

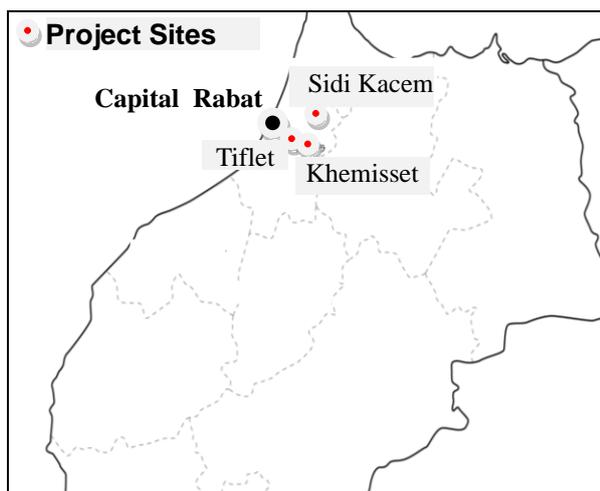
0. Summary

This project was implemented to establish and expand sewerage systems in three cities (Khemisset, Sidi Kacem, and Tiflet) near Rabat, and improve the sanitary environment in the cities, thereby contributing to improvement in living standards in the areas.

The target areas were core cities and communes in regions in which the need for sanitation or sewerage improvement was the highest among those specified in the *National Sanitation Master Plan* (formulated in December 1997, and hereinafter referred to as “SDNAL”), a sector development policy of the Moroccan government. In addition, this project has been highly consistent with Japan’s ODA policy; thus, its relevance is high. The project period of ten years was significantly longer than the planned period (four years) because the project required a considerable amount of labor and time to acquire land for sewage treatment plants. Meanwhile, the project cost was within the plan, at 92% against the recalculated budget plan. Therefore, the efficiency of the project is fair. In Khemisset and Sidi Kacem, the sewerage systems were established almost as planned, excluding some sections, thereby improving the sanitation environments in the cities. On the other hand, in Tiflet, although the trunk sewer and sewage collection network were improved as planned, and the sanitation environment in the city was improved, the establishment of a sewage treatment plant remains incomplete. This led to the fact that sewage in the city has been untreated and discharged into the river. According to an interview survey, local residents are satisfied with this project, and positive impacts on the natural environment, public health, and economy in the cities have been confirmed. Although the improvement in living standards in the target cities has been achieved, consideration for the natural environment and measures for water quality monitoring are insufficient. To summarize the above, the effectiveness and impacts of the project are fair. For the systems for maintenance in this project, implementation systems by the headquarters, regional and provincial offices, and city service offices have functioned. With regard to technical aspects, the National Office of Electricity and Drinking Water (Office National de l'Electricite et de l'Eau Potable [ONEE]) has a good track record in maintenance and sufficient technical capabilities. In addition to the soundness of its financial condition, the balance of payments combined with water supply and electric power has been active every year, and no major problems have been observed. Therefore, the sustainability of the project effects is high.

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

1. Project Description



Project Location



The sewage treatment plant installed by the project (Khemisset)

1.1 Background

In infrastructure improvement in Morocco, sewerage improvement is one of the fields in which delay is still conspicuous. It is a priority issue that must be resolved immediately from the perspectives of the sanitation environment and recycling of scarce water resources. In large cities including Casablanca and Rabat, sewerage has been developed by local governments (municipalities) or private companies and operated and managed by public corporations such as ONEE or private companies. On the other hand, in smaller cities, local governments have been in charge of sewerage improvement, but the progress has been slow because of rapid urbanization and acute fund shortage in local governments.

In 1997, the Moroccan government formulated SDNAL, and positioned ONEE providing water supply service as the main implementing body of sewerage projects. Based on the institutional framework, ONEE formulated the *National Sanitation Program* (PNA) (2003-2017), in which top priority projects to be implemented in 2003-2017 were selected.

To promote balanced economic growth through improvement of economic and social infrastructure including sewerage systems, ONEE requested, through the Moroccan government, the Japanese government to provide an ODA loan for establishment and improvement of sewerage systems by local governments, which is the component with the highest priority in PNA, and the request was approved.

1.2 Project Outline

This project was implemented to establish and expand sewerage systems in three cities near Rabat, and improve the sanitary environment in the cities, thereby contributing to improvement in living standards in the areas.

Loan Approved Amount/ Disbursed Amount	4,203 million JPY	/	2,919 million JPY
Exchange of Notes Date/ Loan Agreement Signing Date	November 29, 2005	/	November 30, 2005
Terms and Conditions	Interest Rate		0.75%

	Repayment Period (Grace Period)	40 years (10 years)
	Conditions for Procurement	General Untied
Borrower / Executing Agency	National Office of Electricity and Drinking Water (Office National de l'Electricite et de l'Eau Potable: ONEE)	
Project Completion	May, 2016	
Main Contractors	No contractor exceeds 1 billion JPY	
Main Consultants	Consultant 1: Nippon Koei Co., Ltd. (Japan) / TEAM MAROC,S.A. (Morocco) / NOVEC S.A. (Morocco) Consultant 2: Nippon Koei Co., Ltd. (Japan) / TEAM MAROC, S.A. (Morocco) / SCET-SCOM S.A. A DIRECTOIRE ET A CONSEIL DE SURVEILLANCE (Morocco)	
Related Studies	Special Assistance for Project Formation (SAPROF) for Sewerage System Development Project in Four Communes (2004)	
Related Projects	<p>[Technical Cooperation]</p> <ul style="list-style-type: none"> - JICA Expert dispatch / Technical Assistance to the Water Conservation Agency (2001 - 2004 / 2004 - 2006) - JICA Expert dispatch / Support on planning for local drinking water supply (2004 - 2007) <p>[Japanese ODA Loan]</p> <ul style="list-style-type: none"> - Rural Water Supply Project (I) (II) (L/A: 2000, 2000 - 2004) (I) 4,513 million JPY, (II) 2,236 million JPY - Urban Environment Improvement Project (L/A: 2007, 2007 - 2014) 7,383 million JPY <p>[Japanese Grant Aid]</p> <ul style="list-style-type: none"> - Southern Provinces Drinking Water Supply Plan (2000) - Benslimane District Drinking Water Plan (2003) <p>[Other International Organizations, Aid Agencies, etc.]</p> <ul style="list-style-type: none"> German Reconstruction Finance Corporation (KfW) - 20 ONEE projects on National Sanitation Master Plan, Islamic Development Bank (IsDB) - 9 loan projects with ONEE on National Sanitation Master Plan 	

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriaki Suzuki, IC Net Limited

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October 2019 - November 2020

Duration of the Field Study: December 7 - 27, 2019

2.3 Constraints during the Evaluation Study

The second field survey scheduled for 2020 was canceled because of the impact of novel coronavirus infection (COVID-19), and the evaluator could not travel to Morocco. However, the evaluator communicated in writing with the executing agency and the JICA Morocco Office. In addition, the supporting researchers (local consultants) conducted supplementary surveys by telephone or email. Thus, minimum necessary information was obtained.

3. Results of the Evaluation (Overall Rating: B¹)

3.1 Relevance (Rating: ③²)

3.1.1 Consistency with the Development Plan of Morocco

(1) Development plan of Morocco at the time of the appraisal

SDNAL provides that ONEE becomes the main implementing body of sewerage projects, and specifies the importance of ONEE's undertaking sewerage projects in core cities and their surrounding communes. Based on SDNAL, ONEE formulated the *National Sanitation Program* (PNA) (Target: 278 communes; Total cost: About 180 billion yen; Beneficiary population: About 4.50 million), aiming to improve sewerage systems in 15 years in all the jurisdictions to which ONEE supplies water. It was decided that projects with the highest priority from perspectives of 1) pollution risk of water supply sources, 2) population size, and 3) progress in necessary surveys for project implementation (Target: 90 communes; Total cost: About 50.8 billion yen; Beneficiary population: About 3.40 million) in PNA would be implemented in the first five years (2003-2007). Meanwhile, in the *National Economic and Social Development Plan* (2000-2004), which is Morocco's long-term development plan approved in the country's Parliament in September 2000, environment improvement in core cities through sewerage improvement was positioned as one of the top priority issues at the time of the appraisal. Thus, as the project is part of the investment plan for PNA, its relevance is high.

(2) Development plan of Morocco at the time of the ex-post evaluation

SDNAL was revised once after its formulation in December 1997, and the plan period was extended to 2022. In the quarterly reports of SDNAL projects, the importance of ONEE's undertaking sewerage projects in core cities and their surrounding communes is specified. In addition, PNA, formulated based on SDNAL, has been reviewed every five years; and now as PNA for 2018-2022, the same contents have been continued. As of July 2019, 181 sanitation projects have been implemented in approximately 156 core cities or communes, and an amount of 12,807 million MDH or 155 billion yen (Exchange rate: 12.1 yen/MDH) has been invested. Although the periods became longer than the initial plans and the costs became more than planned, in order to cover the initially planned 278 core cities and communes, sanitation or sewerage improvement has been promoted (Progress as of July 2019: 56%). Thus, even at the time of the ex-post evaluation, the direction of the development plan for national sanitation remained unchanged. Therefore, this project is consistent with the development plan of Morocco also at the time of the ex-post evaluation.

3.1.2 Consistency with the Development Needs of Morocco

Each of the three target cities in this project, Khemisset, Sidi Kacem, and Tiflet, is a core city relatively near the capital. In PNA, based on SDNAL, 278 core cities and communes were stipulated as priority areas for sanitation or sewerage improvement. Ninety areas out of those were designated as areas in which a sanitation project should be implemented in 2003-07. Each of the target cities in

¹ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

² ③: High, ②: Fair, ①: Low

this project was designated as one of these priority areas. In the priority ranking, Khemisset is ranked 1st, Sidi Kacem 3rd, and Tiflet 15th. Each of them is a core city and commune with higher priority among the priority areas. Although ranked 15th, Tiflet is a city in Khemisset Province with Khemisset as the core city, and near the capital Rabat; thus, a future population increase is expected. Therefore, its selection is of relevance. From this, the relevance of selecting Sidi Kacem, Khemisset, and Tiflet as the target cities in this project is high. Incidentally, other cities with high priority were to be aided with fund schemes by other donors and private banks.

