

Republic of Mauritius

Environmental Sewerage & Sanitation Project

External Evaluator: Takeshi Daimon, Waseda University

0. Summary

This project has been extended with the objective of “preventing water pollution in the metropolitan area and protecting the oceanographic ecosystem.” The project indeed matches the development policies, development needs, and Japanese development policies, and is highly relevant. Additionally, efficiency is fair, because the project cost is within what was planned, but the project period far exceeded what was planned. BOD and other operating indicators meet the planned level and have contributed to the improvement of environmental and sanitation conditions; however, the effectiveness is fair, because the operating level is lower than the planned level by approximately 30%. Sustainability is an area of concern, because, although the overall system and technology are fine, there is a shortage of revenue in recovering Operations and Maintenance (O&M) costs and because some of the non-functioning facilities are left unrepaired for a long time.

In light of the above, this project is evaluated to be partially satisfactory.

1. Project Description



Project Location (Star)



Treatment Plant: Pond (Upper Right) and Trash Filter (Lower Right)

1.1 Background

Since independence, and especially since the 1980s, Mauritius has experienced environmental problems owing to economic development and demographic expansion. The textile industry has been expanding rapidly, and demographic concentration in Port Louis, the capital city, has been prominent. In addition, household and industrial wastewater is currently discharged generally without any proper treatment into the lagoons and oceans around the island, threatening the tourism industry (which is a major source of earnings in foreign currency) and the livelihoods of artisanal fishermen with oceanic pollution. The standard of living in terms of per capita income has increased, but the quality of life was adversely affected by increased public health and sanitation problems including intestinal and eye diseases.

The demand for wastewater treatment in Port Louis was expected to increase from 25 thousand m³/day (1997), through 48 thousand m³/day (2005), to 61 thousand m³/day (2007). This exceeds the existing capacity of wastewater treatment plants (17 thousand m³/day) in Fort Victoria and Pointe aux Sable, both of which were in a deteriorated condition and require immediate replacement with new treatment systems. Meanwhile, the Government of Mauritius requested the Japanese Government to help establish a new wastewater treatment system in the Montagne Jacquot area, which was located six km south-west of the city. Wastewater was to be sent to this facility through compression pipes from new pumping stations, covering 1,340 ha (or a population of 118 thousand, as of 1997) in residential and commercial districts.

1.2 Project Outline

The project aims to prevent water pollution and to protect marine biodiversity by establishing a new sewerage system in southern part of the capital city Port Louis, thereby contributing to the improvement of living standards as well as to the development of tourist industry.

This project is co-financed by the World Bank.

Loan Approved Amount/ Disbursed Amount	4,538 million yen / 4,533 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	September 1998 / September 1998
Terms and Conditions	Interest Rate: 1.8% Repayment Period: 25 years (Grace Period: 7 years) Conditions for Procurement: General Untied
Borrower / Executing Agency(ies)	Government of the Republic of Mauritius/ Wastewater Management Authority ¹

¹ The executing agency was originally Waste Water Authority, Ministry of Public Utilities, at

Final Disbursement Date	December 2008
Main Contractor (Over 1 billion yen)	China International Water and Electric Corporation (Chinese national) Jan De Nul Dredging Limited (Belgian national)
Main Consultant (Over 100 million yen)	Nippon Jogesuido Sekkei Co., Ltd.
Feasibility Studies, etc.	M/P (AfDB, 1994) F/S, D/D (World Bank, 1997)
Related Projects (if any)	Technical Assistance: Short Term Experts (3) Yen Loan: Grand Baie Sewerage Project (L/A signed in July 2010) International Organization: Environmental Sewerage and Sanitation Project (Accelerated Co-financing Facility)

2. Outline of the Evaluation Study

2.1 External Evaluator

Takeshi Daimon, Waseda University

2.2 Duration of Evaluation Study

Duration of the Study: December 2010 – December 2011

Duration of the Field Study: February 27 to March 12 and July 31 to August 6, 2011.

2.3 Constraints during the Evaluation Study (if any)

Regarding Operations and Maintenance (O&M), the executing agency of the Wastewater Management Authority (WMA) does not have a separate account of revenues and expenditures of treatment plants, making it difficult to conduct accurate financial analysis (re-calculation of FIRR) from the project finance perspective.

3. Results of the Evaluation (Overall Rating: C²)

3.1 Relevance (Rating: ③³)

3.1.1 Relevance with the Development Plan of Mauritius

the time of appraisal, and has been corporatized as WMA since August 2001.

