Malaysia

Ex-Post Evaluation of Japanese ODA Loan Project

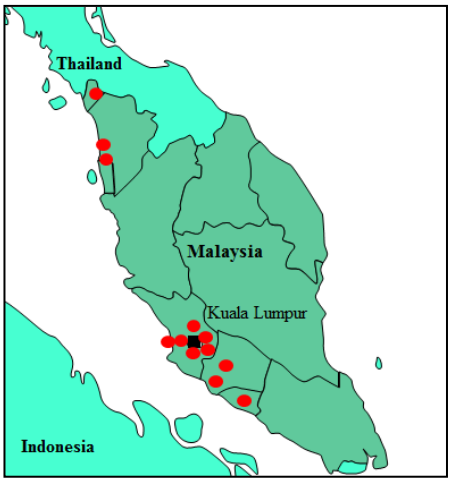
"Sewerage Treatment Plant Project"

External Evaluator: Hisae Takahashi, Ernst & Young Sustainability Co., Ltd.

## 0. Summary

This project was conducted to improve water quality by developing 13 large-scale sewerage treatment plants, as the first project of its kind in Malaysia and helping improve public sanitation conditions. The project is consistent with Malaysian development policy and needs, both of which have prioritized the sewerage sector, and aligned with Japanese assistance policy to Malaysia, thus the relevance is high. In addition, the quality of outflow at target plants was drastically improved by developing sewerage treatment plants under this project and the percentage of population served also achieved the target number. Thanks to constructing large-scale treatment plants, demolition of small treatments plants nearby the target plants and a reduction in their operation cost were confirmed as impacts of the project. Furthermore, under circumstances where the project implementation system on the Malaysian side was not well matured, since this was the first project to construct large-scale sewerage treatment facilities in Malaysia, cases of lessons learned by the executing agency were confirmed. This involved introducing a Charter to fix the period for the sewerage project. Due to the delays in the bidding process and additional construction work, both project cost and period were significantly higher than planned, thus the project efficiency is low. In terms of the sustainability, current operation and maintenance conditions are positive, but the concerns remain over the financial capacity because of insufficient service charges and chronic deficit of the O&M institute. In the light of the above, the project is evaluated to be partially satisfactory.

## 1. Project Description




Project Locations

(● = Locations of Target Sites)

Damansara Sewerage Treatment Plant

### 1.1 Background

At the time of project appraisal, the volume of living drainage soared due to rapid development and population growth in urban area of Malaysia. Accordingly, environment sanitation problems were worsening and immediate improvement was required. At the time, while the water supply penetration exceeded 90%, the provision of sewerage services was far behind. Under these circumstances, Sewerage Services Act (SSA) was institutionalized in 1993, followed by privatization of the operation and maintenance department and establishment of a regulatory agency in 1994 to improve and develop a sewerage system. Although this involved serious development of sewerage and septic tank facilities, etc., the sewerage sector remained in an unsatisfactory condition.

Under the above circumstances, the government of Malaysia, aware of the need to improve hygiene and living standards for economic development, announced a policy to promote and strongly boost these issues. To make progress however, despite the urgent need to construct and improve sewerage facilities to meet the drastic population growth, the economic situation of Malaysia, affected by the Asian currency crisis, compounded its difficulties. Accordingly, the government of Malaysia requested assistance from the government of Japan to develop sewerage facilities[1] and it was decided to construct large-scale Sewerage Treatment Plants (STP) and Central Sludge Treatment Facilities (CSTF) as a national first in 14 urban cities of Malaysia.

### 1.2 Project Outline

The objective of this project is to improve the water quality by developing STP, CSTF, sewer pipelines and pumping stations, etc. at 14 sites, thereby contributing to improve public sanitation conditions and to preserve natural environment in Malaysia.

| | |
|---|---|
| Loan Approved Amount/ Disbursed Amount | 48,489 million yen / 48,258 million yen |
| Exchange of Notes Date/ Loan Agreement Signing Date | March 2000 / March 2000 |
| Terms and Conditions | Interest Rate 0.75%<br>Repayment Period 40 year<br>(Grace Period) (10 year)<br>Conditions for Procurement: General untied |
| Borrower / Executing Agency | Malaysia / Sewerage Service Department (SSD), Ministry of Energy, Water and Communication |

[1] "Sewerage facilities" here indicates Sewerage Treatment Plants (STP), Central Sludge Treatment Facilities (CSTF), sewer pipelines, pumping stations, etc.

| | |
|---|---|
| Final Disbursement Date | July 2011 |
| Main Contractor | Shimizu Corporation (Japan) / Hitachi Plant Engineering & Construction (Japan)/Road Builder Sdn. Bhd.(Malaysia)(JV), Taisei Corporation (Japan)/Kubota Corporation (Japan)(JV), Nishihara Environment Technology(Japan)/Kajima Corporation (Japan)/ Ebara Corporation (Japan)(JV) |
| Main Consultant | Nippon Jogesuido Sekkei(Japan)/ Erinco Sdn.Bhd.(Malaysia)/ Engineering and Environmental Consultants Sdn.Bhd.(Malaysia)(JV) |
| Feasibility Studies, etc. | "Special Assistance for Project Formulation (SAPROF) for Sewerage Treatment Plant Project" JICA 1998-1999 |
| Related Projects | (Technical Cooperation)<br>・Individual experts (Sewerage sector-related: dispatched three times between 2000 and 2002 to SSD as Counter Part) |

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Hisae Takahashi, Ernst & Young Sustainability Co., Ltd.

### 2.2 Duration of Evaluation Study

Duration of the Study: August, 2013 – August, 2014

Duration of the Field Study: October 20 – November 6, 2013, March 13 – 21, 2014

## 3. Results of the Evaluation (Overall Rating : C[2])

### 3.1 Relevance (Rating: ③[3])

3.1.1 Relevance to the Development Plan of Malaysia

The development plan of Malaysia at the time of project appraisal, "7th Development Plan (1996-2000)" described the development of sewerage facilities as an important component, given the crucial need to improve the living environment on a national level. In this plan, fifteen times more funding was allocated to the sewerage sector compared to the 6th Development Plan, underlining its importance. The development policy at the time of the ex-post evaluation, the "10th Malaysian Development Plan (2011-2015)", highlighted an infrastructure development plan and 12 priority areas. One of the latter included attempts to improve the living environment. In the water supply and sewerage sector, more efficient operating and managing services as well as providing appropriate sewerage facilities were

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ② Fair, ① Low

prioritized. In addition, the Greater Kuala Lumpur (KL) / Klan Valley Plan[4] (2010), which aims to make areas of Kuala Lumpur and the Klan Valley into an international city by 2020, also has prioritized environmental improvement as one of the factors to create attractive urban cities. The plan also clearly mentioned that efforts would be made to improve sewerage water treatment and help enhance water quality in rivers.