Moreover, PNA stipulates sanitation or sewerage improvement in smaller regional cities as an urgent task, and recommends increasing the sewerage connection rates to 80% and the sewage treatment rates to 60% by 2020. The sewerage connection rates in Sidi Kacem and Tiflet were low among such cities, and the sewage treatment rate in each of the three cities was 0%. Through this project, the connection rates have been significantly higher than the target, over 95%, and the sewage treatment rates in Sidi Kacem and Khemisset have become over 90%, satisfying the development needs of Morocco. Currently in Khemisset and Tiflet near Rabat, urban development as a commutable area or commuter town to the capital Rabat has been put on a fast track. A future significant increase in the number of households is expected. Therefore, the importance of sanitation or sewerage improvement in both cities is continuously high after the ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policy

In Japan's *Country Assistance Policy for the Kingdom of Morocco* in 2006, the environment was taken as one of the six priority areas. JICA's (former JBIC's) *Implementation Policy for Overseas Economic Cooperation Operations* (2002-2004) defined "projects for environment conservation" and "support for economic infrastructure improvement to reduce income and regional disparities, the social sector, and poverty programs" as priority support areas in light of deterioration of the living environment accompanying urbanization, and conspicuous wealth and regional disparities. The *Implementation Policy for Overseas Economic Cooperation Operations* (2005-2007) continuously focused on efforts toward poverty reduction with the necessity of contribution to achievement of the Millennium Development Goals (Goal 1-Goal 6) in mind. In association with this project, emphasis was placed on support to "continuously improve economic and social infrastructure with high needs in developing countries (transportation and physical distribution, irrigation, water and sewer services, etc.) and promote sustainable growth." In addition, since 2005, JICA has promoted reduction of regional and social disparities, as well as a policy for support contributing to sustainable economic growth and reduction of social and regional disparities in order to contribute to stabilization of regional parts and balanced development of the Moroccan economy. This project aimed to promote sewerage projects in regional parts and solve the water quality problems in rivers, lakes, dams, and similar. From this perspective as well, this project was consistent with Japan's ODA policy.

3.1.4 Appropriateness of the Project Plan and Approach

The objectives, indicators, and activities set at the time of the appraisal are logically connected and feasible with no major problems. In Tiflet, the sewage treatment plant could not be constructed because of unexpected circumstances that could not be controlled by the executing agency, such as the price of land to acquire that became several times the original estimate and significantly exceeded the city's budget for land acquisition. However, this is far from inadequate project plan or approach. In the other two cities, the plants were constructed as planned, which resulted in production of expected results.

As described above, this project has been sufficiently consistent with the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Table 1 shows the comparison between planned and actual outputs (sewerage systems) of this project.

Table 1: Project Outputs (Plan / Actual)

Items	Plan (2005)	Actual (2016)
Khemisset		
Sewage Treatment Plant	Pretreatment + anaerobic pond + aerated lagoon	As planned
Sewage Treatment Volume per Day (m ³ /day)	11,008	12,152 The Treatment Volume was slightly increased in consideration of future population growth.
Cleaning of Sewer Lines (km)	3.6	0 None
Rehabilitation of Sewer Lines (km)	0.3	0 None
Sewer trunk line / Sewage collection network / interceptor (km)	23.5	15.5 Some of the existing sewers were sufficient to be reused. As a result, the new trunk sewer, sewage collection network, and interceptor could be kept to a minimum.
Drainage Ditch	6.1	6.1 It was integrated with newly installed sewer collection network by confluence system. Khemisset city office has implemented it.
Pumping Station	2	1 The sewage pumping stations were reduced from two to one by optimizing the sewer network.
Sidi Kacem		
Sewage Treatment Plant	Pretreatment + anaerobic pond + facultative pond	As planned
Sewage Treatment Volume per Day (m ³ /day)	11,120	7,600 It is about 70% of the planned value. The designed sewage treatment volume was reduced by 30% according to actual population. ³
Cleaning of Sewer Lines (km)	42.5	0 None
Rehabilitation of Sewer Lines (km)	2	10.7 The number of sewer lines that can be repaired was more than expected, and it was reused.
Sewer trunk line / Sewage collection network / interceptor (km)	33.5	30.9 There was a part that could be repaired. The part of interceptor pipes was increased by reviewing the sewer network. In addition, a part (4.5 km) of the sewer trunk lines remain uncompleted.
Drainage Ditch	22.2	22.2 Integrated with newly installed sewer collection network by confluence system. Sidi Kacem city office has implemented it.
Pumping Station	1	2 Since there are many areas with a larger longitudinal gradient than expected, one pump station was added.

³ The planned value was calculated by using the population estimate for the year following project completion expected at the time of the ex-ante evaluation of this project (scheduled for 2010), which is 138,000. However, the population estimate for the year following the actual project completion (2017) was 93,255, which resulted in a divergence of as much as 32% between the planned and actual.

Tiflet		
Sewage Treatment Plant	Pretreatment + anaerobic pond + facultative pond	None
Sewage Treatment Volume per Day (m ³ /day)	4,850	0 No sewage treatment
Cleaning of Sewer Lines (km)	4.6	0 None
Rehabilitation of Sewer Lines (km)	0.2	0.2 As planned
Sewer trunk line / Sewage collection network / interceptor (km)	20.1	21.6 The distribution of trunk pipes, collection pipe networks, and interceptor pipes was changed by reviewing the sewer network. The sewer network was covered as planned.
Drainage Ditch	3.6	0 It was integrated with newly installed sewer collection network by confluence system.
Pumping Station	3	3 As planned

Source: Documents provided by JICA, and by ONEE

Project outputs were basically produced as planned. The outputs produced as planned, including installation of trunk sewers, sewage collection networks, interceptors, and relay pumping stations in the three target cities in this project, contributed to production of project effects.

Some components had differences between planned and actual outputs. The components having particularly significant differences are shown in the table below.

Table 2: Major differences between planned and actual outputs of this project, and the reasons

Major difference between planned and actual outputs	Reason
1) Failure to establish a sewage treatment plant in Tiflet ⁴	Because the land acquisition price increased to an amount that was several times the expected one, the Tiflet City government could not take budgetary measures for land acquisition. Thus, land could not be acquired.
2) Incomplete part of the trunk sewer in Sidi Kacem	While the trunk sewer was constructed, the outsourcing contractor could not cover the construction costs. Thus, the planned construction work was discontinued. Then, another contractor took measures, but there was some point at which the trunk sewer must pass under a railway in its course, and the construction permission could not be obtained. In this situation, this project ended and part of the trunk sewer was left incomplete. ⁵
3) Unimplemented cleaning of sewer lines	ONEE has taken measures within its normal operation and maintenance services, and the cleaning has not been implemented in the project scope.
4) Regarding the trunk sewer, sewage collection network, and interceptor in Khemisset City, the difference between the planned and actual results was 34%, which was about 66% of the planned achievement level.	At the time of the detailed planning of this project, sewers in Khemisset were reviewed, aiming to use and optimize the existing sewers. As a result, the sewage pumping stations were reduced from two to one, and the existing system was reused. Therefore, the new trunk sewer, sewage collection network, and interceptor could be kept to a minimum.

As for 1), the incomplete applicable scope has affected production of project effects. The executing agency held negotiations for land acquisition for a sewage treatment plant in Tiflet together with the Tiflet city office, but they met opposition of farmers around the site in the first negotiations for land acquisition. At the time of the second negotiations for land acquisition, the increased purchasing price of land significantly exceeded the budget estimated by the city office. Numerous unexpected

⁴ After the project start, land acquisition for a sewage treatment plant was attempted in Tiflet, but farmers around the planned site for establishment of a sewage treatment plant opposed it. Thus, its establishment in Tiflet was given up. After that, the procedures for land acquisition were proceeded in 2013 in Tiflet as in the other cities, but then the landowner demanded a price increase. The increased land price could not be covered by the budget approved by the Tiflet city government, so price negotiations for land acquisition were given up. At the time of an interview in the ex-post evaluation, we confirmed that the land price had increased to about five times as much as the amount calculated at the time of the ex-ante evaluation. After that, another site was sought but not found, so the project ended with the completion of the sewage treatment plants in the two other cities. As a result, establishment of a sewage treatment plant in Tiflet remains undone. The reasons for the rise in land price are: 1) rapid progress in urban development in Tiflet since around 2013, and land price increase in Tiflet and neighboring cities, 2) land price increase by the landowner who heard that the local governments had disbursed a large amount of funds for land acquisition for establishment of a sewage treatment plant in the other cities, and intended to sell land at a price as high as possible, etc.

⁵ After project completion, a subcontractor for construction of the incomplete part was selected. This work is to be funded by parties other than JICA.

problems arose, and land acquisition for a sewage treatment plant was given up. This caused the failure to establish a sewage plant. Sewage in Tiflet has been untreated and discharged into rivers as it was before. Improvement of the natural environment in the river near the city has not been achieved. However, all sewage in the city came to be collected and discharged at points distant from residential areas in the city; thus, no negative impacts on the sanitation environment in the city have been produced. As for 2), because part of the trunk sewer in Sidi Kacem is incomplete, sewage from households in areas connected with the incomplete trunk sewer has not been treated. Construction of the trunk sewer connected to the sewage treatment plant is incomplete, but sewage has been collected,⁶ and the percentage of sewered population has been higher than the target (Achievement ratio: 131%). Moreover, the amount of treated sewage has accounted for 95% of the target readjusted by using the actual population. Therefore, the incompleteness has not particularly affected achievement of the project objective. As for 3), we confirmed that the cleaning has been within the range of ONEE's normal operation and maintenance services, having no impacts on achievement of the project purpose, and its implementation in the project scope has been unnecessary. As for 4), at the time of the detailed planning of the project, the planned sewer lines were reviewed and optimized; thus, the planned project scope has been kept to a minimum, which has contributed to a reduction in the project cost. Part of the sewage collection network in Khemisset has been being constructed by the Khemisset city office as a substitute. No major impacts of the difference in 4) have been observed on the project's purpose.