² A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

³ ③: High, ② Fair, ① Low

In 1990, the Government of Mauritius (GOM) approved the National Environmental Action Plan (NEAP), resulting from the World Bank assistance since 1988, and established the National Environmental Committee. The wastewater sector, in particular, has been recognized as a high priority area, and the Master Plan (M/P) was drafted in 1994 that has actually been financed by the African Development Bank (AfDB). The M/P lists the major policy goals of the wastewater sector as “prevention of water pollution in island and oceanic areas,” “improvement of people’s health and public health,” and “establishment of technological, legal, institutional, and financial framework in order to achieve sustainable growth in the sector.”

The NEAP was modified to the NEAP2 (2000–2010 Action Plan) as a part of the National Environmental Strategies. The NEAP2 was taken over by the Maurice Ile Durable (MID) Plan (NEAP3 Action Plan), which was effective at the time of post-evaluation. The importance of the wastewater sector continues to be recognized from the perspective of benefits to the tourism and fishery sectors through the prevention of seashore pollution.⁴

Hence, the aim of “preventing water contamination in metropolitan areas and promoting the oceanographic ecosystem in surrounding areas” has been overall relevant.

3.1.2 Relevance with the Development Needs of Mauritius

Until the time of appraisal (November 1997), owing to the textile-based industrialization and demographic concentration in Port Louis since independence, household and industrial wastewater was discharged into the lagoons and in the ocean without proper treatment. The consequent ocean pollution has threatened tourist resources and has adversely affected the health and sanitation situation in nearby areas, as evidenced by an increase in intestine and eye diseases. The demand for wastewater treatment in Port Louis was expected to increase from 25 thousand m³/day (1997), through 48 thousand m³/day (2005), to 61 thousand m³/day (2007), exceeding the existing capacity of wastewater treatment plants (17 thousand m³/day). All existing plants were in a deteriorated condition and need immediate replacement with new treatment systems.

As discussed later in the Effectiveness section, at the time of post-evaluation, the wastewater treated was 31 thousand m³/day (measured in 2009), lower than the demand originally planned. However, the demand for treatment still exists from the development perspective. It is pointed out that the reason to fall below the demand forecasting is a deceleration of growth in the textile industry. The surplus treatment capacity is being matched by the WMA’s efforts to increase the number of network connections.

3.1.3 Relevance with Japan’s ODA Policy

The appraisal document makes no mention about the consistency of Japanese development policies and this project. Hence, this can only be estimated through the circumstantial evidence from

⁴ Interviews with the Ministers of Environment and of Fishery as well as the “Maurice Ile Durable” Green Paper.

that time. For example, the ODA White Paper (FY 1999) stressed the importance of achieving diplomatic goals such as “strengthening of bilateral friendship,” “securing of support and cooperation for Japan in multi-lateral diplomacy,” and “contribution to African issues (promotion of socio-economic development, settlement of conflicts, and assistance for humanitarian aids).” The report also mentions that Mauritius has a relatively high income and that assistance must be extended “in order to support economic stabilization.”

This project matches the overall diplomatic goals of “bilateral friendship” as well as “African issues (especially environmental problems) in Japanese assistance policies for Africa.” Additionally, the project is consistent with Japanese assistance policy in the sense that this assistance has been extended to “support economic stabilization.”

This project has been highly relevant with the country’s development plan, development needs, as well as Japan’s ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

As the table below shows, there was no difference between the planned and actual outputs for either the physical component (the target of the ODA loan being a consulting service and the wastewater treatment system without the compression pipeline) and technical assistance (which is not covered by the ODA loan but by the World Bank loan).

Table 1 Comparison of Original and Actual Outputs

Item	Original	Actual
Pumping Station	2	As planned
Force Main (*)	6 km	As planned
Waste Water Treatment Plant	Treatment Capacity 48,000 m3/day	As planned
Sea Outfall	645 m long, 30 m deep	As planned
Consulting Services	Procurement Preparation and Supervision	As planned
Technical Assistance (*)	Management and Staff Trainig, etc.	As planned

(Source: PCR, hearing during post-evaluation)

* World Bank-financed portion (non-ODA Loan)

The Environmental Impacts Assessments (EIA) conducted in 1997 and 2001 decided that the outflow of treated water would not be disposed of through an underground borehole (digging boreholes for water outfall), but through “sea outfall” (645 m offshore, 30 m depth undersea), and that the outflow would be disinfected (for bacteria, etc.) through chlorination in addition to the originally planned primary treatment (elimination of suspended particles and metals). These modifications and addition will be discussed in “3.2.2.2 Project Period” and “3.4.2 Other Positive and Negative Impacts.”

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost increased (to 126% of the original cost at the time of the appraisal)⁵ for the treatment plant, pumping station, and outfall. This increase can be attributed to the price escalation of steel and other materials owing to the delay in construction.

On the other hand, the costs of the consulting service and the World Bank's technical assistance have decreased by 58% from that quoted at the time of the appraisal⁶. This is due to a reduction in the contract amount for technical assistance in the ODA loan and the World Bank's financing.