At the time of appraisal, SSA 1993[5] was enacted; targeting further development and expansion of sewerage. Subsequently, the Water Services Industry Act 2006 (WSIA 2006) was enforced and both water supply and sewerage services were unified under the Malaysian government. Under this act, operations of sewerage services were opened by concession methods, and the National Water Services Commission (SPAN), a supervisory, surveillance and controlling institution, was established and promoted efforts to ensure efficient water supply and sewerage services and accelerate their development.

As stated above, the development of sewerage facilities has been prioritized as a means of boosting the living environment in Malaysia, from the time of appraisal up to the ex-post evaluation; hence the project is consistent with the policy and plans.

### 3.1.2 Relevance to the Development Needs of Malaysia

At the time of appraisal, the coverage of the sewerage service system showed a significant delay compared to the water supply system, with penetration exceeding 90%. For example, while the penetration rate of septic tanks[6] increased to 37.3% in 1990 compared to 17.2% in 1970, the increase for sewerage remained minimal, from 3.4 to 5.0%. Conversely, amid rapid economic and population growth, the volume of living sewerage soared and the water environment deteriorated dramatically in large urban areas, whereupon immediate action to improve the sewerage system was required. As of the ex-post evaluation, the penetration ratio of sewerage system increased to 66.6% by 2012, but must reach a minimum of 73% by 2020 with population growth in major urban cities and 223 sewerage plants must be constructed in the region by 2040[7] to maintain their living environment.

Accordingly, developing a sewerage system has been consistently cited as an important issue from the time of appraisal till the ex-post evaluation, meaning the need remains

[4] The Greater KL and Klan Valley Plan is one of 12 national major priority areas specified in the 10th Malaysian Development Plan. It aims to make KL one of the top 20 most livable cities in the world (decided by accessibility, business environment, appeal of tourism, recreation and other services) by expanding its role by 2020 and making KL into an international commercial and financial center.

[5] By installing SSA1993, the sewerage service was privatized with a concession contract, and the Sewerage Service Department (SSD) was established as a supervisory agency.

[6] The term 'Septic Tanks' here includes individual and communal septic tanks.

[7] The result of a survey which SSD commissioned a private research firm to perform. This survey result was not included in any policy documents but was utilized by SSD as a significant source of information to analyze needs, according to the SSD staff.

high.

3.1.3 Relevance to Japan's ODA Policy

The Country Assistance Policy for Malaysia at the time of appraisal prioritized 1) environment conservation, 2) poverty reduction, and 3) development of human resources and small and medium sized enterprises. Among these three, 1) environment conservation focused on improving and developing the urban environment, which was deteriorating due to rapid economic growth, and included developing a sewerage system among its issues[8]. The project supported the construction of sewerage facilities in 13 urban cities and was thus consistent with Japan's ODA policy.

As described above, the project has been highly relevant to the Malaysia's development plan, development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

**3.2 Effectiveness[9] (Rating: ③)**

3.2.1 Quantitative Effects (Operation and Effect Indicators)

At the time of appraisal, improving the percentage of population served[10] in the area operated and maintained by Indah Water Konsortium[11] as well as BOD[12] concentration, which shows water quality, were expected as indicators to show the effect of implementing the project. In addition to these planned effectiveness indicators, SS[13] concentration and the connection rate to STP, which were additionally collected, were captured and utilized as information to analyze the situation as of the ex-post evaluation.

(1) Percentage of Population Served Operated and Maintained by IWK

The percentage of the population served increased from 38.8% at the time of appraisal to 68.8% as of ex-post evaluation, which exceeded the planned target of 51%

[8] Annual report on the implementation status of Official Development Assistance of Japanese Government in 1999

[9] Sub-rating for Effectiveness is to be put with consideration of Impact.

[10] The coverage of sewerage facilities in Malaysia is shown in terms of the population with access to sewerage facilities under the IWK operation (PE) / the total population of the area where IWK manage sewerage services (PE) * 100. Refer to footnote 15 for details of PE (Population Equivalent).

[11] Operation and maintenance of the whole sewerage system for the Malaysian peninsula, except those for Kelantan, Sabah and Sarawak provinces, which were delegated to IWK as the national sewerage operating and maintenance company.

[12] BOD stands for Biochemical Oxygen Demand. BOD concentration is an indicator used to evaluate the proper operation of plants. It shows the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material, and the higher this figure, the worse the water quality.

[13] Suspended Solids (SS) Concentration is an indicator used to determine whether the facility operates properly by observing water turbidity.

(See Table 1), thus achieving the desired end result. The project was the first in Malaysia to construct large-scale sewerage treatment facilities in terms of capacity at 13 sites nationwide and can thus be said to have largely helped expand the percentage of people served with sewerage treatment facilities. For information, the actual data for the ST is not provided because users are now responsible for desludging ST, thus out of service from IWK due to the introduction of WSIA 2006.

Table 1 Target and actual of percentage of population served, operated and maintained by IWK

| | Baseline (1998) | Target[14] | Actual (2013: 3 years after completion) |
|---|---|---|---|
| STP | 21.3 % | 27.0 % | 68.8 % |
| ST | 17.5 % | 24.4 % | - |
| Total | 38.8 % | 51.4 % | 68.8 % |

Source: Documents provided by JICA and IWK.

(2) Water Quality Improvement

Table 2 shows target and actual BOD concentrations of treated water (outflow) at each target plant of the project. At the time of appraisal, the BOD concentration of treated water at each plant was expected to be below 20mg/L. The actual BOD concentration was much lower than 20mg/L at all target STPs and achieved the target, therefore improved water quality of the target STP was confirmed.

Regarding SS, which quantifies the small solid particles remaining in water, neither baseline nor target value were set[15], which made it difficult to compare or understand the attainment level. When the environmental standard defined by the Department of the Environment (DOE) in Malaysia was confirmed, the actual SS concentration at all target STP met the A level (below 50), which is categorized as the best water quality (See Table 3.)[16] Accordingly, it was confirmed that the treated water quality of the target STP for the project was high.

[14] Initially, this project was scheduled for completion in 2003 (See "3.4.2.2 Project Period" for the details), thus the target year was set between 2004 and 2010.

[15] Since SS concentration was not set as the operation and effect indicators of this project at the time of project appraisal, neither baseline nor target values were listed. On the other hand, IWK provided the information that the target value (outflow) in the design manual was 40mg/l.

[16] In addition, the actual SS concentrations (outflow) at all STP have achieved the target value (40mg/l) which was provided by IWK as a reference.

