List of Knowledge Lessons (Final Version)　　Sewage Management

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Sewage Management 1	Project Design	Project Design of Effective Sewage Management
Sewage Management 2	Institution Building	Development of Effective Sewerage-Related Legislation
Sewage Management 3	Organizational Strengthening and Capacity Development	Capacity Building of Implementing Agencies of Sewerage Projects
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Knowledge Lesson Sheet		
Sewage Management 1	**Project Design**	**Project Design of Effective Sewage Management**

Lessons Learned	
Type of Lessons Learned	**Lessons learned in the sector and sectoral characteristics**
Keywords	**Judgment of sewerage services implementation in view of the economic situation, financial resources, gradual sophistication of the treatment method**

Applicable Cases	Lessons (Countermeasures)	
When forming sewerage-related projects in developing countries	Timing of Application	Project formation stage
	Countermeasures	Comprehensively analyze the financial infrastructure and legal system, as well as the facility construction and maintenance of the target countries, to carry out the formation of sewerage projects.
Risks		**[Planning of sewerage projects in view of the economic situation of the target areas]** Because sewage development requires large investments over a long period of time, when formulating sewage development projects in developing countries, the following points should be considered. • When a country's GDP per capita is about 3,000 USD, it can embark on a sewerage development. When the GDP per capita is about 5,000 USD, the basis for sewerage management—such as regulations and institutions, financial resources, and infrastructural development such as electricity supply—becomes enhanced, and there is also a tendency that people starts to have greater interest in environmental issues. (When Japan's sewage management experienced rapid progress, the GDP per
[Risk that the project formed does not reflect the actual conditions] When the formed project fails to reflect the actual conditions of the recipient country or when it does not provide support in accordance with the development stage of the country, there is a risk that reasonable outcomes would not be realized and that project activities would not be smoothly operated.		

		capita was about 5,000 USD.) • However, even in developing countries where their GDP per capita is less than 5,000 USD, sewerage development is already in progress in areas where local governments have financial surplus (such as capitals and larger cities). On the other hand, there are cases where, despite the large national GDP, operations for sewerage projects for rural cities are not economically feasible. Therefore, it should be noted that country's GDP is not the determining factor in deciding on the implementation of sewage management projects. • In cases where it is judged that there is not enough economic leverage in both the central and local governments, it is important also to consider the option of not forming and planning projects from the standpoint of sustainability—even if the recipient government has strong wills. **[Appropriate sewerage planning]** The sewerage system is comprised of sewerage facilities implemented by public institutions (sewage treatment plants, pumping stations, sewer pipe and drainage (trunk + branch line + mounting tube + home connections)) and home drainage equipment. The effects of the sewerage system are not observed unless the whole series of these systems are put in place integrally. Thus, an integral development plan of the entire sewerage system and securing its necessary financial resources become crucial. (It should be noted that, when employing a separated sewerage system, the cost of the pipe and drainage installment is higher than the cost of treatment plant maintenance.)

		According to a study of the World Bank, the criterion for the implementation of sewer network and treatment plant development projects, from the standpoint of construction costs and maintenance expenses, is a population density of greater than 250 people/ha. In area with less density, the development of distributed treatment facilities is more appropriate from the standpoint of economic efficiency. **[Understanding the status of legal system development]** ① Confirmation of the situations of laws related to the sewerage field Because sewerage is closely interrelated with environmental law, urban planning law and regulations related to waste management, the positioning of sewerage sector in each law, regulations and standards must be clearly identified. In particular, inflow and effluent water quality standards are important items related to facility design; thus, the existence of criteria (or the progress in developing the criteria, if absent) should be verified. ② Availability of state budget and confirmation of these subsidies During the development stage of project plans, it is recommended to confirm the availabilities as well as coverage of the state budget and subsidies from the central government, etc. for the sewerage services. It should also be noted that it is important to determine to what extent local governments and residents' beneficiaries are able to share the cost burden. **[Securing financial resources of the sewerage**

		services cost to suit the situation of the country] The main cost of sewerage projects is roughly divided into construction costs and administrative costs. Funding these costs require definition of the respective burden level of three parties; the central government, local government and the user. The concept of funding is outlined below. Yet, in the actual project design, it is necessary to determine the financial responsibility for each party in accordance with the respective country's circumstances. ① Construction costs The construction cost is a heavy burden, and it is difficult for local governments to finance alone, so the central government as well as donors needs to finance a large part or the full amount of the cost. Sewerage facilities are considered to be the property of local governments which receive the benefits by environmental improvement. It is also necessary to consider the possible burden amount level for local governments. ② Administrative costs Administrative costs include maintenance costs, and depreciation cost, which are based on the "principle of the user burden." To recover the administrative costs via fee collection from the users, it is necessary to establish appropriate fees to do so. The amount that could be recovered from fee collection in developing countries is limited because of its small scale. The sewerage service fee levels first need to be set as to cover the maintenance costs; the economy and the pipe can progress with development; and plans, such