Further, Mauritian expenditure in domestic currency, such as spending on the pre-treatment plant and land acquisition, has decreased by 66% (in USD equivalent)⁷ from the time of the appraisal. This is partially because government transfers were not made for big clients, such as factories (these facilities financed their own construction), but mostly because there has been a 45% drop in the value of the local currency against the dollar and a 65% drop against the Japanese yen.

As a result, the total project cost was realized as 61.0 million USD (or 7,015 million JPY at the average exchange rate during the lending period), as compared to the appraised 63.7 million USD (or 7,708 million JPY with the exchange rate at the time of appraisal). In USD, the cost was only 96% (or 91% in JPY) of the appraised amount.

Table 2 Comparison of Original and Actual Project Costs

Item	Original	Actual
Amount paid in Foreign currency	5,155 million yen	4,658 million yen
Amount paid in Local currency	2,553 million yen (442 million MUR)	2,367 million yen (628 million MUR)
Total	7,708 million yen	7,015 million yen
Japanese ODA loan portion	4,538 million yen	4,533 million yen
Exchange rate	1 USD = 121 yen 1 USD = 21.1 MUR (As of December 1997)	1 USD = 115 yen 1 USD = 30.5 MUR (Average between January 2005 and December 2007)

(Source: PCR) (Exchange rate used for post-evaluation is taken from average during lending period).

3.2.2.2 Project Period

Although the construction period had been planned from October 1999 to December 2002 (39 months), it actually started in March 2005, after a five-year delay; the construction period ended in January 2007 (23 months). Despite the construction period having been shortened by 16 months, the delay in the start date resulted in 99 months⁸ for the project period, or 194% of the planned 51 months from the signing of the loan agreement.

⁵ 39.1 mil. USD (at appraisal), as compared to 49.1 mil. USD (at completion).

⁶ 14.3 mil. USD (at appraisal), as compared to 9.5 mil. USD (at completion).

⁷ 4.2 mil. USD (at appraisal), as compared to 2.4 mil. USD (at completion).

⁸ This has resulted in the extension of final disbursement date from December 2004 to December 2008.

One of the reasons for this delay is the WMA's move to modify the appraised scope of the project and introduce an alternative plan (namely, sea outfall instead of disposal of the wastewater through boreholes). This was partially owing to the frequent protests and demonstrations by coastal fisheries' fishermen. The alternative plan was rejected by the Ministry of Environment in January 2001; however, it delayed the entire process of the approval (December 1998), modification (October and December 2001), and evaluation (July 2002) of P/Q documents by three and half years.

Another reason for the delay is the lawsuit against the treatment plant and pumping station. When the first bidder was negotiating a contract with the WMA, the second bidder, unsatisfied with the results, went to court to request the suspension of bidding.⁹ The second bidder was eventually offered the construction contract.¹⁰ This process resulted in the delayed approval of the bidding result in February 2004. The sea outfall went through a separate bidding process, with the announcement of the bid in February 2003, evaluation in May 2003, and approval of the evaluation (in which a Belgium company was offered the bid) in February 2004.

Although the project cost was within the plan, the project period was exceeded, therefore efficiency of the project is fair.

3.3 Effectiveness ¹¹(Rating: ②)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

As an operating indicator, a "daily average inflow" of 48,075 m³/day (thereafter, this design water flow was assumed to be maintained) ¹²was introduced. In reality, however, as the table below shows, in 2007, the daily average inflow (measured) was 32,714 m³/day (or 68% of that planned at the time of appraisal); by 2009, this ratio had not increased, and continued at the same level.

Additionally, the WMA considers the number of connections to the wastewater as an operating indicator, although it was not part of the operating indicators at the time of appraisal. As the table below shows, the higher number of connections does not match the stagnant amount of treated water, because, according to the WMA, Mauritius has suffered from a chronic shortage of water since 2007 and there has been a supply cut in potable water. In addition, there was not an expected increase of large clients, owing mainly to the external factors such as closure of textile factories in the sewerage covered area in light of the decelerated growth of textile industry.

⁹ Filing a lawsuit was the only way to disagree with the procurement procedure before Public Procurement Act of 2006 was promulgated, making it possible to appeal to Independent Review Panel. This made the procedure a lot shorter than the lawsuit.

¹⁰ This is based on the information obtained during the interview with the consultant (NJS) although no information was provided from WMA.

¹¹ Rating takes into account of Impact as well.

¹² "Maximum daily flow" by design is 187,500 m³/day.

Table 3 Comparison of Original and Actual Operating Indicators

	Original	Actual*		
	2006	2007	2008	2009
Average Daily Flow (m3)	48,075	32,714	30,191	31,096
Number of Connection	N/A	2,145	2,545	2,845

(Source: WMA)

(* Actual figures are annual average. The sewerage system started operational in January 2007, and there is no actual data in 2006.)