Table 2　BOD concentration

| | Target (Outflow) | Actual BOD concentration(mg/l)（Annual average） | | | |
|---|---|---|---|---|---|
| | | 2012 | | 2013 | |
| | | Inflow | Outflow | Inflow | Outflow |
| Bunus | 20 | 180.3 | 4.2 | 163.9 | 3.3 |
| Pantai | | 226.1 | 3.2 | 204.5 | 3.5 |
| Bandar Tun Razak | | 180.6 | 2.2 | 146.1 | 3.9 |
| Puchong | | 125.2 | 2.7 | 126.9 | 2.7 |
| Sungai Nyior | | 75.1 | 11.4 | 66.6 | 4.0 |
| Juru | | 64.8 | 12.7 | 43.9 | 4.3 |
| Kangar | | 82.1 | 9.1 | 2,298 | 2.6 |
| Damansara | | 176.5 | 2.1 | 231.1 | 2.4 |
| Sunggala | | 24.7 | 2.0 | 31.3 | 2.0 |
| Kuala Sawah | | 72.0 | 3.9 | 62.8 | 8.5 |

Source: Appraisal documents provided by JICA and data provided by IWK

Notes: Data of CSTF is not included. Annual average is calculated based on the average of each month. The actual data for 2013 shows the average up to September 2013. The reason of high BOD concentration of inflow in 2013 was not explained clearly, thus it is likely to be caused by anomalous value.

Table 3　SS concentration

| | Target | SS concentration (mg/l) Actual （Annual average） | | | |
|---|---|---|---|---|---|
| | | 2012 | | 2013 | |
| | | Inflow | Outflow | Inflow | Outflow |
| Bunus | No target value | 154.2 | 13.1 | 128.9 | 4.0 |
| Pantai | | 670.4 | 7.9 | 461.6 | 10.4 |
| Bandar Tun Razak | | 131.8 | 3.3 | 117.6 | 3.9 |
| Puchong | | 153.3 | 5.6 | 134.3 | 4.4 |
| Sungai Nyior | | 71.3 | 16.5 | 94.9 | 8.9 |
| Juru | | 69.5 | 19.9 | 163.5 | 6.9 |
| Kangar | | 172.3 | 12.7 | 29,975 | 12.4 |
| Damansara | | 172.6 | 3.1 | 232.3 | 10.4 |
| Sunggala | | 39.3 | 3.4 | 38.3 | 19.8 |
| Kuala Sawah | | 105.1 | 8.5 | 82.0 | 9.2 |

Source: Data provided by IWK

Notes: Data of CSTF is not included. Annual average is calculated based on the average of each month. The actual data for 2013 shows the average up to September 2013. The reason of high SS concentration of inflow in 2013 was not explained clearly, thus it is likely to be caused by anomalous value.

(3) Other Indicators (Population Served, Connection Ratio)

The population served by the target STP, not including CSTF, of this project as of the ex-post evaluation is 1,502,279 (PE[17]) which is 88% of the target (1,709,000 PE) set by the executing agency, namely the Sewerage Service Department (SSD) with 2020 as the target year (See Table 4.) Although 88% of the connection rate is considered sufficient,

[17] PE indicates Population Equivalent or converted population. PE is not a measure of population, but a numerical figure, which was converted to show the sewerage facility inflow equivalent to the water volume, regardless of the number of people in homes, commercial facilities and public facilities.

it varies from 11 to 111% depending on the STP at the time of ex-post evaluation and is particularly low in the Sunggala STP area, near where many hotels are located. The low connection is attributable to many hotels having their own small treatment facilities, and tending to avoid paying the STP connection fee[18]. In addition, the increase in residents was lower than estimated in some areas of Bandar Tun Razak, which affected the low connection rate at the time of the ex-post evaluation.

Table 4 Planned and actual population served and the connection ratio at each STP

| STP | State | Planned population served | Population connected | Connection ratio (%) |
|---|---|---|---|---|
| Bunus | Federal Territory of Kuala Lumpur | 352,000 | 393,660 | 112 |
| Pantai | | 377,000 | 377,414 | 100 |
| Bandar Tun Razak | | 100,000 | 52,434 | 52 |
| Sungai Nyior | Penang | 150,000 | 95,232 | 63 |
| Juru | | 150,000 | 120,101 | 80 |
| Kangar | Perlis | 30,000 | 16,728 | 56 |
| Damansara | Federal Territory of Kuala Lumpur | 100,000 | 72,945 | 73 |
| Sunggala | Negeri Sembilan | 60,000 | 6,627 | 11 |
| Kuala Sawah | | 240,000 | 200,170 | 83 |
| Total | | 1,709,000 | 1,502,279 | 88 |

Source: Data provided by IWK

Note: Data as of 2012. Planned population served and population connected are shown as PE and converted population.

However, SSD considered that a certain period will be needed for the connection rate to achieve 100%, and the target year for which is set at 2020 as mentioned above (See Table 5.) Accordingly, for some STPs, it is too early to judge the achievement level for connection rate at the time of ex-post evaluation. Some STP have connection rates exceeding 100% because they use an Oxidation Pond (OP) in addition to the STP constructed by this project and data for OP are also included in the connection rate.

[18] However, the Malaysian government requested that all hotels in the Sunggala area connect to the Sunggala STP by 2016.

Table 5 Projection of connection for each facility

| STP | Designed PE | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | | Projection for the connection | | | | | | | |
| Bunus | 352,000 | 393,660 | 393,720 | – | – | – | – | – | – |
| Pantai | 377,000 | 377,414 | 381,172 | – | – | – | – | – | – |
| Bandar Tun Razak | 100,000 | 54,694 | 55,564 | 74,694 | 87,694 | 92,916 | 151,138 | – | – |
| Puchong | 150,000 | 167,953 | – | – | – | – | – | – | – |
| SG Nyior | 150,000 | 96,199 | 106,018 | 115,838 | 130,000 | 150,000 | – | – | – |
| Juru | 150,000 | 120,416 | 130,000 | 140,000 | 150,000 | – | – | – | – |
| Kangar | 30,000 | 16,728 | 17,728 | 19,728 | 22,728 | 24,728 | 26,728 | 28,728 | 30,000 |
| Damansara | 100,000 | 72,945 | 77,425 | 81,905 | 86,384 | 90,864 | 175,674 | – | – |
| Sunggala | 60,000 | 21,361 | 24,809 | 32,855 | 38,453 | 51,254 | 60,000 | – | – |
| Kuala Sawah | 240,000 | 223,080 | 240,000 | – | – | – | – | – | – |

Source: Data provided by SSD and IWK

## 3.3 Impact

### 3.3.1 Intended Impacts

(1) Improvement in Public Health and Public Hygiene Environment

At the time of project appraisal, improving the public hygiene environment such as decreasing the number of water-borne diseases including cholera, dysentery, typhoid, etc. were expected as the impact of the project.

