palau's drinking water quality standards are provided under the EQPB Regulations, 1996 and Public Water Supply Systems Regulations, 1996. These regulations also make provisions for review of the design and development of new water supplies, issue of permits for the operation of water supplies, licensing certification of water supply operators, operation of private water supplies, and powers for enforcing the regulations.

16. Current laws relating to the operation of the public water supply, sewerage treatment and sewage collection systems are generally insufficient to support current operations, and are not a sufficient legislative basis to allow reforms to current water supply arrangements.

17. A recent review of legislative reforms to facilitate water supply infrastructure development and institutional reforms for Palau's public water supplies include (i) comprehensive new laws

⁵ PWSC was merged into PPUC under the Utilities Consolidation Act 2013 to maximize efficiencies and potential cost savings through shared services and administrative functions.

dealing with all aspects of public water supplies; (ii) amendment to the Environmental Quality Protection Act, 1996 to provide a clear mandate for the EQPB to regulate water abstractions following an approval of the National Water Resources Management Plan, and to address issues involving competing claims for rights access water resources; (iii) new regulations made under an amended environmental quality protection act⁶; (iv) a new water resource management policy to manage national and state water resources; (v) legislation to regulate the abstraction of water from the nation's fresh water sources.⁷

2. Government's Sector Strategy

18. The goal and actions of the government's medium-term development strategy are (i) investing in water and sanitation, (ii) moving state-owned enterprises toward full cost recovery, and (iii) reducing government expenditure by eliminating subsidies.⁸ Most of Palau's nation-building projects are nearing completion, and the country's new challenge is taking responsibility for their use and maintenance. ADB assisted Palau in meeting the challenge through the recently completed technical assistance (TA) for a facility for economic and infrastructure management, under which the medium-term development strategy was developed.

19. Capital Improvement Program Office, a division of the Ministry of Public Infrastructure, Industries and Commerce, is responsible for planning and implementing of Palau's public infrastructure projects. The ability of Capital Improvement Program Office to plan and implement new projects is constrained by its small staff. Systems for monitoring, planning, and selecting maintenance and assets need to be improved immediately. Until July 2013, BPW, a division of the Ministry of Public Infrastructure, Industries and Commerce, operated and maintained Palau's water supply and sewage collection and treatment systems. BPW also manages and maintains a wide range of other services, including buildings and roads. Relative to its responsibilities, BPW's budget is too small and erratic, and its productivity low. The government established PWSC and, subsequently, WWO to take over responsibility for the management and delivery of water supply and sewage collection and treatment services.

3. ADB Sector Experience and Assistance Program

20. Palau became a member of Asian Development Bank (ADB) in 2003. ADB assistance has been primarily delivered through technical assistance. ADB supported the development of a medium-term development strategy through TA for the facility for economic and infrastructure management, development of national health insurance scheme, and institutional and policy reforms in water supply and sanitation services. The first lending operations started in 2009, with approval of the Water Sector Improvement Program, that has supported the implementation of institutional and policy reforms to help improve efficiency and sustainability of water supply and sanitation service delivery. This has created an important foundation for the proposed investment project to improve the sanitation systems and services.