For effectiveness indicators, on the other hand, Biochemical Oxygen Demand (BOD)¹³, Chemical Oxygen Demand (COD)¹⁴, and Total Suspended Solids (TSS)¹⁵ have been used, with COD 580 mg/l, BOD 340 mg/l, and TSS 400 mg/l (as of 2006) set as goals (measured at the outflow point). These figures are consistent with the “Environment Protection (Standards for effluent discharge into the ocean) Regulation 2003.”¹⁶

Table 4 Comparison of Original and Actual Effectiveness Indicators

	Standard	Original	Actual*		
		2006	2007	2008	2009
COD	750	580	446	252	326
BOD	250	340	83	142	152
TSS	300	400	94	100	100

Source: WMA

(*Actual figures are bi-monthly average).

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

(1) Economic Internal Rate of Return (EIRR): At the time of appraisal, it was decided that the EIRR would not be calculated “because, in the wastewater project, as in education, health, and other social infrastructure, it is difficult to quantify the benefits,”^{17,18} making it impossible to conduct before-after comparisons.

(2) Financial Internal Rate of Return (FIRR): Using post-project tariff revenues, actual O&M data (2007–2009)¹⁹, and the same assumptions²⁰ made at the time of the appraisal, FIRR was re-calculated,

¹³ BOD is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in water.

¹⁴ COD is the amount of dissolved oxygen needed to oxygenize organic compounds in water.

¹⁵ TSS is the non-filterable residue in water.

¹⁶ Environmental Protection (Standards for effluent discharge into the ocean) Regulation 2003, Government Notice No. 45 of 2003.

¹⁷ JICA appraisal documents.

¹⁸ The World Bank portion of the project calculates EIRR, taken tariff and tourist industry revenues as benefits, with 19.2% at the completion (ICR), as compared to 12.2% at appraisal.

¹⁹ As WMA does not have a separate accounting system per treatment plant, the FIRR has

resulting in a negative figure. As discussed in the Sustainability Section, this is because the tariff level and amount of wastewater are insufficient to recover O&M costs. In addition, with increased tariff revenue in 2011 and drastic management efforts²¹, including an O&M cost cut, the FIRR has barely been positive.

Table 5 Recalculated FIRR

Appraisal	Post-Evaluation (base)	With managerial efforts
7.4%	-10.4%	0.8%

Source: Recalculated by external evaluator

3.3.2 Qualitative Effects

Assumptions at the time of appraisal include the beneficiaries—that is, 120 thousand residents and approximately 150 factories (of which approximately 60% were related to the textile industry)—contributing to “the improvement of public health and sanitation,” “protection of ecosystem and promotion of tourism,” and “promotion of sustainable economic activities.”

As a part of the qualitative evaluation, a beneficiary survey was conducted for residential and commercial districts (sample size of 100, including 10 fishermen and 5 factories).²² Among those who responded with “very much satisfied” or “satisfied” (58), a great majority listed “improvement of sanitation” (32), or “improvement in coastal water” (16) as their reason of satisfaction. Considerably fewer number of people listed “protection of environment” (6), “decrease in wastewater pollution” (2), and “promotion of tourism industry” (1), and none listed “the decrease of water-borne diseases”²³ or “promotion of economic activities.”²⁴ 40 responded with “unsatisfied” or “very much unsatisfied” because of the “overflow of water at the pumping station in rain”(13), “high level of tariff”(18), and “environmental damage near treatment plant and damage to fishery”(9). Out of 10 samples from fishery industry, 8 responded “unsatisfied” or “very much unsatisfied” for the reason of polluted water (and resulting damage to fishing). From the above, it was found that the beneficiaries recognized environmental effects more than economic effects.

not been calculated but approximated from the balance sheet of WMA and the share of daily inflow at Montagne Jacquot Treatment Plan over the aggregate amount of treatment (approximately 30%, measured in 2008).

²⁰ Calculated based upon the assumption of “project life = 30 years including the construction period” (conditions at the time of appraisal).

²¹ Based upon the assumption of 40% improvement of cash flow (with increased revenue or decreased O&M costs).

²² At the time of post-evaluation, there were only 15 to 20 factories in the covered area, and the number of textile factories decreased, so the sample size of the commercial facilities was limited to 5 firms.

²³ A separate survey on the water-borne diseases showed a slight improvement (21 cases before the project and 17 cases after the project).

²⁴ Interviews with neighboring firms (5 sample firms) also showed that after the project the sales “have not changed” (1), “have decreased” (4), while the management “has not changed” (1) “has suffered from increased sewerage pre-treatment costs” (4).