Table 3: Consulting service output (Plan / Actual)

Items	Plan (2005)	Actual (2016)	
(a) Review of Detailed Design, Preparation for bidding	O	O	As planned
(b) Supervision on the Constructions	O	O	As planned
(c) Environmental Monitoring	O	X	None (because it was no longer needed)
(d) Training and OJT on sewage treatment systems for O&M support	O	O	As planned
	Feb. 2007 - Feb. 2013	Apr. 2007 - May 2016	
International consultant (M/M)	59 M/M	96.5 M/M	Increased by 64%. Construction management and monitoring operations were increased due to extension of construction period
Local consultant (M/M)	197 M/M	201 M/M	Almost as planned

Source: Documents provided by JICA, and by ONEE

Consulting services were basically provided as planned. As part of the consulting services, training in the sewerage field and technical support for maintenance were provided. ONEE personnel for the regions, provinces, and service offices of the three target cities in this project were very satisfied with the technical support. The consulting services in this project can be assessed as very beneficial for improving the sustainability of the project. Training or support in environmental monitoring was not provided, because ONEE already possessed a necessary technology and implementation system for environmental monitoring focusing on water quality monitoring.

⁶ Additionally, in areas unconnected to the sewage treatment plant, sewage collecting pipes were constructed and sewage has been collected. The sewage collected in these areas has been discharged into rivers along the way. The discharge points are distant from residential areas; thus, negative impacts have not been produced on the natural environment in the city. Construction of the trunk sewer in the areas has already started, and the trunk sewer is scheduled to be completed in 2020.

3.2.2 Project Inputs

3.2.2.1 Project Cost

First, for efficiency analysis of the project cost, it is necessary to adjust the incomplete parts in this project. The reason why establishment of a sewage treatment plant in Tiflet was not realized was inability to take budgetary measures for land acquisition. The incomplete part of the trunk sewer in Sidi Kacem was caused by the contractor's inability to take financial measures to continue the construction. In efficiency evaluation of the project cost, we judged it appropriate to subtract the budget calculated for these incomplete parts from the total budget (costs of public works and land acquisition) to evaluate the project cost with regard to efficiency. Similarly, for the sewer lines cleaning not implemented in this project's scope, the total budget was modified by subtracting the initial budget allocated to cleaning of sewer lines. The next issue is what to do with the land acquisition cost. Land was acquired in Sidi Kacem City and Khemisset City, but the executing agency has not grasped the actual land acquisition costs accurately. Thus, it is decided to assume that, in both cities, the planned and actual land acquisition costs are the same. Based on the above, for more appropriate efficiency evaluation, the planned land acquisition cost will be modified to the minimum possible extent, and the actual land acquisition cost is revised as follows.

(Revision of budget amounts)

- (1) The construction cost of the incomplete portions above will be subtracted from the initial budget.
- (2) The land acquisition cost remains the same for Sidi Kacem City and Khemisset City where land acquisition was done. However, for Tiflet City that implemented no land acquisition, the acquisition cost will be subtracted from the initial budget.
- (3) Taxes accounted for in the initial budget were estimated on the basis of the following rates: 14% for public works and land acquisition; and 20% for materials, equipment, consulting services, and contingency. However, the tax amounts in the initial budget will be revised because the changes in (1) and (2) above will affect the tax calculation process.

Table 4: Details of the Revision of the Planned Budget

(1) Reduction of the public works cost	784
Incomplete sewage treatment plant in Tiflet	638
Incomplete part of sewer network in Sidi Kacem	111
Unimplemented pipeline cleaning	35
(2) Reduction of the land acquisition cost	42
Tiflet City	42 ^{*1}
(3) Changes in taxes, etc., after the budget revision above	673^{*2}
Public works + land acquisition ³	526 ^{*2}
Equipment, consulting services, and contingency (as initially planned)	148 ^{*2}

*1: The land acquisition budget of Tiflet City is calculated as follows: percentage of each city in the land acquisition costs (Sidi Kacem City: 48%, Khemisset City: 21%, Tiflet City 30%) at the time of the preliminary survey is multiplied by 139 million yen, which is the sum of the land acquisition budgets of the three cities.

*2: The total amount is rounded off and differs from the sum (674 million yen) of rounded-off items.

*3: Multiplying by 14% the figure for "public works + land acquisition" upon reduction cited in (1) and (2) above.

(Revision of the actual cost)

- (1) Regarding public works, Sidi Kacem City and Khemisset City implemented alternative construction for part of the project scope. However, because the executing agency has not grasped the actual cost

of the alternative construction accurately, it is assumed that the actual cost is the same as the planned one.

- (2) As mentioned above, the executing agency has not grasped accurately the actual costs of land acquisition in Sidi Kacem City and Khemisset City. Thus, for convenience, it is assumed the actual costs are the same as the planned ones.

The following are the initial budget, revised budget, and actual costs that summarize the above.

Table 5: Breakdown of the Planned Initial Budget, Revised Budget, and Actual Cost at the Time of the Ex-Post Evaluation

Item	Planned initial budget (million JPY)			Revised budget (million JPY)			Actual cost (million JPY)		
	JICA	ONEE	Total	JICA	ONEE	JICA	JICA	ONEE	Total
Public works	3,553	889	4,442	2,769	889	3,658	2,174	1,159 ^{*1}	3,333
Equipment procurement	86	0	86	86	0	86	102	0	102
Consulting service	427	0	427	427	0	427	643	0	643
Contingency	137	89	226	137	89	226	0	0	0
Land acquisition	0	139	139	0	97	97	0	97 ^{*2}	97
Taxes and duties	0	684	684	0	673	673	0	629	629
Total	4,203	1,801	6,004	3,027	1,583	5,167	2,919	1,328	4,804

Source: Documents provided by JICA and ONEE

* The following exchange rates are used: 12.1 yen/MDH (Moroccan dirham) (September 2004) at the time of the appraisal; and 11.7 yen/MDH (2007-2016 average) at the time of the ex-post evaluation.

* All public works deductions are from the JICA budget, and the land acquisition deductions are from the ONEE budget.

*1: The actual cost of alternative construction by the municipalities for the drainage ditch in Sidi Kacem City and Khemisset City is the same amount as the planned initial budget for it.

*2: Regarding the actual cost of the land acquisition in Sidi Kacem City and Khemisset City, the budget amount at the time of planning is applied as it is.

The revised total budget was 5,167 million yen. The actual project cost was 4,804 million yen, within the planned budget after recalculation (93%).

The consulting services cost increased (the reason is to be described later), while optimization of sewage collection networks as well as repair and reuse of the existing collection networks made it possible to significantly reduce the cost to construct sewage collection networks. In addition, contract lots of public works were subdivided to create an environment where, widely, many building/construction companies can tender for contracts, thereby encouraging competition among companies participating in the tenders, which resulted in reduction in the project cost as a whole. Moreover, the executing agency ONEE properly implemented construction supervision of the many contractors and monitoring of progress in the public works together with the consultants, and ONEE's project implementation system functioned at the regional, provincial, and city levels. This seems to have contributed to the project implementation within the planned budget.

The project cost was 93% against the plan, within 100% of the budget. Therefore, the project cost evaluation falls under ③.

3.2.2.2 Project Period

The planned project period was from November 2005 to October 2009 (48 months), while the actual project period was from the start of this project to May 2016 (127 months), 265% against the plan and significantly longer than planned.

Table 6: Project Period (Plan / Actual)

Work Contents	At the time of Preliminary Evaluation (2005)	At the time of the Project Completion (2016)
Sewage facilities construction in Khemisset	Oct. 2006 - Oct. 2009	Feb. 2009 - Mar. 2016
Sewage facilities construction in Sidi Kacem	Nov. 2005 - Oct. 2009	Feb. 2007 - Apr. 2016
Sewage facilities construction in Tiflet (Excluding the sewage treatment plant)	Dec. 2005 - Oct. 2009	Feb. 2007 - Apr. 2016
Equipment Procurement	Nov. 2005 - Oct. 2007	Jul. 2006 - Jan. 2007 Apr. 2014 - Apr. 2015
Training, Technical Assistant Service	Oct. 2006 - Oct. 2009	Feb. 2007 - Feb. 2013 Aug. 2013 - May 2016
Project Completion	Oct. 2009	May 2016

Source: Documents provided by JICA, and by ONEE

Note: The bidding and contract for the main construction starts from the preliminary qualification examination (P/Q)

The biggest cause of the project period being over ten years was the unexpectedly slow progress in land acquisition. In all the three target cities in this project, land acquisition required much time. Particularly in Tiflet, land acquisition for a sewage treatment plant required more time than in the two other cities, and the construction period was also extended. Moreover, in this project, many contractors entered into agreements with ONEE, and each contractor was in charge of a different process of construction processes for the same facility. Therefore, in any of the three cities, when a contractor's process fell behind schedule, work of the contractor in charge of the next process was also delayed, and the delay affected the subsequent processes. This work procedure in which many contractors worked as a collective was also a major cause of delay.

Meanwhile, the significant extension of the project period caused an increase in the cost for consulting services and a decrease in cost efficiency.

The project period was significantly longer than planned, increasing to 265% of the planned period. Therefore, the project period evaluation falls under ①.

3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

Financial Internal Rate of Return (FIRR)

Terms and conditions for FIRR calculation and FIRR at the time of the appraisal and at the time of the ex-post evaluation are organized below. Benefits are sewerage charge receipts and sewer connection charge. The sewer connection charge is paid by beneficiaries. The project life is 40 years, but 40 years from the L/A year was defined as the period for FIRR calculation at the time of the appraisal and at the time of the ex-post evaluation.

Factors	Project life: 40 years Expenses: Construction costs and Maintenance costs related to the project, excluding the land acquisition costs Benefits: Revenue from Sewerage service charges and Sewer connection fee (Beneficiary's Contribution)	
At the time of appraisal:	(2005 - 2044) 2.9% Khemisset: 2.25% Sidi Kacem: 4.61% Tiflet: 1.93%	At the time of ex-post evaluation: (2005 - 2044) -5.95% Khemisset: -14.93% Sidi Kacem: -6.57% Tiflet: -0.24%

At the time of the ex-post evaluation, FIRR was a negative value in each of the cities, and FIRR in the project as a whole was -5.95%. This was caused by a decrease in the actual sewerage charge receipts by about 30% from the amount estimated at the time of the ex-ante evaluation. In Khemisset, FIRR was nearly -15%, showing the largest divergence from the time of the appraisal. This can be attributed mainly to the treatment method of aerated lagoon at the sewage treatment plant in Khemisset, and increase in equipment cost and subcontract cost for this method. On the other hand, in Tiflet, although a negative value, FIRR was nearly 0%. In this city, the sewage treatment plant has not been established. This caused a decrease in construction cost and pushed up FIRR.