As shown in Table 6, the incidence rate of water-borne diseases among patients in each State in which target STPs are located, slightly improved compared to before and after the project implementation. Meanwhile, the result of the beneficiary survey[19] conducted in this ex-post evaluation showed that only 20% of the respondents stated that the construction of target facilities had helped improve public health (See Table 7.) This reflects the fact that improvement in health was due not only to improved sewerage facilities but also other factors, and a lack of full awareness among residents of the relation between the effect of sewerage treatment and water-borne diseases, etc.

[19] To complement efforts to evaluate the quantitative effect and impact, a beneficiary survey was conducted of 100 neighbors; 25 each at four sites, Pantai, Puchong, Bandat Tun Razak and Sugai Nyior. The respondents included 51 males and 49 females, 3 of whom aged below 19 years old, 32 of whom between 20 and 30 years old, 8 of whom between 31-40, 26 of whom between 41-50 and 21 respondents aged above 50.

Table 6 Incidence rate of water-borne disease per 100,000 population

| States where target STP located | Cholera | | Dysentery | | Typhoid | |
|---|---|---|---|---|---|---|
| | Before Project: 2003 | After project: 2011 | Before Project: 2003 | After project: 2011 | Before Project: 2003 | After project: 2011 |
| Perlis | 0.00 | 0.00 | 0.46 | 0.42 | 0.46 | 0.00 |
| Kedah | 0.06 | 0.00 | 1.12 | 0.20 | 1.80 | 0.41 |
| Pulau Pinang | 0.00 | 0.00 | 1.34 | 0.00 | 0.21 | 0.06 |
| Selangor | 0.00 | 0.02 | 0.33 | 0.25 | 0.62 | 0.68 |
| Kuala Lumpur | 0.13 | 0.00 | 0.93 | 0.06 | 0.97 | 0.40 |
| Negeri Sembilan | 0.00 | 0.00 | 0.11 | 0.00 | 0.44 | 0.10 |
| Melaka | 0.00 | 0.00 | 0.00 | 0.00 | 0.29 | 0.00 |

Source: Health Indicators for 2003, 2007 and 2011, Ministry of Health Malaysia

Table 7 The changes of health (water-borne diseases)

| 【Question】 Has the incident rate of water-borne diseases improved after improving the sewerage facilities? | Largely improved | Slightly improved | Same | Slightly worsened | Largely worsened |
|---|---|---|---|---|---|
| | 5% | 13% | 80% | 2% | 0% |

Source: Result of beneficiary survey

In addition, the target sites are located in urban areas and the river water is rarely used for daily living purposes. Accordingly, it should be noted that the baseline data for water-borne diseases as of the project appraisal was primarily low. The incidence rate of water-borne disease is one of the general indicators used to gage the impact of the water sector project, but it is difficult to understand the causal relation with accurate figures where the project site is located in an urban area like this one and the STP outflow is not utilized as water for daily life. From this point, this incidence rate is not necessarily realistic to analyze the impact of this project. Accordingly, it can be said that the indicator for analyzing the impact had to be set based on full awareness of the nature of the project at the time of project appraisal.

(2) Improvement in the Living Environment

Improvement in the living environment was also estimated as an impact of this project by developing sewerage as well as implementing sewerage and desludging treatment. Although it cannot be said that all residents and beneficiaries understood the relation between developing sewerage facilities and improving the living environment, 55% of respondents answered that the living environment had improved by developing sewerage treatment facilities, according to the beneficiary survey result regarding changes in the living environment. The reasons were cited as improvement in: odor (75%), vector attraction (27%) and landscape aesthetics (29%.)

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

"OECF Guidelines for Environmental Considerations" (1995) was applied to implement the project and the project was categorized as B level because no major environmental issues were confirmed. In 1998, approval for the necessary procedure was also received from the DOE of Malaysia, and it was concluded that the negative environmental and social impacts of this project were limited. At the time of ex-post evaluation, SSD, as the executing agency, IWK, as the operating and maintaining institution, and the target plants confirmed that the required conditions in terms of odor, noise and water quality had been satisfied at all target plants based on their records. In addition, cases of complaints over noise, odor, etc. during and after project implementation were very limited based on the result of the beneficiary and site surveys, hence no serious issues were confirmed.[20].

3.3.2.2 Land Acquisition and Resettlement

Interviews with staff of the executing agency and target plants confirmed that no land acquisition or resettlement of residents had occurred at the target sites.

3.3.2.3 Unintended Positive/Negative Impact

(1) Decommissioning Small Plants and Reduction of Operational Cost

62 small sewerage plants located nearby the target sites were decommissioned after developing large-scale plants nationwide, which allowed savings on the operational cost. According to IWK, electricity and labor costs, which accounted for 40% of the total operating and maintenance cost at each plant, could be reduced by decommissioning small plants. Many plants constructed under this project apply the latest technology, which helps save more energy. For example, the electricity usage at the target plants is about 2kWh/PE, as compared to around 3.5kWh/PE at the old type of small plants. This difference is thus considered the operational cost saving, following the implementation of the project and the decommissioning of small plants[21].

(2) Improvement in the River Water Quality

Data to show changes in river water quality were not available when analyzing the

[20] IWK has tried to maintain a minimum service level by setting out a Customer Charter. Under this Charter, complaints over noise and odors, etc. must receive a response within 24 hours. Accordingly, the same actions were taken at the target plants while implementing the project.

[21] Decommissioning small sewerage plants and deducting operating cost; based on the information provided by IWK, it can be estimated that monthly operating cost savings of 175,305 ringgit (approximately 5.537 million yen) were achieved by decommissioning the 62 small sewerage plants.
(Calculation basis) Assumption: Capacity of each small sewerage plant assumed to be 5,000PE and electricity cost of 0.377/kWh ringgit (RM).
Calculation formula: 5,000PE×62STPs×1.5kWh/PE×RM0.377/kWh = RM175,305

effect of the project implementation. The staff of SSD, the executing agency and IWK, which is in charge of operation and maintenance, explained that the impact on the improvement in river water quality was limited while areas treated at the target plants had clearly improved. The reasons were explained as polluted water from neighboring factories largely affecting the river water quality and the outflow volume of target plants being insufficient to improve the overallriver quality. The result of the beneficiary survey also showed that 71% of respondents did not perceive any change in the water quality of the neighbouring river after developing the plants.

(3) Improvement in Capacity on SSD Project Management

At the time of project commencement, SSD, the executing agency, was an institution with limited project management experience. In interview surveys, SSD staff explained that they lacked experience of managing and implementing projects, despite having experience of managing or supervising tasks, meaning that operating an unfamiliar project with limited staff was a difficult task. However, the SSD staff also said they could experience the project operation and implementation and accumulate know-how after experiencing the project. For example, under the project, the project period was delayed, which was used by SSD as a lesson learned, whereupon they officially included it to regulate the Charter. The project construction period should be set as 30-36 months for developing sewerage treatment plants and 42-48 months to construct sewer pipelines, in their Charter. It can be said that SSD gained experiences by implementing large-scale sewerage plant construction projects as a first in Malaysia, which could underpin the implementation of future projects, which will be supported nationally or by other donors.