This project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Impact

3.4.1 Intended Impacts

The expected impact at the time of appraisal was “to contribute to the upgrading of living standards and development of the tourism industry.” The standard of living is considered to have been upgraded to some extent, as shown in the number of beneficiaries who listed “improvement of sanitation conditions” as their major reason for satisfaction under the “qualitative effects” section. On the other hand, there is no evidence of benefits linked to the development of the tourism industry, even though there has been a steady increase in the tourism business and the number of foreign visitors to Mauritius since the project implementation. This is not enough to determine causality, however.

Table 6 Trends of Tourism Indicators

	1995	2000	2005	2008	2009
Foreign Tourists (in 1,000)	422	656	761	930	871
Tourism Revenue (in million USD)	616	732	1,189	1,823	1,390
Tourism Revenue (% of total exports)	26.2	27.9	31.7	37.0	33.2

Source: WDI

In Mauritius, there are four wastewater treatment plants, including the plant in Montagne Jacquot, which accounts for approximately 30% of all water treated in the country by design and measurement. The construction of this plant has expanded the capacity of the nation’s wastewater treatment and has enhanced connectivity. At the time of the appraisal, there were approximately 24,000 connections (including individual and corporate contracts), with a coverage of 18% (70% in Port Louis only); at the time of post-evaluation, however, there were 64,700 connections (same definition), with a national coverage of 25%.

3.4.2 Other Impacts

(1) Impacts on the natural environment

Mauritius has an Environmental Impact Assessment (EIA) system, and two EIAs were conducted in 1997 and 2001, before the project started. The reason for the 2001 EIA was, as explained in the “3.2.1 Output” section, that the “sea outfall” system was adopted rather than the “underground borehole injection” system, to change the original scope of work. Since 2008, the Ministry of Environment has commissioned an Independent Environmental Audit (IEA) for the WMA managed

wastewater treatment plants, whereas the Ministry of Fisheries has surveyed water quality in coastal areas, including the vicinity of this plant.

The environmental impacts of the treated sewerage water on coastal areas are related to the existence and quantity of BOD, COD and other organic pollutants, TSS and other suspended solids, arsenic and other chemical pollutants, and fecal coli and other bacteria. Suspended solids and chemical pollutants have been within the permissible levels, according to the surveys conducted by the WMA, IEA, and the Ministry of Fisheries.²⁵ In a survey conducted by the Ministry of Fisheries, however, bacteria have been detected in the vicinity of the plant.

Table 7 Trends of faecal coliform (Unit : CFU²⁶/100ml)

	Vicinity of Pointe aux Sables Pumping Station (max and min)	Vicinity of Montagne Jacquot Treatment Plant (max and min)	Albion Testing Point (average)
2000	10 - 2450	NA	NA
2001	5 - 26900	NA	NA
2002	4 - 14500	NA	NA
2003	5 - 95000	NA	NA
2004	2 - 500	NA	6
2005	5 - 395	NA	10
2006	2 - 610	NA	41
2007	3 - 315	NA	NA
2008	10 - 280	NA	NA
2009	15 - 1940	12 - 540	NA
2010	15 - 450	25 - 1500	NA

Source: Ministry of Fisheries

Note: Point aux Sable Pumping Station is located on 2 km north coast to the MJ Treatment Plant, and Albion is located on 1 km south coast.

There were no standards for faecal coliform in the “2003 Environmental Regulation”²⁷ at the times of appraisal and post-evaluation. However, the “Guidelines for Coastal Water Quality”²⁸ (1999) stipulates that if a level of more than 200 CFU/100 ml of faecal coli²⁹ is detected, swimming and

²⁵ WMA conducts its own surveys (unpublished), apart from the official monitoring required by EIA. There is no record of periodical reporting of the monitoring results to JICA, however.

²⁶ Colony-Forming Unit to measure the number of bacteria.

²⁷ Environmental Protection Regulation 2003.

²⁸ Guidelines for Coastal Water Quality (General Notice No. 620 of 1999).

²⁹ US and EU standards are set at this level, and Japanese “water quality standards for swimming” (Ministry of Environment Ordinance) stipulates that 100 CFU/100ml or below is “suitable” and 400-1,000 CFU/100ml or below is “possible” for swimming.

fishing are banned; wastewater plants are expected to meet this standard, although it is not legally binding, as with other possible sources of contamination. The maximum level of faecal coli measured actually exceeds this standard, as shown in Table 7. According to the Ministry of Environment, this is most likely due to the wastewater plants.³⁰ However, further studies are required to detect the various other possible causes of pollution more accurately.