Economic Internal Rate of Return (EIRR)

Terms and conditions for EIRR calculation and EIRR at the time of the appraisal and at the time of the ex-post evaluation are organized below. Benefits are, similarly to the time of the appraisal, improvement in production of agricultural products,⁷ decrease in medical cost for diseases,⁸ reduction in water treatment cost (only in Khemisset),⁹ and rise in land value.¹⁰

Factors	Project life: 40 years Expenses: Construction costs and Maintenance costs related to the project, excluding the land acquisition costs Benefits: Improvement of the productivity of agricultural products, reduction in medical cost related to diseases, reduction of water treatment cost (Khemisset only), increase of land value	
At the time of appraisal:	(2005 - 2044) 18.7% Khemisset: 15.1% Sidi Kacem: 24.8% Tiflet: 12.9%	At the time of ex-post evaluation: (2005 - 2044) 11.9% Khemisset: 7.4% Sidi Kacem: 16.8% Tiflet: 7.8%

⁷ It is expected that the water quality of rivers serving as water sources for irrigation and the productivity of agricultural products will improve through sewage treatment. Similarly to the time of the appraisal, the benefit effect was estimated at 20% of the production before the project start (in 2004), by using the cases of sewerage projects in other developing countries as references. In Tiflet, collected sewage has not been treated, so the benefit was defined as none.

⁸ It is expected that improvement of the living environment by preventing sewage mixed with sewage from flooding into the city will cause a decrease in the number of sufferers from waterborne diseases including cholera, typhoid fever, hepatitis, and diarrhea, as well as a reduction in medical cost. Through this project, the living environments were improved as planned in all the cities. Therefore, all the reductions estimated at the time of the ex-ante evaluation were considered a benefit.

⁹ The Kansera Dam, the water source for Khemisset and Tiflet, is located in the lower reaches of the river into which sewage in Khemisset is discharged. To prevent water pollution at the Dam from progressing with the untreated sewage discharged at that time, the water had been purified, but the water purifying cost became unnecessary after sewage came to be treated through this project. Therefore, the reduction in water purifying cost estimated at the time of the ex-ante evaluation was considered a benefit.

¹⁰ A rise in land value caused by improvement of the living environment through installation of a sewerage system is generally estimated at 5-20%. At the time of the appraisal, a rise rate of 7% was applied to Khemisset and Sidi Kacem, and a rise rate of 10% was applied to Tiflet, whose living improvement effect was seen as the greatest. Meanwhile, the land value rise rate in Kenitra near the three target cities in this project, in which a sewerage project was implemented in the same manner at the same time, was 41%. When contributions of the sewerage project are taken into account, this rate could fall within or beyond the range of 5-20%, general rise rates caused by a sewerage project. In EIRR calculation for this project, low rise rates were multiplied: a rise rate of 7% was applied to Tiflet, which had the highest population growth rate compared to before the project start, a rise rate of 6% was applied to Khemisset, and the lowest general rise rate of 5% was applied to Sidi Kacem, which had the lowest population growth rate. The rises in land price were considered a benefit.

As described above, EIRR of the project as a whole was 11.9%, decreasing by 6.8% from the time of the appraisal. This was caused by a decrease in the total amount of benefits during the project life by about 22%, although benefits were produced almost as planned. Moreover, in Khemisset, the operation and maintenance cost for the sewage treatment plant adopting the method of aerated lagoon increased by 23% from the initial budget; and in Sidi Kacem, the land value rise rate estimate was lowered from 7% to 5%. This pushed down EIRR more in both cities (a decrease by about 8% from the time of the appraisal). On the other hand, in Tiflet, decrease in the project cost, caused by incomplete establishment of a sewage treatment plant, pushed up EIRR, and absence of benefit in improvement in the productivity of agricultural products pushed down EIRR. As a result, EIRR decreased by about 5% from the time of the appraisal, but the rate of decrease is lower than in the two other cities.

Although the project cost was within the plan after the readjustment by taking into account the undone or incomplete projects and the part not implemented, the project period significantly exceeded the plan. Therefore, efficiency evaluation of the project falls under ② according to the rating criteria in the ex-post evaluation.

3.3 Effectiveness and Impacts¹¹ (Rating: ②)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

The three indicators used to evaluate the quantitative effects of effectiveness were the sewage treatment volume per day (m^3/day),¹² the sewerage connection ratio, and the BOD concentration of treated water (mg/L). At the time of the appraisal, the target year of the project was 2010, but at the time of the ex-post evaluation, the quantitative evaluations of effectiveness were compared with the results of indicators in 2017, the year following project completion, because the project was actually completed in 2016. On the other hand, as the project targeted the three provincial cities of Khemisset, Sidi Kacem, and Tiflet, and the cities operated their sewage businesses independently, the degree of achievement for the above-mentioned indicators in each city was calculated to evaluate effectiveness, and the overall degree of achievement was computed by weighting the degree of achievement for each city according to the city's population when evaluating the overall quantitative effects of effectiveness.

(1) Sewage Treatment Volume per Day (operation indicator)

At the time of the appraisal, the target sewage treatment volume per day¹³ was 9,350 m^3/day for Khemisset, 7,780 m^3/day for Sidi Kacem, and 3,880 m^3/day for Tiflet. These targets were calculated based on each city's population that was projected for one year after the completion of the project

¹¹ Effectiveness is rated by adding impacts when judging it.

¹² Sewerage uses the confluence system with rainwater flowing into sewers in the rainy season. In addition, if the amount of rain increases, rainwater mixed with sewage is discharged halfway through the interceptor at the dam of the storm overflow chamber. In this project, the sewage treatment volume is sought by measuring the volume of sewage that flows into sewage treatment plants.

¹³ The sewage treatment volume per day is obtained by dividing the annual sewage treatment volume for sewage treatment plants in each city by 365 days.

expected at the time of the appraisal (2010). However, the estimated population for one year after the completion of the project (2017) decreased to 140.7 thousand people in Khemisset (-14%) and 93.3 thousand people in Sidi Kacem (-32%) and increased to 92.6 thousand people in Tiflet (+16%). In particular, the estimated population for Sidi Kacem was reduced by 32% compared to the one estimated at the time of the appraisal. This is because the population for 2010 was estimated based on the population census of 2000 while the one for 2017 was estimated based on the population census of 2014. The ex-post evaluation used the population estimated for 2017 based on the population census of 2014, which shows an estimated population that is closer to the actual one, to readjust the target sewage treatment volume per day. Table 7 indicates the targets set at the time of the appraisal, targets after readjustments, results, and the degree of achievement.

Table 7: Sewage Treatment Volume per Day (m³/day)

Cities (Actual project completion year)	Baseline (2005)	Target (2010)	Readjusted Target (2017)	Actual (2016)	Actual (2017)	Degree of Achievement
Khemisset (2016)	N.A.	9,350	8,045	N.A.	6,771	84%
Sidi Kacem (2016)	N.A.	7,780	5,257	N.A.	5,000	95%
Tiflet (2016)	N.A.	3,880	4,491	N.A.	N.A.	0%

Source: Documents provided by JICA, and by ONEE

One year after the completion of the project, the actual sewage treatment volumes per day for Khemisset and Sidi Kacem respectively exceeded 80% of the post-readjustment target. The degree of achievement for the daily sewage treatment volume was 84% for Khemisset and 95% for Sidi Kacem. Located in a mountainous region, Sidi Kacem has more precipitation in the rainy season than Khemisset. In Sidi Kacem, it is estimated that more rainwater flowed into sewage when the latter was treated, making the overall amount of sewage treated larger than the actual one. Meanwhile, Tiflet did not see the completion of its sewage treatment plant, leaving the degree of achievement at zero.

(2) Sewerage Penetration Rate

At the time of the appraisal, the sewerage penetration rate represented the percentage of households connected to ONEE's sewage services to the total number of households in ONEE's sewerage connection service area in each city in 2005. Table 8 shows the targets set at the time of the appraisal, results, and the degree of achievement.

Table 8: Sewerage Penetration Rate (%)

Cities (Actual project completion year)	Baseline (2005)	Target (2017)	Actual (2016)	Actual (2017)	Degree of Achievement *1
Khemisset (2016)	85.0%	85.0%	99.0%	99.0%	100% (116%)
Sidi Kacem (2016)	72.0%	75.0%	97.0%	98.0%	100% (131%)
Tiflet (2016)	75.0%	80.0%	89.0%	96.0%	100% (120%)

Source: Documents provided by JICA, and by ONEE

*1: The degree of achievement is evaluated as 100% even if it exceeds 100%. Figures in parentheses indicate the actual degree of achievement obtained by comparing targets and results. In these cases, the degree of achievement is counted as 100%.

As shown by the base figures, a certain percentage of households in each city were connected to ONEE’s sewage service even before the start of the project. Through the implementation of the project, the goal of increasing the sewerage penetration rate in small and medium-sized provincial cities to 80% or more by 2020 was achieved as part of PNA. The degree of achievement for each city exceeded 100%, and it is judged that sufficient effects were obtained through the implementation of the project.

(3) BOD Concentration of Treated Water

The BOD concentration of treated water¹⁴ represents the BOD concentration of treated sewage which is released from the sewage treatment plants developed in this project. At the time of the appraisal, the standard BOD concentration for treated water released from the sewage treatment plant was set at 70 mg/L or less, but in those days, Morocco did not have any standard for discharged sewage. In 2006, the year after the start of the project, the government stipulated national wastewater standards, providing that the BOD concentration should be 120 mg/L or less. Therefore, in this project, it was considered appropriate to evaluate the degree of achievement by comparing results with the national wastewater standards rather than the targets set at the time of the appraisal. Table 9 indicates the targets set at the time of the appraisal, results, and the degree of achievement.