As described above, at the time of ex-post evaluation, the percentage of population served, operated and maintained by IWK and the improvement in water quality treated at the target facilities met the target, thus the project effects are confirmed. Although impacts such as improvement in public health and river water quality were limited, it should be noted that some indicators of impact lacked clear and direct relations with the project.

Hence, the project has largely achieved its objectives. Therefore its effectiveness and impact are high.

**3.4 Efficiency (Rating: ①)**

3.4.1 Project Outputs

The project comprised STP and CSTF as well as a sewer pipeline construction work,

and consulting service related to construction work. The planned and actual outputs were as follows:

Table 8 Planned and actual output of this project

| | | Planned (As of appraisal) | | | Actual (As of the ex-post evaluation) | | |
|---|---|---|---|---|---|---|---|
| Outline of the plant construction (Sewerage Treatment Plant: STP, Central Sludge Treatment plant: CSTF) | | | | | | | |
| No. | Site | Package | Type | Designed capacity(PE) | Package | Type | Designed capacity(PE) |
| 1 | Bunus | 1 | STP | 352,000 | 1 | As planned | As planned |
| 2 | Pantai | 1 | STP | 377,000 | 1 | | |
| 3 | Bandat Tun Razak | 1 | STP | 100,000 | 1 | | As planned except the changes of treatment method |
| 4 | Puchong | 1 | STP | 150,000 | 1 | | |
| 5 | Sungai Nyior | 2 | STP | 150,000 | 2 | | As planned |
| 6 | Juru | 2 | STP | 150,000 | 2 | | |
| | | | CSTF | 300,000 | | | |
| 7 | Kangar | 2 | STP | 60,000 | 2 | | 30,000 |
| | | | CSTF | 200,000 | | | 150,000 |
| 8 | Damansara | 3 | STP | 100,000 | 3 | | As planned |
| 9 | Sunggala | 3 | STP | 60,000 | 3 | | |
| | | | CSTF | 50,000 | | | |
| 10 | Kuala Sawah | 3 | STP | 360,000 | 3 | | 240,000 |
| 11 | Klang | 4 | CSTF | 400,000 | 1 | | As planned |
| 12 | Sungai Udang | 4 | CSTF | 300,000 | 3 | | |
| 13 | Kota Setar | 4 | CSTF | 300,000 | 2 | | |
| 14 | Terengganu | 4 | CSTF | 400,000 | Cancelled | | |
| Sewer pipeline | | 6 networks Pantai, Sungai Nyior, Juru, Sunggala, Kuala Sawah, Kangar | | | 2 networks Pantai, Puchong | | |
| Consulting services | | Detailed design survey, supporting documentation for bidding and its process, assisting contract negotiation, facilitating contract performance, construction control, technical transfer to the executing agency and sub consultants and formulating an environmental management plan | | | As planned | | |

Output was almost as planned. However, the cancelation of the CSTF at Terengganu construction, capacity changes in STP and CSTF at Kangar and STP at Kuala Sawah, and changes in the numbers and sites when constructing sewer pipelines were made. In addition, the number of construction packages was revised from four to

three to make it efficient by regrouping neighboring plants, which were originally scattered geological sites, to meet the budget constraints. Means of treating sewerage were devised at Bandar Tun Razak and Puchon considering the available land, despite no change in output. The reasons for the major changes in each output are as follows:

- ✓ Cancelation of Terengganu CSTF construction: Under the project, the cost was increased due to the rise in steel price and the delays in project implementation (See details in "3.4.2.2 Project Period"), which meant the cost had to be revised to fit the planned limit. Canceling the CSTF construction at Terengganu was deemed most appropriate, given its geographical distance from other plants[22] and with project efficiently in mind. This cancelation was decided after confirming the portion of sludge which was scheduled for acceptance at the Terengganu site could be transferred to the other existing neighboring sludge treatment plant if CSTF construction was canceled at the Terengganu site. This cancelation was made to fit the scheduled project cost and after efforts to choose the site which would have least impact on the project if canceled and is thus considered appropriate.

- ✓ Capacity modification at Kangar STP and CSTF as well as Kuala Sawah STP: For the same reason as canceling Terengganu CSTF, the capacity of STPs and CSTF of Kangar and Kuala Sawah, where population growth was expected to be relatively moderate, were deduced. The utilization rates of Kangar and Kuala Sawah STPs were 89 and 87% respectively (See Table 11 of 3.5.4 Current Status of Operation and Maintenance), hence the lack of capacity is not currently confirmed.

- ✓ Modification of output during sewer pipeline construction: It was not easy to obtain approvals from local authorities and related institutions such as electricity agencies to construct the sewer pipeline. After examining the measures and considering the time and effort required by the Malaysian side, it was decided that the sewer pipeline construction planned under packages 2 and 3 (Sungai Nyior, Juru, Sunggala, Kuala Sawah and Kangar) should be performed by the Malaysian side. Construction of these sewer pipelines, which went outside the scope of this project, was completed by the Malaysian side at the time of ex-post evaluation. For the reasons described above, these changes were deemed appropriate from an efficiency perspective.

[22] While target plants are all located to the west of the Malay Peninsula, Terengganu is located in the east coast.

Kuala Sawah STP

Sungai Udang CSTF

### 3.4.2 Project Inputs

#### 3.4.2.1 Project Cost

The actual project cost was 63,905 million yen (48,258 million yen from Japanese ODA loan) while a total cost of this project was planned to be 64,652 million yen (48,489 million yen from Japanese ODA loan). Thus the total project cost was lower than the planned amount (see Table 9.) Considering the fact that the construction of one plant (Terengganu) had been cancelled, however, the actual project cost was deemed to slightly exceed the planned cost[23]. The planned cost to construct the canceled plant as planned was 74.6 million RM (about 2,357 million yen), equivalent to 4.3% of the planned construction cost. Taking this into account, the total project cost was considered to amount to about 104% of the planned project cost.

The actual local currency portion exceeded the planned amount due to increases in the unit construction price, additional ground improvement works, price escalation, etc. In addition, extending the project period with additional construction work also affected the increase in cost.

[23] Construction of the Terengganu CSTF was canceled, whereupon it was decided to adjust the project cost based on plans to respond to the increased project cost caused by the project delay, etc. Meanwhile, efforts and attempts made by the executing agency, including choosing Terengganu CSTF which would have the least impact on the project after much consideration, have to be noted.