The EIA (2001) required the treatment plant to disinfect sewerage through chlorination; however, this has been temporarily stopped since 2008. The WMA explained that this is because the EU, as part of its technical assistance, advised the WMA to “stop chlorination because it is not effective with ammonized sewerage (like in this system).”³¹ The WMA further explains that the resumption of chlorination depends on a re-examination of the technical aspects (that is, effectiveness), and cost effectiveness of chlorination. At the time of the post-evaluation, however, there was no concrete plan for such a re-examination

Furthermore, the sewerage-filtered sludge is compressed, de-watered, and dumped in the Mare Chicose Landfill (a trash dumping center with a capacity of 400–500 tons/day)³² without being burnt .

(2) Relocation and Expropriation

There was no relocation, but land (10 ha, privately owned) was expropriated in November 1998. This land was intended for the expansion of the treatment plant (for secondary treatment with microbiological disinfection). This land remains untouched up to now. There is no residential district in the vicinity; however, there is a prison and a farmyard.

(3) Other Positive and Negative Impacts

The appraisal made no mention about these impacts, and there were no problems at the time of post-evaluation.

Hence, even it is at the effort level, there is some concern about the negative impacts of faecal coli.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

At the time of the appraisal, O&M was expected to be contracted out to a private company.³³ In

³⁰ 2010 data on the fecal coli in the vicinity of Montagne Jacquot Treatment show a significant variation of 25 – 1,000 CFU/100 ml. The Ministry of Fisheries explains that this is due to the fluctuation of sea current. It is, however, possible to improve the measurement to obtain more accurate data, so it appears to be necessary to conduct a separate survey for cross-checking purpose.

³¹ Memorandum (27th June 2008), Technical Assistance for the Mauritius Wastewater Sector Policy Support Programme (European Union).

³² Trash dumping center (40 ha) financed by the World Bank in 2000. World Bank (Mauritius - Environmental Solid Waste Management Project (Project Information Document)).

³³ WMA explains that the most of O&M operations are contracted out to private companies in

actuality, total 31 WMA staff are operating the O&M division. These staffs are divided into various time shifts (as the plant is supervised 24 hours a day) and some work for the two pumping stations. Therefore, the actual number of personnel working in one time shift is considered to be between 15 and 20.

There are 424 WMA staff members (as of January 2009),³⁴ and the decision-making body is a board comprising of the Permanent Secretary of the supervising agency (Ministry of Public Utilities) and representatives of other relevant ministries. There is a chairperson of the board of the WMA, and an officer-in-charge with two deputy general managers (one in charge of technical issues and other in charge of administrative and financial issues). The overall O&M is supervised by the vice-president in charge of technical issues, and more routine works are supervised by the director and the O&M staff.

The wastewater quality is inspected by the WMA Laboratory. The inspection is conducted at the wastewater treatment plants and pumping stations, for compliance with environmental standards. Additional inspection is conducted at coastal areas with water outfall, firms, hotels, and hospitals with their own water quality treatment facilities. Inspection is conducted regularly³⁵ by sampling water and inspecting it against various parameters (total solid, chemical hazards, etc.) in the laboratory.

Hence, the overall institutional framework of the O&M is good.

3.5.2 Technical Aspects of Operation and Maintenance

Mauritius had accumulated experience in O&M techniques since the French had assisted Mauritius with its sewerage system before this project. The overall initial conditions in human capital (education level, etc.) are favorable. Further, there is no problem in the current technology level.

Given these relatively favorable initial conditions, it is not always easy to bring about additional technology transfer and institutional capacity building. However, the O&M techniques acquired through this project (sewerage system management and water quality inspection) have been used for other projects³⁶, indicating that there has been some transfer of technology. In addition, an institutional building (World Bank financed soft component), three JICA short-term experts (O&M), and a one-year training by the contractor after the completion of project have been provided.

These inputs can be sustained only if there are “self-help efforts” by the implementing agency in the follow-up and sharing periods of the training experience. WMA explains that “capacity building has been top priority”³⁷ at both the individual and institutional levels and that it has sent personnel to Japan, France, Egypt, and other countries for training.

3.5.3 Financial Aspects of Operation and Maintenance

St. Martin Treatment Plant, while at the Montagne Jacquot, it was not contracted out because of “high cost” (WMA executive staff).

³⁴ WMA Annual report (2009).

³⁵ In most facilities, sampling surveys are conducted twice a month.

³⁶ World Bank (2007) Implementation Completion and Results Report (Loan No. 42830).

³⁷ WMA Annual Report.

At the time of the appraisal, WMA was just one division under the Ministry of Public Utilities, and investment and current costs were a part of the Ministry's (general) budget. In fiscal year 2001³⁸, when the WMA was corporatized,³⁹ it became financially autonomous from the general budget. Since the corporatization, the steady increase in revenue until 2005 resulted in a surplus; since 2007, however, owing to the increased O&M from this project, the balance sheet has been in deficit.