Table 9: BOD Concentration of Treated Water (mg/l)

City (Actual project completion year)	Indicator item	Baseline (2005)	Target (2010)	National standard value ¹⁵ (2006)	Actual (2016)	Actual (2017)	Degree of achievement
		Appraisal year	1 year after the project completion		Project completion year	1 year after project completion	
Khemisset (2016)	Water flowing into treatment plant	N.A.	380	300	N.A.	290	103%
	Water discharged from treatment plant	N.A.	70 or less	120	N.A.	120	100%
Sidi Kacem (2016)	Water flowing into treatment plant	N.A.	480	300	N.A.	1,750	17%
	Water discharged from treatment plant	N.A.	70 or less	120	N.A.	320	38%
Tiflet (2016)	Water flowing into treatment plant	N.A.	400	300	N.A.	N.A.	0%
	Water discharged from treatment plant	N.A.	70 or less	120	N.A.	N.A.	0%

Source: Documents provided by JICA and ONEE

¹⁴ BOD stands for biochemical oxygen demand. It refers to the amount of oxygen consumed by aerobic microorganisms when a sufficient amount of dissolved oxygen (DO) is available and organic matter in water is decomposed by such microorganisms. It is determined from the amount of oxygen consumed when a sample is cultivated at 20°C for five days in a dark place.

¹⁵ The national standards are based on “Bulletin Officiel n° 5448 du Jeudi 17 Août 2006.” The highest permissible BOD concentration for sewage that flows into a sewage treatment plant is set at 300 mg/L, and this is equal to the upper limit of the BOD concentration of sewage discharged from households. In fact, the BOD concentration sometimes exceeds 300 mg/L because household sewage is mixed with other types of filthy water in the drainage ditches to sewage treatment plants. On the other hand, the upper limit to the standard BOD concentration of treated water released from sewage treatment plants is 120 mg/L.

The sewage treatment plant in Khemisset meets the national wastewater standards, and there is no problem with the quality of treated water. On the other hand, the plant in Sidi Kacem far exceeds the national wastewater standards with the result nearly three times as high as the standards. This is because the BOD concentration of sewage that flows into the plant is extremely high, at 1,750 mg/L, and the high BOD concentration was affected by the disposal by olive growers of large amounts of agricultural waste from olive oil refining operations into drainage ditches during the sampling period (December 2017). Incidentally, in May 2018, when ONEE measured the BOD concentration of inflow/effluent water at the sewage treatment plants in both cities, the BOD concentration at each sewage treatment plant was within the national wastewater standards,¹⁶ indicating that the BOD concentration improved further.

Tiflet does not have a sewage treatment plant. Its sewage is collected at three pump stations, and then released into a nearby river without being treated. BOD concentrations cannot be confirmed, as the monitoring of water quality in Tiflet is not conducted, and the quality of sewage discharged is estimated to far exceed the national standards. Prior to the completion of the project, sewage was released at 11 locations in the city, and some of the locations, which were in close proximity to residential areas and school-commuting roads, always smelled of sewage. When it rained and rainwater mixed with sewage overflowed from the drainage ditch, the school-commuting road close to the location of release was closed, causing problems such as preventing students from going to school. The project concentrated the locations of release, enabling sewage to be released from locations far away from residential areas; afterwards, rainwater mixed with sewage no longer overflowed, and the smell of sewage was removed from the former locations of release. Thus, the sanitary environment in the city improved remarkably, and it is fair to say that this is a positive effect of the project.

(4) Summary of Quantitative Effects Evaluated

In evaluating quantitative effects, the degree of achievement for the three operation and effect indicators mentioned above was calculated for each city, and the calculated degree of achievement was weighted according to the cities' populations; thus, the overall quantitative effects of the project's effectiveness was evaluated. Shown below are the results of evaluation of quantitative effects of effectiveness and the breakdown thereof.

Table 10: Evaluation Results of Quantitative Effectiveness

City	City population (thousand)	Weight (%)	Achievement of three indicators for effectiveness evaluation (%)			Effectiveness achievement level of each city	Degree of achievement of each city after multiplied by weight
			Sewage treatment volume per day	Sewerage penetration rate	BOD concentration (at the time of release)		
Khemisset	140.7	43.1%	84%	100%	100%	94.7%	40.8%
Sidi Kacem	93.3	28.5%	95%	100%	38%	77.5%	22.1%
Tiflet	92.6	28.4%	0%	100%	0%	33.3%	9.5%
Total	326.6	100.0%					72.4%

Source: Documents provided by JICA and ONEE, and the achievement results of the effectiveness evaluation indicators used in the ex-post evaluation of the project

¹⁶ In Khemisset, the BOD concentration value at inflow was 230 mg/l, and the BOD concentration value of treated sewage at discharge was 36 mg/l, indicating that the BOD was reduced by 84%. In Sidi Kacem, it was 420 mg/l and 100 mg/l, respectively; thus, the BOD was reduced by 76%.

The degree of achievement for the indicator of quantitative evaluation of effectiveness in the entire project area was 72.4%. The greatest reason for failure to achieve 80% or more was that the degree of achievement for the daily sewage treatment volume and the BOD concentration of sewage released was 0% for Tiflet because the installation of a sewage treatment plant in the city was not completed.

3.3.2 Qualitative Effects (Other Effects)

This ex-post evaluation covers the monitoring of water quality in the project as well as qualitative operation and effect indicators related to consulting services.

(1) Periodic monitoring of the quality of water released from treatment plants

In Morocco, the quality of water released from sewage treatment plants is monitored in summer (June) and winter (December), and such monitoring is conducted at the treatment plants, the points where treated sewage is released, and the upper and lower courses of rivers into which treated sewage is released. In addition, if there are major riverheads (dams) or agricultural land nearby, the quality of water is monitored at these locations.¹⁷ However, the monitoring of water quality is carried out only for cities that have sewage treatment plants (only Khemisset and Sidi Kacem in this project), and cities without such plants (such as Tiflet) are not covered by the monitoring. It cannot be said that the monitoring of water quality by ONEE is satisfactory; nor is full attention paid to the natural environment around rivers into which sewage is released.

(2) Technology Transfer through Consulting Services and Its Effects

In this project, environmental monitoring through consulting services was not conducted. The reason for this was that it was judged that the necessity of environmental monitoring was low because the Environmental Monitoring Department at the ONEE headquarters already had a system and technology to conduct such monitoring. On the other hand, training in sewage treatment systems as well as administration and guidance was provided, but partly because ONEE, which had experience in the sewage treatment technology applied under this project in other cities, already possessed a sufficiently high level of technology, the effects of consulting services peculiar to the project were not particularly confirmed.

As described above, the effects of this project are high, but one result is that in aspects such as consideration to the natural environment, some issues were left unaddressed. Efforts to make this project more effective are hoped for.

¹⁷ In Khemisset, there is the Kansera Dam, the source of water supply for the capital area, in the lower course of a river into which treated sewage is released, and the monitoring of water quality is conducted at the dam. In Sidi Kacem, the sewage treatment plant is located adjacent to agricultural land, and sewage from the plant is likely to leak into the underground, affecting neighboring agricultural land. For this reason, the quality of groundwater or similar outside the sewage treatment plant is also monitored.

3.4 Impacts

3.4.1 Intended Impacts

(1) Quantitative Assessment for Intended Impacts

The impacts that are expected in this project are to improve the environment and the sanitation of local residents with the aim of making the living standards better in the areas covered by the project. The project places emphasis on the natural environment as well as health and sanitation. To assess quantitative impacts on the natural environment as well as health and sanitation, indicators of quantitative impacts before and after the installation of sewage facilities are compiled in Table 11. The impact indicators listed in Table 11 were not set at the time of the ex-ante evaluation but were newly set at the ex-post evaluation to measure impacts in quantitative terms.

Table 11: Quantitative Impact of the Project

Cities	Indicator items		Water quality sampling results before installation of the sewage facilities (2008 - 2011)	Actual (2018) 2 Years after the project completion
Khemisset	Water quality in the river into which treated sewage is released	Lower course BOD (mg/l)	Upper course: 120 - 290 Lower course: 13 - 110	Upper course: 365 Lower course: 61
		Lower course SS concentration (mg/l)	Upper course: 98 - 430 Lower course: 20 - 400	Upper course: 295 Lower course: 98
		Changes in the number of Colon Bacilli (number/100 mL)	Upper course: 1.1×10^3 - 1.6×10^8 Lower course: 5.0×10^5 - 1.1×10^7	Upper course: 1.1×10^5 Lower course: 4.6×10^4
	Number of people contracted waterborne Infectious Diseases (person) ^{*1}		N.A.	0 (Dec. 2019)
	Water quality of the Kansera dam (dyke) into which the treated sewage from Khemisset is flowed: COD concentration (mg/L)		Dam surface: 1.0 - 2.5 Dam bottom: 1.4 - 2.0	Dam surface: < 0.6 - 2.2 Dam bottom: < 0.6 - 1.9
Sidi Kacem	Water quality in the river into which treated sewage is released	Lower course BOD (mg/l)	Lower course: 4 - 130	Lower course: 46.mg/L
		Lower course SS concentration (mg/l)	Lower course: 6 - 13,000	Lower course: 86 mg/L
		Changes in the number of Colon Bacilli (number/100 mL)	Lower course: 2.4×10^4 - 2.4×10^7	Lower course: 4.6×10^6
	Number of people contracted waterborne Infectious Diseases (person) ^{*1}		N.A.	0 (Dec. 2019)
Tiflet	Water quality in the river into which treated sewage is released	Lower course BOD (mg/l)	Downstream: 170 - 900	N.A.
		Lower course SS concentration (mg/l)	Downstream: 220 - 820	N.A.
		Changes in the number of Colon Bacilli (number/100 mL)	Downstream: 3.0×10^5 - 9.0×10^7	N.A.
	Number of people contracted waterborne Infectious Diseases (person) ^{*1}		N.A.	0 (Dec. 2019)

*1: At the time of the ex-post evaluation (December 2019), the interview survey results for 10 households in each of the 3 cities were collected.

Quality of water in the river into which treated sewage is released

From 2008 to 2011, the period prior to the installation of sewage facilities, and in 2017 and 2018, the years after their installation, ONEE conducted the monitoring of water quality in the rivers in the three project cities into which treated sewage was released and in the Kansera Dam located in the lower course of the river into which treated sewage was released by the sewage treatment plant in Khemisset. Table 11 compares the situations before and after the installation of sewage treatment plants using the results of water-quality sampling at the points covered by the monitoring. In Khemisset and Sidi Kacem, no clear improving trend in the water quality in the rivers was confirmed

on the basis of BOD concentrations, SS concentrations,¹⁸ and the number of colon bacilli in the downstream part of the rivers into which treated sewage is released. The COD concentration for the Kansera Dam into which water released in Khemisset flows¹⁹ has remained practically unchanged before and after the installation of sewage facilities, indicating that at least, effects such as improvement in the quality of water by the project are not felt.