Table 9　Original and actual project costs

| | Original | | | Actual | | |
|---|---|---|---|---|---|---|
| | Foreign currency (million yen) | Local currency (million yen) | Total (million yen) | Foreign currency (million yen) | Local currency (thousand RM) | Total (million yen) |
| Construction works | 33,928 | 20,267 | 54,195 | 15,632 | 1,405,196 | 59,998 |
| Consulting services | 845 | 2,285 | 3,130 | 1,647 | 70,597 | 3,859 |
| Administration cost | 0 | 1,909 | 1,909 | 0 | 0 | 0 |
| Contingencies | 3,393 | 2,025 | 5,418 | 48 | 0 | 48 |
| Total | 38,166 | 26,486 | 64,652 | 17,327 | 1,475,793 | 63,905 |

Source: Appraisal documents and internal data provided by JICA.
Note: Exchange rate (As of appraisal) 1 Ringgit (RM) =31.6 yen, (As of the ex-post evaluation) PKG 1:1RM＝34.2336 yen, PKG 2 and 3：1RM=29.079 yen

3.4.2.2 Project Period

The project period was scheduled to last for a total of 52 months, from September 1999 to December 2013. However, the project actually took 99 months, from November 2000 to January 2009, which was significantly longer than planned (190%). The main reasons for the delay are as below.

(1) Delay in Bidding Procedure

Extensive delay occurred in the prequalification[24] stage, which was implemented before the bidding procedure under the project as time was required to establish a consensus between the Malaysian government and the Japanese side on screening treatment of companies. The Malaysian government issued a notice of determination for disqualification, since one of the Japanese companies which participated in the bidding was involved in a bribery issue in Japan, although not directly related to this project. Meanwhile, the Japanese side deemed this disclaimer to the Japanese company as inappropriate based on transparency of procurement guideline and the principle of discrimination. After the Japanese side and Malaysian government carefully considered and engaged in multiple rounds of discussion, the Malaysia side met the view of the Japanese side in line with the “Instruction to Bidders”of prequalification. Accordingly, the letter notifying implementation of the bidding procedure was received and the bidding process was recommenced, which resulted in 22 months of delay. Additionally, as of the bidding, clarification of the bidding

[24] The survey, which was conducted before bidding or requesting proposals to review the integrated implementation capacity of candidate firms by the contractor, is called Prequalification (PQ). Normally candidate firms prepared the documents for PQ and the contractor sides evaluate the contents of the prepared documents. Finally only qualified candidate firms for PQ are invited for bidding.

documents and consultations took longer, delaying the bidding process due to insufficient paperwork on the bidding documents, the bidding price exceeding estimates over 10%, etc.

(2) Additional Ground Improvement Works

The result of the scrutinized ground survey showed that the ground foundation was weaker than the original design, meaning additional ground improvement works were required and the construction period had to be extended[25]. Since Special Assistance for Project Formulation[26] (SAPROF) highlighted the weakness of ground foundation in the Malay Peninsula, works to strengthen the foundation using pile foundations, which were generally applied to the weakest ground foundation, were planned in the project. However, ground improvement works to strengthen the foundations with embankments became necessary at sites with significant ground subsidence, which extended the project period. Planned works to strengthen foundations were also designed based on the geological data of the surveyed target site, but no detailed boring survey[27] for the ground foundation was implemented. Accordingly, foreseeing the issue of ground subsidence around the target plants before implementing the project precisely is considered difficult.

(3) Delays in Obtaining Approval from Local Authorities and Related Institutions

Regarding the sewer pipeline construction in package 1, gaining approval from local authorities and coordinating with the electricity authority, etc. took time. For example, approval from the local authority was not obtained at Puchong as planned, because the planned construction site was crisscrossed by a highway. Likewise, due to delays caused when the project started, coordination with other ongoing projects was needed, which took time at Pantai and thus significantly exceeded the planned project period. In light of these experiences, meetings to request coordination among related local authorities and institutions were held when the project was started for all projects currently implemented by SSD.

(4) Lack of Experience of the Executing Agency on Project Implementation

In Malaysia, authority and resources etc. on sewerage services were transferred from local to federal government under SSA in 1993, while the SSD was established in the Ministry of Local Housing and Local Government as the executing agency in

[25] Sites where ground improvement were needed included Bunus, Klan, Sungai Nyior, Juru, Kota Setar, Kanfar, Sunggla and Kuala Sawah.

[26] Special Assistance for Project Formulation (SAPROF) is an additional survey conducted by entrusted consultants to assist with project formulation efforts of recipient countries.

[27] Whether conducting a boring survey or not in the initial stages of the project is decided on a case-by-case basis. Many cases use existing geological data of the target area due to budget constraints.

1994 in line with this transfer, as a relatively young institution with a limited number of staff, e.g. 4 or 5 at the time. Moreover, this was the first project in the sewerage sector supported by foreign countries, so the lack of knowledge, experience, structure and capacity of the executing agency was considered for effecting as one of the cause of the project delay. Where institutions with limited experience are commissioned as executing agencies, as in this project, a structure to support the project management of the executing agency, such as setting the Project Monitoring Unit (PMU) and including external resources, had to be considered.

3.4.3 Results of Calculations of Internal Rates of Return (Reference only)

At the time of appraisal, the Financial Internal Rate of Returns (FIRR) was estimated as 0.69%. Under the ex-post evaluation, no recalculation was conducted because the basic condition used to calculate the appraisal was unconfirmed and measuring this benefit based on monetary value alone was difficult.

As mentioned above, although the project cost was within the plan, the actual project cost slightly exceeded the plan due to cancelation of part of the output. However, it should be noted that this change was necessary to keep the project cost on budget because the cost had been estimated to exceed the original plan due to price escalation and additional construction work. The project period was extended significantly beyond the planned period (192%) due to the additional construction work and the longer time required to obtain approval from local authorities on construction. Therefore, efficiency of the project is low.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

Except for some area, IWK manages the Operation and Maintenance (O&M) works of all sewerage plants in Malaysia. IWK employed 77 staff for management, 1,032 for administration at its headquarters, and a total of 2,856 as of 2011; 1,747 of whom are engaged in O&M tasks at each plant. In sewerage sector in Malaysia, other than IWK, SPAN is responsible for setting rules, regulations and pricing and SSD as the implementing and supervisory agency, also oversees the technical advisory role on sewerage to the government.

With consideration of the institutional aspect of IWK, which is responsible for O&M, the number of staff is minimal considering the enormous number of plants (about 6,000 plants). For example, Kangar STP conducts O&M tasks for more than 50 small STPs in the covering area, as well as the target STP with five O&M staff. In addition, the high staff turnover is also raised as a current IWK issue, according to the

IWK staff of headquarters as well as each plant. Though the official turnover of IWK could not be obtained, issues caused by the high turnover, including lack of sharing information at the time of handover as well as O&M of inexperienced staff, have to be resolved in future. In the interview survey with IWK staff, the high turnover was attributed to low staff salaries, but improvement was considered difficult, due to the poor financial condition of IWK (Refer to 3.5.3 Financial Aspects of Operation and Maintenance for details.)