The "Expenditure/Tariff Revenue" ratio is below 100% if cost can be recovered and above 100% if the cost cannot be recovered. For 2008, the ratio was 151% (the cost recovery ratio is its reverse number, 67%).

Table 8 Trends of Financial Indicators

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Revenue(A)	227	236	250	N/A	301	311
<i>Tariff Revenue</i>	196	196	204	N/A	233	249
<i>Gov't Subsidies</i>	31	40	41	N/A	68	62
Expenditure(B)	134	198	211	N/A	318	377
<i>O&M</i>	56	73	84	N/A	213	238
<i>Personnel</i>	N/A	N/A	N/A	N/A	67	70
<i>Repayment</i>	N/A	N/A	N/A	N/A	25	58
<i>Others</i>	N/A	N/A	N/A	N/A	121	110
Balance(A-B)	93	38	39	N/A	-17	-66
Expenditure/Tariff Revenue	68%	101%	103%	N/A	136%	151%

Source: WMA

WMA endeavors to increase revenue by increasing the tariff (or decreasing the number of unpaid contractors, estimated to be approximately 15%). However, the tariff⁴⁰ falls exclusively within the purview of the Ministry of Public Utilities and cannot be changed through WMA's managerial efforts alone. The Ministry of Public Utilities states that it is discussing a drastic reform plan to merge potable and sewerage systems in order to increase efficiency and profitability.

On the other hand, the balance sheet of the WMA is not recorded for each treatment plant separately and is only assessed as an agency. In the current difficult financial situation, the private sector would make each section a "cost center" and would introduce the cost accounting system to lower O&M costs as a part of the management efforts. The WMA has not institutionalized this system yet.

3.5.4 Current Status of Operation and Maintenance

Facilities, as a whole, are operating to lower BOD to the minimum level; however, some facilities have been out of operation for a long time. At the time of the post-evaluation, a de-watering/sludge holding tank (one out of two) remained unrepaired; a "drum screen" (trash filter) (one out of two) was

³⁸ Mauritian Fiscal Year runs from July 1st to June 30th.

³⁹ WMA Act 2000.

⁴⁰ Since 2008, commercial tariff has been fixed to 20MUR/m³, while residential tariff has been fixed to 5.5MUR/m³ (below 10m³), 6.5MUR/m³ (11-20m³), 15.0MUR/m³ (21-30m³), and 34.0MUR/m³ (above 31n³).

not operational, a clarifier pond (one out of three) remained unused⁴¹, and polymer machines were not operational. The chlorine disinfection system has not been used, as mentioned earlier. With regular usage, these facilities cannot simultaneously break down so easily, thereby implying that there have been problems in maintenance methods.

WMA explains that its O&M budget is appropriated for repairs costing less than 2 million MUR (or approximately 5.5 million JPY)⁴², while a general budget must be secured from state budget (general budget) through the WMA board approval for repairs costing more, thus taking more time. All broken facilities left unrepaired at the time of post-evaluation costing more than 2 million MUR were awaiting the state budget.

The beneficiary survey indicates that industrial heavy oil has been illegally dumped into the sewage network, damaging the pumping stations and treatment plants. Additionally, during the rain, facilities frequently overflow with untreated water near the Pointe aux Sable station (the outfall of the previous system), as indicated by the residents in the area; WMA officials were also aware of the need to take some action.

Some problems have been observed in terms of financial aspect of O&M, therefore sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project has been extended with the objective of “preventing water pollution in the metropolitan area and protecting the oceanographic ecosystem.” The project indeed matches the development policies, development needs, and Japanese development policies, and is highly relevant. Additionally, efficiency is fair, because the project cost is within what was planned, but the project period far exceeded what was planned. BOD and other operating indicators meet the planned level and have contributed to the improvement of environmental and sanitation conditions; however, the effectiveness is fair, because the operating level is lower than the planned level by approximately 30%. Sustainability is an area of concern, because, although the overall system and technology are fine, there is a shortage of revenue in recovering Operations and Maintenance (O&M) costs and because some of the non-functioning facilities are left unrepaired for a long time.

In light of the above, this project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

The substantive delay was caused by the protest of a bidder who lost during the procurement stage.

⁴¹ WMA explains that the clarifier pond (1) has not been in use because the inflow of sewer water remains below capacity for the purpose of “odor abatement”.

⁴² 1MUR=2.75 JPY (exchange rate at the time of post-evaluation)

The only way to protest at that time was to file a formal lawsuit; however, a revision of the law (Public Procurement Act 2006) made it possible to file a claim at the Independent Review Panel designated by the Agency of Bidding Coordination. This is supposed to substantively simplify the procedure and shorten time; however, the implementation agency must make it even more efficient and transparent.