In Tiflet, data were not obtained because the quality of water was not monitored in 2017 and 2018. Because collected sewage is released as it is in the city, the importance of conducting the monitoring of water quality is greater than in other cities, and it is necessary to monitor the quality of water in the river into which collected sewage is released and other sources of water supply at least twice a year (once in the rainy season and once in the dry season).

Number of People Who Contracted Waterborne Infectious Diseases

At the time of the ex-post evaluation, households in the three cities were asked in a fact-finding survey whether family members had contracted any waterborne infectious disease attributed to the overflow of sewage or filthy water before the installation of sewage facilities under this project and during the previous year. In the survey conducted in Tiflet, while some respondents said when asked about the period prior to the installation of sewage facilities, “In the period during which rainwater smelling of sewage overflowed in the city, I used to take my children to a hospital often,” all households replied when asked about the previous year, “No one has contracted such a disease.”²⁰ In the surveys carried out in the other two cities, similar replies were received.

(2) Qualitative Assessment for Intended Impacts

At the time of the ex-post evaluation, to confirm whether the living standards had improved, qualitative surveys were conducted to assess the qualitative impacts emerged from the project implementation. Fact-finding surveys were carried out for a wide range of people, including the people concerned with sewerage development and its beneficiaries (residents in the cities and people engaged in agriculture in the suburbs), in the three project cities, Khemisset, Sidi Kacem, and Tiflet. A total of 30 households as beneficiaries, 10 in each city, were interviewed. The result of the surveys showed that 91% of households replied that they were highly satisfied with the project. As one of the project’s major contributions, respondents cited the fact that the city was no longer filled with water mixed with sewage or effluent and that the smell of sewage had been removed. In total, 82% of households replied that the living environment had improved, and it can be said that the project contributed greatly to the improvement of beneficiaries’ living standards. Table 12 summarizes the results of the surveys that compared the qualitative impacts felt under the project before and after the implementation of the project, including the results of qualitative surveys.

¹⁸ SS stands for suspended solids, and the SS concentration is an indicator of contamination with impurities contained in water.

¹⁹ COD stands for chemical oxygen demand, and the COD concentration is an indicator of contamination with organic matter, which is used for lakes and lagoons.

²⁰ In the past, many children particularly developed symptoms of waterborne infectious disease attributed to the overflowing of sewage and filthy water. In the survey, it was also confirmed that residents had often taken their children to a clinic.

Table 12: Qualitative Survey Results of the Project (Based on the Indicators for Qualitative Surveys)

Indicators	Survey subjects	At the time of the ex-ante evaluation (2005)	Results (2019)
1. Improvement of the health of local residents	Residents living near the sewer pipes installed in the project (Around 10 households in each city, including two to three people engaged in agriculture in the suburbs of the city)	1. Many people contracted a waterborne infectious disease.	1. The qualitative survey confirmed whether people had contracted such a disease during the previous year (2019). Survey results indicated that nobody had replied that during the previous year, his/her household members had developed symptoms of a waterborne infectious disease attributed to the spread of sewage or filthy water when the city was submerged.
2. Reduction of contamination damage due to the overflowing of rainwater or sewage on the low ground		2. Rainwater mixed with sewage overflowed on the low ground, causing floods and filling the city with the smell of sewage. If it rained heavily, the amount of running sewage increased, raising the level of water in the river into which the sewage was released, and this caused damage such as sewage backflow. If that happened, residents suffered damage such as the smell of sewage spreading through their houses.	2. The three cities all use the rainwater/sewage confluence system, collecting sewage and at the same time letting rainwater flow into sewer pipes. However, in some areas of Sidi Kacem, separate drainpipes have been installed for rainwater. This has prevented the entire town from being inundated and rainwater from being mixed with sewage even if the former more or less stays, and the town no longer smells of sewage. One opinion of residents living near a pump station or similar where sewage is concentrated was that in summer, the station smelled of sewage as the amount of water decreased. Currently, ONEE is taking measures such as preventing the smell of sewage from leaking outside by planting tall trees around the pump stations.
3. Economic effects produced as the reuse of treated water for agricultural water progressed thanks to the improvement of water quality		3. Treated water had been reused for agricultural water, and it had not been confirmed whether crops produced using treated sewage actually caused damage, but it was estimated that the situation was extremely dangerous.	3. In Sidi Kacem and Khemisset, sewage was treated, and treated sewage was released into rivers whose water was used for agricultural water. In these two cities, untreated sewage is not used, and it is estimated that the effects of sewage on crops have been reduced. On the other hand, in Tiflet, where sewage is not treated, untreated sewage was formerly used, but today, rainwater, well water, or similar are used.
Improvement of the quality of water in the lower course of the river into which treated sewage is released, the preservation of the quality of water in the upper course of the river into which treated sewage is released (riverheads), etc.	Upper and lower course of the rivers in the three project cities into which treated sewage is released	N/A	In Sidi Kacem and Khemisset, where sewage was treated, fact-finding surveys for qualitative effects found that 60% of the 20 households surveyed replied that the quality of water (turbidity, odor, etc.) in the river had improved (The remaining 40% said that they did not know). In Tiflet, 70% of respondents said that the quality of water had not particularly changed.

The most important change in the indicators used for qualitative surveys before and after the implementation of the project was that the overflowing of filthy water, including sewage, which had frequently occurred on the low ground, no longer happened, improving the living environment in the city dramatically. Other changes included the improvement of the quality of water (turbidity, odor, etc.) in the river into which treated sewage was released, and 60% of the 20 households covered by the fact-finding survey for qualitative effects in Khemisset and Sidi Kacem, where sewage treatment

plants were built, recognized that the quality of river water had improved. On the other hand, some respondents expressed their negative opinions, complaining, for example, that in the dry season when the precipitation was low, the pump stations where sewage was concentrated gave out offensive smells. With respect to the offensive smells from the pump stations, however, it was confirmed with ONEE at the time of the ex-post evaluation that the National Office would take measures such as preventing such smells from leaking outside by planting tall trees around the stations.

3.4.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

This project is classified as Category B for the following reasons: under the “Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Consideration” (established in April 2002), it is not a large-scale sector one, has no characteristic of such sector, and is not located in a sensitive area, and it is unlikely to have a significant adverse impact on the environment. The governments of the three project cities compiled reports on environmental impact assessments (EIA) in 2005, and these reports were already approved by the Ministère de l’Aménagement du Territoire, de l’Eau et de l’Environnement (MATEE). The environmental monitoring stipulated in the EIA was conducted before the project was completed (2008-2011) and after completion (2017-2018). The results of environmental monitoring for the river environment are as shown in Table 11, and there was no negative impact of the project on the rivers. In addition, sewage treatment plants and pump stations were installed far away from residential areas as part of the measures to reduce noise and offensive smells, and other measures included planting trees around sewage facilities; as a result, there have been no negative effects on the environment around residential areas. Nor have there been any other events that affected the domestic ecosystems, because the project area did not have nature reserves. However, in Tiflet, which has no sewage treatment plant installed, environmental monitoring for rivers into which sewage was released was not conducted after the completion of the project, and there is concern about the fact that the effects of such sewage on the natural environment are not recognized.

(2) Resettlement and Land Acquisition

Since the land required for the installation of sewage facilities consisted of agricultural land, residents were not relocated during the implementation of the project. In addition, no particular impact on the livelihood of farmers was confirmed in the sale of the land, and no complaint from the farmers on recovering their livelihood has been confirmed until now. The reason why the Tiflet city government eventually could not acquire land was that land prices soared due to the effects of urban development in the city. It took time to identify the final candidate for the site of sewage facilities in both Sidi Kacem and Khemisset and sweep away the concern about being chosen as the site of such facilities. A similar situation occurred in Tiflet, but land acquisition was given up because of soaring land prices.

In light of the above, certain effects were observed through the implementation of the project. Thus, the effectiveness and impacts of the project are fair.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional/Organizational Aspects of Operation and Maintenance

(1) Central Organizational Structure

The National Sewerage Plan calls for ONEE to enter into joint operation agreements with provincial core cities and communes and take the initiative in maintaining and managing sewerage in accordance with the agreements. For the past two decades, ONEE has worked with provincial core cities and communes to take responsibility for maintaining and managing regional sewerage operations. When prioritized core cities and communes are selected, ONEE works out plans to introduce sewage facilities and establish prefectural offices which are responsible for regional sewage projects. In the operation and maintenance of this project, the northern office of ONEE in the city of Kenitra (DR4), one of the ten ONEE regional offices under the control of ONEE's Bureau of Industry, was in charge of operating and maintaining sewage facilities under the project together with prefectural offices under its control (Khemisset and Sidi Kacem prefectural offices).

(2) Operation and Maintenance System for Sewerage Services

Sewerage services are operated and maintained based on municipal offices that belong to prefectural offices under DR4's control. In this project, engineers in Khemisset, Sidi Kacem, and Tiflet were incorporated into the personnel of ONEE municipal offices in the respective cities²¹ in an effort to reinforce the operation and maintenance system for sewerage services. All offices in the three project cities belong to DR4, which has a total of 588 personnel (as of December 2019). DR4 has four prefectural offices, in Kenitra Prefecture, Khemisset Prefecture, Sidi Kacem Prefecture, and Tamesna Prefecture, respectively. The municipal offices in the three project cities belong to the Khemisset or Sidi Kacem prefectural offices, and each municipal office has tens of engineers as part of its personnel.

²¹ The municipal offices in Khemisset, Tiflet, and Sidi Kacem received four, four, and two engineers, respectively. The engineers received from the respective city governments, who were familiar with the situation of the respective cities, contributed to the performance of construction work under the project by acting as intermediaries between ONEE and residents. Other engineers from the communes shared the geographical traits of the respective cities, candidates proposed for sewerage facilities to be installed, the characteristics of the ground at installation points, the existence of groundwater veins (such as groundwater), issues to address, and others with ONEE. Thus, they contributed mainly to detailed design of highly feasible facilities, and the smooth execution and management of construction work.