### 3.5.2 Technical Aspects of Operation and Maintenance

IWK is an experienced institution, which has long been tasked with responsibility for O&M of sewerage facilities in Malaysia. Accordingly, the enrolled staff have abundant knowledge and experience of O&M, and are also regularly trained to ensure they have the basic skills required. The training comprises not only internal training, which is conducted regularly and on joining the IWK, but additional external training opportunities. For example, IWK staff participated in JICA country-by-country training held at Obihiro city for O&M of sewerage facilities and treatment plants. As described above, however, minor concerns remain in terms of ensuring sustainability for technical capacity in future, due to the high turnover and many staff with less than 2 to 3 years' experience.

### 3.5.3 Financial Aspects of Operation and Maintenance

Table 10 shows the annual O&M cost of target plants. Although the individual circumstances differ, detailed amounts could not be obtained. However, the budget for appropriate O&M has not yet been secured, based on interview surveys with IWK and each plant.

Table 10 Annual O&M cost of target plants

(Unit: million Ringgit (RM))

| | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| Annual O&M cost | 29.0 | 35.6 | 34.3 | 25.1 |

Source: Data provided by IWK
Note: Costs in 2013 show the data until September.

Imposing a sewerage service charge had an impact on this budget insufficiency. While IWK is the public sewerage service agency with the capital of Ministry of Finance, the O&M cost could not be recovered due to the low service charge. This resulted in a persistent budget deficit, in response to which the government subsided 35 and 32% of the operation cost in 2009 and 2010. SSD, SPAN and IWK aim to minimize the government subsidy to IWK in future. The current sewerage service

charge system comprises four customer categories, namely: "Domestic[28]", "Industry[29]", "Commercial[30]" and "Government[31]". The basic charge for domestic premises in particular has remained wholly unchanged since 1997, at a very cheap charge of RM8 per month (about 250 yen). IWK and SSD explained that this charge was set by the government and SPAN and that political leverage would be required to raise charges, despite the crucial need to do so to improve the financial situation of IWK. Accordingly, this is not an issue which IWK can solve alone. In interviews with SPAN, IWK and SSD staff, however, they all agreed that the sewerage service charge (8 RM per month) is unreasonable and unsustainable considering the current price level and hence continued negotiating with government to raise the charges. In addition, under current circumstances, sewerage service charges are levied based on the annual values of land and buildings, however, it was explained that they should be unified and proportionate to water supply charges in future[32].

### 3.5.4 Current Status of Operation and Maintenance

O&M of sewerage facilities work requires daily inspection, assessment of water quality, regular cleaning, checking parts having deteriorated or facilities requiring rehabilitation, etc. Under current circumstances, O&M of facilities and equipment is conducted in line with Planned Preventive Maintenance and each plant is responsible for reporting to IWK (water quality to DOE). Most of the facilities and equipment of the target plants are properly maintained, although some equipment is temporarily out of service due to maintenance or spare parts required.

Conversely, some common issues included "spare parts are expensive and take considerable time to acquire", "available contractors to conduct proper maintenance are limited" and "contractors have not registered on the IWK register list, which is compulsory when requesting agents", were confirmed at several plants. Moreover, the sludge concentration rate[33] after the sludge had been concentrated using a mechanical thickener is currently about 1-2% at most of the plants, despite originally being designed for 4%[34]. One of the reasons is considered to be clogging of the mesh, but

[28] The monthly sewerage service charge levied for domestic premises is 8 RM. However, the charge for low-cost houses and government quarters in some categories is 2 RM, while houses in some villages specified by the state pay 3 RM.
[29] Industrial customers will be charged based on the total number of employees (2.5RM per head per month).
[30] Monthly sewerage service charges for commercial premises are a sum of the basic charge based on the premises annual values. For example, if the annual value is 100,001-200,000RM, the monthly charge is 120RM. Refer to IWK web site for the details. http://www.iwk.com.my/v/customer/commercial
[31] Monthly basic charge of sewerage services for government premises is 40RM.
[32] Based on the interview survey with SPAN
[33] Since sludge extracted from sedimentation tanks includes a high water content and high volume, water has to be removed to reduce the volume, which is called sludge concentration.
[34] According to the IWK, the lower than the expected 4% of thicken sludge affects the digester performance. However, the bio-gas generation is below 25% of the design value at the time of

IWK is now modifying part of this machine on a trial basis and implementing trial operation to improve the concentration rate.

Table 11 shows the treated volume and utilization rate of target plants under the project. STPs have an average utilization rate of 70%. Conversely, desludging of STs was not conducted under regular IWK management due to the enforcement of WSIA 2006, meaning the responsibility was left to users. By introducing WSIA 2006, a means of accelerating private sector participation in desludging services was assumed. However, CSTF utilization rates have remained low, given the reduced desludging frequency of STs, when the responsibility was given to users, who lacked understanding of the importance of sewerage treatment. Increasing user awareness of the mandatory need for desludging from ST, which is currently under the user's responsibility, would be an effective means of promoting desludging henceforth. Since SPAN has already recognized its importance, there will be a need to continue negotiation with government to realize it in future.

Table 11 Treated volume and utilization rate of each plant

| Location of STP/CSTF | | Designed capacity $m^3$/day | Treated volume [Note] | Utilization rate |
|---|---|---|---|---|
| | | | $m^3$/day | % |
| Bunus | STP | 87,000 | 65,250 | 75 |
| Pantai | STP | 93,000 | 93,000 | 100 |
| Bandat Tun Razak | STP | 25,000 | 17,500 | 70 |
| Puchong | STP | 37,000 | 25,950 | 70 |
| Sungai Nyior | STP | 37,000 | 22,000 | 59 |
| Juru | STP | 37,000 | 32,797 | 89 |
| | CSTF | 250 | 27 | 11 |
| Kangar | STP | 6,750 | 6,006 | 89 |
| | CSTF | 140 | 20 | 14 |
| Damansara | STP | 25,000 | 18,000 | 72 |
| Sunggala | STP | 15,000 | 2,900 | 19 |
| | CSTF | 35 | 9 | 24 |
| Kuala Sawah | STP | 59,000 | 51,073 | 87 |
| Klang | CSTF | 250 | 33 | 13 |
| Sungai Udang | CSTF | 250 | 50 | 20 |
| Kota Setar | CSTF | 210 | 40 | 19 |