Data for treated wastewater quality inspection must be reviewed and reexamined; in particular, this must be done for the data for E-Coli, F-Coli, and other bacteria (maximum, minimum, and average) at the outfall and near the Montagne Jacquot Wastewater Treatment Plant. This is not covered by the current IEA survey. If necessary, an inspection will be conducted again by an institution designated by the Ministry of Environment to ensure that the water quality near the plant does not adversely affect fishing and tourism. Also, in the vicinity of the plant there exist various possible sources of contamination, with complex oceanographic settings including current, lagoon and bay, which would make it necessary to systematically monitor any causal relationship between the plant and contamination. In this regard, it is necessary for the Ministry of Environment to reach a consensus on the necessity to improve water quality data among the WMA, the Ministry of Fisheries, and all other stakeholders.

The post-evaluation has also revealed that the fecal coli observed at the Montagne Jacquot plant exceeded the “Coastal Water Quality Guideline” (1999); however, the guideline is not legally binding because there is no penalty for violating it. Additionally, there is no standard for fecal coliform in effluent water. At present, the Ministry of Environment is considering legalizing it; however, for now, the observance of guideline must be respected.

In this regard, the possibility of re-starting the chlorination or any alternative disinfection procedure, suspended since 2008 after EU recommendation, needs to be surveyed and discussed from the technical and cost-benefit perspectives.

Also, the beneficiary survey revealed the frequent overflow of water at two pumping stations especially in rainy days. A careful examination of this incidence shall be required in order to determine whether it is related to operation and maintenance or project design itself.

Also, it has been shown that the current tariff and fee collection system cannot allow full cost recovery for operation and maintenance. Therefore, a review of tariff, rationalization of personnel costs, and other drastic measures must be taken in order to strengthen financial viability.

4.2.2 Recommendations to JICA

In order not to weaken the project objective of “promoting the ocean ecosystem in coastal areas,” it is important for the WMA to examine and take necessary measures, if necessary, for the above-mentioned fecal coliform problems. However, the current financial constraints at the WMA may not allow such measures. Therefore, JICA could help them inspect water quality and take necessary action more promptly and effectively through additional surveys, such as Special Assistance for Project Sustainability (SAPS) or the dispatch of short-term sewage experts.

Montagne Jacquot has been designed as a primary treatment plant mainly to remove suspended particles. Originally, however, Mauritius had planned to build a secondary (microbiological) treatment plant after the construction of this project was completed. The level of ammonia may be reduced through nitrification by the secondary treatment thereby making a subsequent disinfection by chlorine more effective. 10 ha of land had been acquired for this; however, it remained unrealized owing to the troubled financial situation. As mentioned in the recommendation for Mauritius, if the necessity arises for secondary treatment, after a careful examination of the additional water quality inspection, JICA might be required to provide technical and financial support or advice.

This project is co-financed by the World Bank, which provided technical assistance for tariff structure, etc. Subsequently, the operational framework of the executing agency turned out to have adversely affected the physical component (Yen Loan portion), as evidenced in the malfunctioning O&M. This suggests that JICA needs to strengthen dialogues with the World Bank over the co-financing project even after the completion of the project for smoother project operation.

4.3 Lessons Learned

In countries with no JICA offices, mid-term monitoring mission and (short-term) expert dispatch would be useful in strengthening the quality and frequency of project monitoring. A project management consultant provided one year of technical assistance in O&M after the completion of the project, in keeping with the contract. This period of one year, however, was too short. Depending upon the capacity of the implementing agency, in other similar projects, three to five (or even more) years of technical assistance is commonly provided for O&M areas through BOT, etc.

Additionally, regarding the finding of concerns and risk of negative environmental impacts of fecal coliform, it is necessary to take joint action in the “Grand Baie Sewage Construction Project” to prevent similar problems in the new project.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs		
Pumping Station	2	As planned
Force Main (*)	6 km	As planned
Waste Water Treatment Plant	Treatment Capacity 48,000 m ³ /day	As planned
Sea Outfall	645 m long, 30 m deep	As planned
Consulting Services	Procurement Preparation and Supervision	As planned
Technical Assistance (*)	Management and Staff Training, etc.	As planned
<i>*World Bank-Financed Portion</i>		
2. Project Period	October 1998 – December 2002 (51 months)	September 1998 – January 2007 (99 months)
3. Project Cost		
Amount paid in Foreign currency	5,155 million yen	4,658 million yen
Amount paid in Local currency	2,553 million yen (442 million MUR)	2,367 million yen (628 million MUR)
Total	7,708 million yen	7,015 million yen
Japanese ODA loan portion	4,538 million yen	4,533 million yen
Exchange rate	1 USD = 121 yen 1 USD = 21.1 MUR (As of December 1997)	1 USD = 115 yen 1 USD = 30.5 MUR (Average between January 2005 and December 2007)