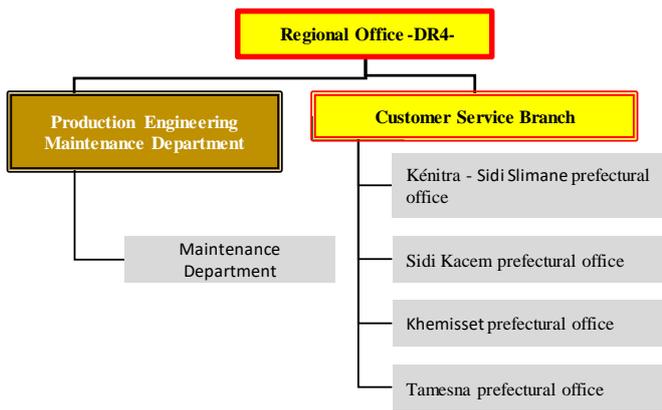


Figure 1: Implementation System Diagram of DR4

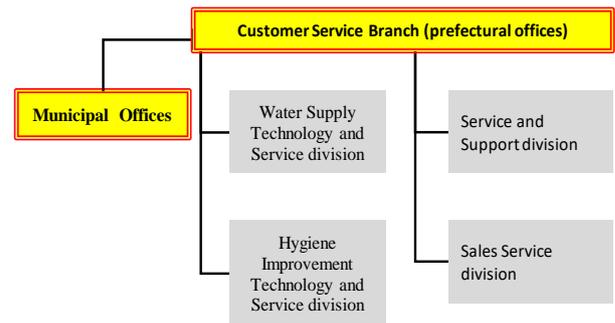


Figure 2: Implementation System Diagram of Local Offices in the Three Project Target Cities

Each municipal office is responsible for supervising the city’s sewage treatment plants, trunk sewage canals, networks of sewage collection pipes, and sewage pump stations and operating and maintaining all sewage facilities of the city. A sufficient number of personnel are assigned to each municipal office to inspect these facilities periodically. All facilities to be inspected are periodically inspected, at a cycle of once a week, and around 30 minutes are spent on inspection at each facility.

(3) System to Conduct Environmental Monitoring for Water Quality

The Direction Contrôle Qualité des Eaux (DCE), which is under the control of the International Institute for Water and Sanitation at the ONEE headquarters, is in charge of environmental monitoring for water quality. Under this project, DCE personnel are seconded to DR4 and enrolled there for a certain period of time. Currently, they visit each sewage treatment plant each month to monitor the quality of water in the plant. Since the summer of 2019, two personnel have been assigned to the sewage treatment plant in Khemisset. Meanwhile, no personnel have been deployed in Sidi Kacem’s treatment plant, with DCE personnel periodically sent to the plant for water-quality monitoring. There is no problem with the level of techniques and the maintenance of equipment required for environmental monitoring for water quality.

Under the control of ONEE’s Bureau of Industry in the central government, which has authority for the operation and maintenance of sewage facilities built under the project, DR4 plays a central role in regular maintenance and management, emergency response when abnormalities are detected, repair and replacement, construction work for expansion, and monitoring of the quality of water in the sewage treatment plant by assigning personnel appropriately and putting implementation systems in place.

3.5.2 Technical Aspects of Operation and Maintenance

ONEE has a track record of operating and maintaining sewage facilities and possesses sufficient technological capabilities. It has many personnel with 20 years of experience or more, who account for half of ONEE’s total employees. With over 62% of its personnel (as of December 2019) having completed related courses of study at university, ONEE has many personnel with technical

knowledge. Similarly, at DR4, which is responsible for operating and maintaining the sewage facilities installed under the project, more than half of engineers have 20 years of experience or more; with regard to academic backgrounds, 59% of personnel have a university degree or higher.

In addition, ONEE has the Technical Training Department (hereinafter referred to as “DIF”), which plans, implements, and monitors projects to develop technology for ONEE business. This department, which has necessary teaching materials, identifies the training needs of each department and reviews and revises the training curriculums. DIF instructors use these curriculums to train some 20 personnel in each training session. Together with this training, ONEE engineers receive practical training at the platform for sewage facilities, which is available at the headquarters for training. This enables ONEE engineers to acquire the technical abilities to solve failures and defects at sewage facilities by themselves. It was confirmed that there was no problem with the operation of sewage facilities, because engineers at DR4 regional offices, prefectural offices, and offices in the cities where sewage facilities had been installed had high-level knowledge of and know-how in on-the-spot surveys in their respective scopes of responsibility.

Both the headquarters and DR4 of ONEE have sufficient experience, abilities, and technological capabilities, therefore, the sustainability of operation and maintenance for sewage facilities in technical aspects is considered to be very high.

3.5.3 Financial Aspects of Operation and Maintenance

(1) Overall Revenue and Income and Operation/Maintenance Costs

It can be confirmed from the financial statements disclosed by ONEE that it has maintained a sound revenue and income structure over a long period of time. Table 13 summarizes changes in revenue and income during the period from 2016 to 2018.

Table 13: Changes in ONEE Income and Expenditures (2016–2018) (Unit: million MDH)

Income / Expenditure Items	2016	2017	2018
Total Revenue	6,322	5,656	5,961
Other incomes (subsidy and etc.)	887	1,329	1,077
Operation and Maintenance costs	1,182	1,244	1,297
Gross profit	6,027	5,741	5,742
Personnel expenses	1,386	1,435	1,476
Overhead, Operational allocation, other, tax	3,276	3,204	3,255
Operating income	1,365	1,101	1,011
Operating income ratio	18.9%	15.8%	14.4%
Financial return (Financial income - Financial loss/expenditure)	-677	-413	-620
Ordinary profit	688	688	391
Income Tax	20	23	21
Net profit	667	665	370
Net profit margin	9.3%	9.5%	5.3%

Source: based on the financial statements of the ONEE Annual Activity Report (2016-2018)

Note: Subsidies from local governments, national governments, and international organizations are calculated as part of the income.

Total revenue has increased and decreased, but the operating income ratio remained between 14% and 19%, indicating that the water supply/sewerage and electricity services earned a sufficient income. Financially, ONEE has run a deficit due to repayment for borrowings from the government and international organizations but is repaying each year without delay and posting net income steadily. Therefore, ONEE has no financial problems.

Table 14: Number of Households and Total Collected Amount by Water and Sewerage Services of ONEE as a Whole

	Number of households subscribing to sewerage service and total collected amount		Number of households subscribing to water supply service and total collected amount		Total collected amount by water and sewerage services (million MDH)
	Number of subscribing households (thousand)	Total amount collected (million MDH)	Number of subscribing households (thousand)	Total amount collected (million MDH)	
2014	865	180	1,807	1,274	1,454
2015	917	233	1,904	1,473	1,705
2016	1,047	259	1,997	1,505	1,764
2017	1,128	305	2,096	1,608	1,913
2018	1,212	310	2,183	1,572	1,882
2019	1,332	350	2,272	1,692	2,042

Source: Documents provided by the executing agency

(2) Operation and Maintenance Costs under the Project

According to interviews with ONEE officials, sufficient budgets were currently appropriated to operation and maintenance, and similar budgets were expected to continue in the future. It was confirmed from this that there was no problem with DR4's overall operation and maintenance costs, including those of the project. All expenses related to the installation of sewage facilities are borne by ONEE, with costs for land acquisition and some drainpipes paid by the communes. Because it earns revenue not only from sewerage business but also from water supply service, ONEE can sufficiently cover costs required for operation and maintenance. Table 15 shows the amounts it is estimated to collect for water supply and sewerage services in the three project cities and actual operation and maintenance costs. The actual operation and maintenance costs exceed the amounts estimated to be collected for sewerage services, indicating that the operation and maintenance costs for sewerage services cannot be fully covered by the amount collected for sewerage services alone. On the other hand, the amounts estimated to be collected for water supply more than double the amounts estimated to be collected for sewerage services, allowing part of the amounts collected for water supply to be appropriated to cover operation and maintenance costs for sewerage services. This can be confirmed in the table below.

Table 15: Estimated Collected Amounts by Water and Sewerage Services and Operation Budget and Actual Costs for the Three Target Cities (Unit: million MDH)

Year	Estimated collected amount by water and sewerage services from the estimated number of households covered by this project					Operation expenses for this project (Actual)	
	Number of households targeted for this project (thousand)	Overall ratio of this project (sewerage) (%)	Estimated total collected amount by sewerage services (million MDH)	Overall ratio of this project (Water) (%)	Estimated total collected amount by water services (million MDH)	Budget (million MDH)	Actual operation and maintenance cost (million MDH)
2014	86.3	10.0%	17.9	4.8%	60.8	31,0	29.5
2015	86.4	9.4%	21.9	4.5%	66.8	35.1	33.3
2016	88.1	8.4%	21.8	4.4%	66.4	36.1	42.1
2017	92.0	8.2%	24.9	4.4%	70.6	40.9	41.1
2018	93.6	7.7%	23.9	4.3%	67.4	39.4	41,0
2019	N.A.	N.A.	N.A.	N.A.	N.A.	40.2	39.5

Source: estimated and calculated by the evaluator on the basis of the responses from ONEE using the questionnaire at the time of the ex-post evaluation

(3) Sewerage Rate System for the Project

The systems and rules for sewerage rates were established based on the report compiled in 2000 (Service Public 2000).²² Table 16 lists the fee for sewerage services in the project cities, which were later revised, in 2017.

Table 16: ONEE Sewerage Service Fee Structure (2017)

Fee Structure (2017) ²³	Khemisset, Tiflet (Group 3)	Sidi Kacem (Group 4)
a. General household use		
Fixed annual fee (MDH)	36	36
Monthly usage fee (MDH/m ³)		
Water use range 1: Monthly usage from 0 to 6 m ³	0.75	0.75
Water use range 2: Monthly usage from 6 to 20 m ³	3.51	3.51
Water use range 3: Monthly usage of 20 m ³ or more	4.71	4.71
b. Use in public facilities and institutions		
Fixed annual fee (MDH)	72	72
Monthly usage fee (MDH/m ³)	4.21	4.21
c. Industrial use		
Fixed annual fee (MDH)	144	144
Monthly usage fee (MDH/m ³)	4.71	4.71

Source: responses from ONEE using the questionnaire at the time of the ex-post evaluation

Because the amount of sewage service used cannot be measured in quantitative terms, it is common to charge sewage service in proportion to the amount of tap water supplied, and sewage rates are charged to households covered by this project according to the amount of tap water supplied. According to Table 16, the fixed amount of 36 MDH is charged to each household annually with

²² Service Public 2000 is a report on long-term charging policy, which was compiled by consultants hired in France. It includes the systems and rules established to revise sewerage rates in order to ensure that ONEE will not fall into a financial crisis in the future.