Source: Data provided by IWK
Note: Average data of 2013

IWK staff responsible for maintaining STPs has sufficient opportunities to receive O&M training and no serious O&M issue for target facilities was confirmed. Conversely, IWK as a whole has difficulties to secure sufficient staff for the appropriate O&M works,

ex-post evaluation..

and the high turnover remains an issue. From a financial perspective, some problems have been observed due to service charges which have long remained unchanged and the need for a government subsidy. Therefore sustainability of the project effect is fair.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

This project was conducted to improve water quality by developing 13 large-scale sewerage treatment plants, as the first project of its kind in Malaysia and helping improve public sanitation conditions. This project is consistent with Malaysian development policy and needs, both of which have prioritized the sewerage sector, and aligned with Japanese assistance policy to Malaysia, thus the relevance is high. In addition, the quality of outflow at target plants was drastically improved by developing sewerage treatment plants under this project and the percentage of population served also achieved the target number. Thanks to constructing large-scale treatment plants, demolition of small treatments plants nearby the target plants and a reduction in their operation cost were confirmed as impacts of the project. Furthermore, under circumstances where the project implementation system on the Malaysian side was not well matured, since this was the first project to construct large-scale sewerage treatment facilities in Malaysia, cases of lessons learned by the executing agency were confirmed. This involved introducing a Charter to fix the period for the sewerage project. Due to the delays in the bidding process and additional construction work, both project cost and period were significantly higher than planned, thus the project efficiency is low. In terms of the sustainability, current operation and maintenance conditions are positive, but the concerns remain over the financial capacity because of insufficient service charges and chronic deficit of the O&M institute. In the light of the above, the project is evaluated to be partially satisfactory.

### 4.2 Recommendations

#### 4.2.1 Recommendations to IWK and SPAN

- At the time of ex-post evaluation, the low utilization of CSTF was confirmed, mainly due to the effect of policy changes in the water supply and sewerage sectors. Conversely, a lack of understanding of the importance of sludge treatment among residents was also raised as an issue. IWK and SPAN have currently conducted awareness activities within a limited budget, so efforts for further improvement should be continued. Meanwhile, SPAN is recommended to lobby the government continuously to make regular ST desludging compulsory.
- Low sewerage service charges have exacerbated the IWK budget crisis and it is currently unable to operate services without a government subsidy. While IWK must constantly strive to improve its financial situation, this is not feasible unless the

sewerage service charges are revised. Accordingly, ongoing efforts must be made to persuade the government to revise the service charges to secure future sustainability.

### 4.3 Lessons Learned

・Thorough and careful development of a contact list of agents dealing with O&M and spare parts

Some difficulties in obtaining the spare parts and missing contacts with agents regarding the equipment provided by this project were confirmed. For similar types of the project in future, the contact lists of agents for O&M and spare parts must be carefully and thoughtfully developed before completing the project, particularly for equipment or spare parts which need to be procured from overseas.

・Pre-arrangement to mitigate the risk of delays by strengthening information sharing among related parties

The project period significantly exceeded the original plan (190%). Although the delays were mainly due to external factors, including delays to the bidding process and additional construction work which was outside the control of the project, the time taken to obtain approval from local authorities and related institutions also significantly delayed the project. Such projects, on a nationwide scale and requiring approvals from related institutions like this one, must devise ways of responding to the risk involved in each delay, such as sharing the schedule when the project gets underway and progress in a timely manner to elicit the understanding of related parties.

・Establishing a support system commensurate to the capacity and experiences of the executing agency

SSD, the executing agency of this project, lacked experience of operating and implementing the work involved in this project and lacked sufficient capacity and staff as the executing agency at the project beginning stage. Where such institutions lacking experience of project implementation become executing agencies as this case, it would be advisable to establish a PMU with experts on project operation and management.

Comparison of the Original and Actual Scope of the Project

| Item | Original | | | Actual | | |
|---|---|---|---|---|---|---|
| 1. .Project Outputs | Package | facility | Designed Capacity(PE) | Package | facility | Designed Capacity(PE) |
| Plants of construction works | | | | | | |
| 1) Bunus | 1 | STP | 352,000 | 1 | As Planned | As Planned |
| 2) Pantai | 1 | STP | 377,000 | 1 | As Planned | As Planned |
| 3) Bandar Tun Razak | 1 | STP | 100,000 | 1 | As Planned | As Planned |
| 4) Puchong | 1 | STP | 150,000 | 1 | As Planned | As Planned |
| 5) Sungai Nyior | 2 | STP | 150,000 | 2 | As Planned | As Planned |
| 6) Juru | 2 | STP | 150,000 | 2 | As Planned | As Planned |
| | | CSTF | 300,000 | | As Planned | As Planned |
| 7) Kangar | 2 | STP | 60,000 | 2 | As Planned | 30,000 |
| | | CSTF | 200,000 | | As Planned | 150,000 |
| 8) Damansara | 3 | STP | 100,000 | 3 | As Planned | As Planned |
| 9) Sunggala | 3 | STP | 60,000 | 3 | As Planned | As Planned |
| | | CSTF | 50,000 | | As Planned | As Planned |
| 10) Kuala Sawah | 3 | STP | 360,000 | 3 | As Planned | 240,000 |
| 11) Klang | 4 | CSTF | 400,000 | 1 | As Planned | As Planned |
| 12) Sungai Udang | 4 | CSTF | 300,000 | 3 | As Planned | As Planned |
| 13) Kota Setar | 4 | CSTF | 300,000 | 2 | As Planned | As Planned |
| 14) Terengganu | 4 | CSTF | 400,000 | Cancel | | |
| Construction of sewer pipelines | 6 networks<br>Pantai, Sungai Nyior, Juru, Sunggala, Kuala Sawah, Kangar | | | 2 networks<br>Pantai, Puchong | | |
| Consulting Service | Detailed design survey, supporting documentation for bidding and its process, contract negotiation, facilitating contract performance, construction control, technical transfer to the executing agency and sub consultants and formulating environmental management plan | | | As planned | | |
| 2.Project Period | September 1999 – December 2003<br>(52 months) | | | November 2000 – January 2009<br>(99 months) | | |
| 3.Project Cost<br>Amount paid in Foreign currency | 38,166million yen | | | 17,327 million yen | | |
| Amount paid in Local currency | 26,486 million yen<br>(838,172 thousand RM (Ringgit)) | | | 46,578 million yen<br>(1,475,793 thousand RM) | | |
| Total | 64,652 million yen | | | 63,905 million yen | | |
| Japanese ODA loan portion | 48,489 million yen | | | 48,258 million yen | | |
| Exchange rate | 1 RM = 31.6 yen<br>(As of June, 1996) | | | 1RM = 34.23 yen for package 1<br>(Average between November 2003 and July 2007)<br>1RM = 29.08 yen for package 2 and 3<br>(Average between March 2006 and January, 2009) | | |