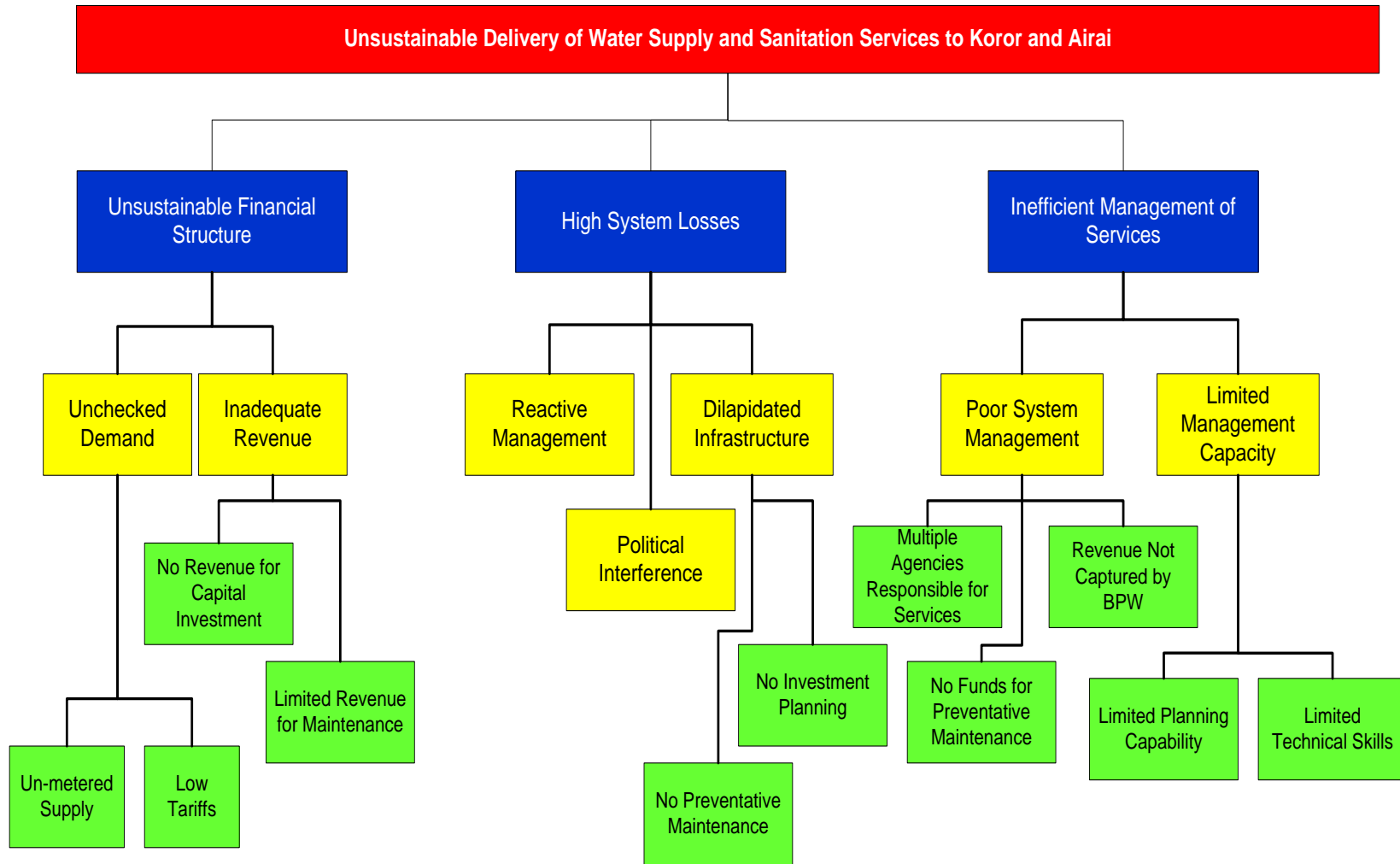
1. Official development assistance provides almost all the capital budget, supports improved facilities and services, and supports general economic growth. Japan, Taipei, China, and the United States provide substantial official development assistance to Palau. Only Taipei, China has recently invested in water and sanitation infrastructure.

⁶ Asian Development Bank. 2008. *Technical Assistance to the Republic of Palau for Preparing the Babeldaob Water Supply Project*. Consultant's interim report. Manila.

⁷ Government of Palau. 2012. *The Water Policy for the Republic of Palau*. Koror. Government of Palau. 2013. Republic of Palau Public Law 9-44. *The Water Abstraction Act*. Melekeok.

⁸ Government of Palau. 2009. *Medium-Term Development Strategy: A Plan for Action*. Koror.

Problem Tree for Water and Sanitation



BPW = Bureau of Public Works.
Source: Asian Development Bank

Sector Results Framework (Water and Sanitation, 2009–2013)

Country Sector Outcome		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contributions	Indicators with Targets and Baselines	Outputs with ADB Contributions	Indicators with Incremental Targets (Baselines Zero)	Planned and Ongoing ADB Interventions	Main Outputs Expected from ADB Contributions
<p>Secure, reliable, and affordable water supplies to communities on Babeldaob and in Koror.</p> <p>Improved collection and treatment of sewage in Koror and Airai states.</p>	<p>The average household water and sewerage bill does not exceed 5% of average household income (2010 baseline: 1.0%)</p> <p>Water losses from the Koror–Airai water supply network decrease to less than 25% by FY2015 (2010 baseline: 43%).</p> <p>Average per capita consumption decreases 30% per person per day by FY2015 (2010 baseline: 169 gallons/person/day)</p> <p>Sewerage overflows from the Koror sewerage system reduced by 20% by FY2015 (2010 baseline: 20).</p>	<p>Water supply and sewerage services reformed.</p> <p>Sewerage infrastructure in Koror and Airai upgraded by 2016.</p>	<p>WWO owns all public water and sewerage assets in Koror and Airai by April 2013.</p> <p>Water and sewage services financially and technically sustainable with 100% recovery of operation and maintenance costs by 30 September 2016. (2010 baseline: 35%)</p> <p>WWO's staff–customer ratio does not exceed 15:1,000 by 1 October 2014. (2010 baseline: 21:1,000)</p> <p>Sewerage network coverage in Koror increased to 85% by FY2015 (2010 baseline: 74%).</p>	<p>Planned key activity areas Reform water supply and sewerage services (57%).</p> <p>Improved sewerage services in Koror and Airai (43%).</p> <p>Pipeline projects with estimated amounts Koror–Airai Sanitation Project (\$30 million)</p> <p>Ongoing projects with approved amounts Water Sector Improvement Program (\$16 million)</p>	<p>Pipeline projects Water policies and legislation approved by April 2013</p> <p>Amended water tariffs applied from 1 February 2011</p> <p>Sewerage tariffs introduced and applied by 1 February 2011</p> <p>Universal metering of all Koror and Airai water supply customers by FY2015</p> <p>Preparation of sewerage master plans for Koror and Airai and implementation of high-priority sewerage projects</p>

WWO = Palau Public Utility Corporation Water and Wastewater Operations.

Source: Asian Development Bank.