²³ The sewage charging system divides cities into four groups. This system is based on the amounts set and charged for sewage services when, before 2000, each city operated and maintained its sewerage independently. In 2000, ONEE started to take responsibility for the operation and maintenance of sewerage and revised the amounts that had been set and charged by each city for sewage services in the past as operation and maintenance costs grew, and the result is the current categorization of charging, which does not take into consideration economic scales, the average income of households, and other factors. Of the project cities, Khemisset and Tiflet are included in Group 3 and Sidi Kacem in Group 4.

0.75 MDH per cubic meter added monthly if the amount of tap water used ranges from zero to 6 m³ (Tap Water Use Range 1). If the monthly amount of tap water used ranges from 6 m³ to 20 m³, the amount charged per cubic meter rises sharply to 3.51 MDH (Tap Water Use Range 2). For subsequent ranges, rates are charged according to the amount of tap water used monthly based on this method. The average amount of water used by households ranges roughly from 11 m³ to 14 m³, and consideration is given to the charging system so that excessive sewage rates are not charged to average households. One of the reasons for this is that sewerage services are strongly intended to contribute to society and are easily affected by politics. Another is that, because it serves provincial core cities and communes, ONEE needs to pay full attention to actions it takes for the poor in particular. Because of such attention, ONEE can collect sewage rates smoothly, and this supports the sound financial condition of ONEE as described above. Currently, ONEE is proposing a plan to increase the rate per cubic meter by 0.1 MDH each year during the period from 2019 to 2023, and this has been approved in the process of discussions about the revision of water supply and sewage service rates. If the plan of increasing the rate by 0.1 MDH annually is realized, it will become possible to cover maintenance and management costs by revenue from sewerage services alone in 2023.²⁴

It is possible to set water and sewage rates required to maintain both water supply and sewage services, and since full consideration is given to factors such as the living standards of residents and the economic situation, it can be said that the financial sustainability of ONEE's water supply and sewage services is extremely high.

As described above, ONEE has a stable financial structure, and there is no problem with the income and expenditure of water supply and sewage services provided by DR4, including the project. Therefore, there is no financial problem.

3.5.4 Status of Operation and Maintenance

In this ex-post evaluation and survey, the operation and maintenance of sewage facilities installed in this project were analyzed based on ONEE's quarterly project progress reports and replies to questionnaires, as well as on-the-spot surveys. All water supply and sewage facilities in the three cities are in operation without problems (Tiflet has only a sewage collection system and does not have treatment facilities). The table below shows the operation of each facility. The sewage treatment facilities used in this project are very basic, enabling all materials and spare parts to be procured within the country. In addition, they use the technology that has brought satisfactory results in the country, and there are many operators that support it.

²⁴ According to interviews with ONEE officials, sewerage services will become profitable if 1.0 MDH/m³ can be charged per month.

Table 17: Current Status of Operation and Maintenance of Sewage Facilities in the Three Cities

Sewage Facilities	Status	Issues	Countermeasures
Sidi Kacem			
Sewage Treatment Plant	Good	Sludge treatment	Purchasing pump for sludge suction
Sewer pipe	Good	None	
Pumping Station	Good	There is a sewage odor when the water amount is small	Plant around the pumping station
Khemisset			
Sewage Treatment Plant	Good	Oxygen concentration sensor did not respond	Sewage dust adhered to the sensor. A maintenance company was asked to clean the sensor, and the problem has been dealt with.
Sewer pipe	Good	None	
Pumping Station	Good	There is a sewage odor when the water amount is small	Plant around the pumping station
Tiflet			
Sewage Treatment Plant			
Sewer pipe	Good	None	
Pumping Station	Good	None	

As described above, there is no problem with the project's operation and maintenance system, technology, finance, and overall situation, and the sustainability of effects brought by the project is high.

4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

This project was implemented to establish and expand sewerage systems in three cities (Khemisset, Sidi Kacem, and Tiflet) near Rabat by improving sewerage in the cities, thereby contributing to improvement in living standards in the areas.

The target areas were core cities and communes in regions in which the need for sanitation or sewerage improvement was the highest among those specified in the National Sanitation Master Plan (SDNAL), a sector development policy of the Moroccan government. In addition, this project has been highly consistent with Japan's ODA policy; thus, its relevance is high. The project period of ten years was significantly longer than the planned four years because the project required a considerable amount of labor and time to acquire land for sewage treatment plants. Meanwhile, the project cost was within the plan, at 92% against the recalculated budget plan. Therefore, the efficiency of the project is fair. In Khemisset and Sidi Kacem, the sewerage systems were established almost as planned, excluding some sections, thereby improving the sanitation environments in the cities. On the other hand, in Tiflet, although the trunk sewer and sewage collection network were improved as planned, and the sanitation environment in the city was improved, the establishment of a sewage treatment plant remains incomplete. This led to the fact that sewage in the city has been untreated and discharged into the river. According to an interview survey, local residents are satisfied with this project, and positive impacts on the natural environment, public health, and economy in the cities have been confirmed. Although the improvement in living standards in the target cities has been achieved, consideration for the natural environment and measures for water quality monitoring are insufficient. To summarize the above, the effectiveness and impacts of the project are fair. For the systems for maintenance in this

project, implementation systems by the headquarters, regional and provincial offices, and city service offices have functioned. With regard to technical aspects, ONEE has a good track record in maintenance and sufficient technical capabilities. In addition to the soundness of its financial condition, the balance of payments combined with water supply and electric power has been active every year, and no major problems have been observed. Therefore, the sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- (1) It is desirable to take steps to acquire land for a sewage treatment plant in Tiflet, design the plant in detail and decide specifications for the plant, and start construction work as soon as possible. After these steps are taken, it is also desirable to start sewage treatment services by 2024.
- (2) Because part of the construction work for drainpipes in Sidi Kacem has not been completed, it is desirable to conclude a construction contract for such a part quickly and complete the part of the work that is left uncompleted (At the time of the ex-post evaluation, according to interviews with the people concerned, the work is expected to be completed in 2020).
- (3) The quality of water is not monitored in Tiflet. The quality of water at the three locations of the river where sewage is released as well as at the eight locations of the river where sewage was formerly released should be monitored to confirm whether sewage or similar is leaking.

4.2.2 Recommendations to JICA

Parts of the sewage facilities in the project cities are left uncompleted. It is necessary to continue monitoring Tiflet's sewage treatment plant, an uncompleted component of the project, and the portion of Sidi Kacem's drainpipes which is left uncompleted. It is desirable to seek a report on the progress in the construction of these uncompleted components from ONEE twice a year and continue monitoring until the components are completed.

4.3 Lessons Learned

(1) Add land acquisition to prior requirements in sewerage development by local governments

In this project, it took much time and labor to acquire land for sewage treatment plants. As a result, the installation of a sewage treatment plant in Tiflet was left uncompleted. If, as in the project, the authority and responsibility for land acquisition lies in the local government concerned, the requirements for prioritization of local governments covered by a sewerage development project, including the availability of land for sewage treatment plants in the project area, the conclusion of memorandums with landowners, budgets nailed down by the government in its annual plan to purchase the land, and so forth, enable the local government to strengthen its commitment for the sewerage development project.

Comparison of the Initial / Actual Scope

Item	Plan	Actual
(1) Project Outputs	<p><u>Khemisset</u> Sewage Treatment Plant: Anaerobic pond + aerated lagoon Total sewage treatment capacity: 11,008 m³/day Cleaning of Sewer Lines: 3.6 km Rehabilitation of Sewer Lines: 0.3 km Sewer trunk line / Sewage collection network / Interceptor: 23.5 km Drainage Ditch: 6.1 km Pumping Station: 2</p> <p><u>Sidi Kacem</u> Sewage Treatment Plant: Anaerobic pond + facultative pond Total sewage treatment capacity: 11,120 m³/day Cleaning of Sewer Lines: 42.5 km Rehabilitation of Sewer Lines: 2.0 km Sewer trunk line / Sewage collection network / Interceptor: 33.5 km Drainage Ditch: 22.2 km Pumping Station: 1</p> <p><u>Tiflet</u> Sewage Treatment Plant: Anaerobic pond + facultative pond Total sewage treatment capacity: 4,850 m³/day Cleaning of Sewer Lines: 4.6 km Rehabilitation of Sewer Lines: 0.2 km Sewer trunk line / Sewage collection network / Interceptor: 20.1 km Drainage Ditch: 3.6 km Pumping Station: 3</p>	<p><u>Khemisset</u> Sewage Treatment Plant: Anaerobic pond + aerated lagoon Total sewage treatment capacity: 12,152 m³/day Cleaning of Sewer Lines: 0 km Rehabilitation of Sewer Lines: 0 km Sewer trunk line / Sewage collection network / Interceptor: 15.5 km Drainage Ditch: 6.1 km Pumping Station: 1</p> <p><u>Sidi Kacem</u> Sewage Treatment Plant: Anaerobic pond + facultative pond Total sewage treatment capacity: 7,600 m³/day Cleaning of Sewer Lines: 0 km Rehabilitation of Sewer Lines: 10.7 km Sewer trunk line / Sewage collection network / Interceptor: 30.9 km Drainage Ditch: 22.2 km Pumping Station: 2</p> <p><u>Tiflet</u> Sewage Treatment Plant: Not implemented Total sewage treatment capacity: 0 m³/day Cleaning of Sewer Lines: 0 km Rehabilitation of Sewer Lines: 0.2 km Sewer trunk line / Sewage collection network / Interceptor: 21.6 km Drainage Ditch: 0 km Pumping Station: 3</p>
(2) Project Period	November 2005 - October 2009 (48 months)	November 2005 - May 2016 (127 months)
(3) Project Cost	<p>At the time of Preliminary Evaluation:</p> <p>Foreign currency: 488 million JPY</p> <p>Local currency: 5,516 million JPY</p> <p>Total: 6,004 million JPY</p> <p>Japanese ODA loan portion Exchange rate: 1 Moroccan Dirham = 12.1 JPY (As of September 2004)</p>	<p>At the time of the Ex-Post Evaluation:</p> <p>N.A.</p> <p>N.A.</p> <p>4,804 million JPY</p> <p>1 Moroccan Dirham = 11.7 JPY (2007 - 2016 average)</p>
(4) Final Disbursement	May 2016	