		as gradual price increases, can be formulated. **[Introduction of sewerage facilities conforming to the conditions of target areas]** ① Selection of treatment methods best suited for developing countries In general, there are often cases in which central governments of developing countries do not have fiscal capacity, lacking cost burden capability, therefore, on the premise of setting upper limit for funding capability, selection of affordable method of sewage treatment facilities becomes important, especially from the viewpoint of simple and cheaper daily maintenance. ② Step-by-step advancement of the treatment system The treatment system of effluent water quality standards and the inflow water quality need to reflect the conditions of the treatment plant site areas, and they need to be selected with the most economical method. However, in developing countries, construction and maintenance costs according to the selected treatment method, in some cases, become excessively burdensome. In such cases, they should only build primary treatment facilities as the first step and plan the expansion of treatment facility and adoption of the advanced treatment method, based on the level of sewage inflow increasing together with the expansion of economic development and sewer pipe maintenance. In this case, as achieving the target treated water quality is expected to be difficult. Therefore in the case of adopting step-by-step advancement of the treatment system, it is required to have a

		prior agreement with environment related institutions on the target level of the treated water quality and its expected impact on the quality of public water, using quantitative indicators at an early stage of development. ③ Selection of the exclusion method Separated sewerage system and the confluence formula are roughly divided into three shielding collection systems, respectively, and in each scheme benefits, there are disadvantages: in the target area, 1) construction environment (traffic conditions, road width, etc.) 2) development status of existing drainage facilities and 3) in view of the financial situation, etc., in some cases, adopt a system that combines those methods. Sewer pipe installation costs and period become lower and shorter in the order of the separated type> combined type> interceptor collection type. • The separated sewerage system and combined sewerage systems provide sewer pipes into home, so improvement on surrounding environment is easily noticed by the residents. On the other hand, house connections to sewer pipe foundation is generally implemented at residents' expenses, and some residents cannot bear the cost burden, and end up not utilizing sewerage facilities effectively in some cases. Therefore, when providing sewer facilities with assistance, it is necessary to study whether door-to-door connections should be included in the scope of the assistance. • Interceptor collection type, different from other methods, use waterway and there is no need of individual home connection, but on the other hand, no physical change can be seen at

		residents' home and residents cannot visualize the effects of the improvement of the water quality. Especially, when using existing open waterway as interceptor waterway, as surrounding environment does not show the change, it is hard to be understood. • When utilizing open waterway, it is important to apply the cover to improve odor and appearance, and promote citizen's understanding on sewage management in parallel. At the same time, it is necessary to consider measures to collect fees from users to recover the cost of interceptor piping development.
	Expected Effects	Project formation will be implemented in line with the economy, legal framework as well as technical level of the recipient country, thus subsequent activities will proceed smoothly, and sewerage services project sustainable and suited for the very recipient country be carried out.

Knowledge Lesson Sheet		
Sewage Management 2	**Institution Building**	**Development of Effective Sewerage-Related Legislation**

Lessons Learned	
Type of Lessons Learned	**The lessons learned in the sector and sectoral characteristics**
Keywords	**Cooperating with the development of by drainage regulation of the industry, clarification of responsibility by the contract documents, gradual strengthening of regulatory standards, stricter legal enforcement**

Applicable Cases	Lessons (Countermeasures)	
When there is no sewerage-related legal system in the recipient country, or even the legal system exist, it is not effective, and when the development of the legal system is required	Timing of Application	Project planning stage Project implementation stage
	Countermeasures	Ensuring the sustainability of the sewerage services by building an effective sewage management system.

Risks

[Risk when there is no ability to execute the legal system]

In developing countries there are cases of non-existence of sewerage service act, or though legal frame work related to water pollution prevention or sewage measures are defined in environment law, legal frame work itself has incompleteness and insufficiencies. Due to lack of legal force, supervision and guidance are undeserved and issues such as unregistered connection to sewer pipes, erroneous connection to drainage, discharge of untreated industrial wastewater which does not conform to the effluent water quality standard with respect to prevention

[Effective Institution Building]

In order to ensure the effectiveness of the legal system, the following items need to be checked and if any condition below is lacking, some advice and guidance should be given to the government.

① Clarifying the subjects to whom the legal system is applied

- When sewer service is introduced, it is necessary to impose obligation of connection to the users who enjoy the benefit from the sewer service. It is necessary to determine who becomes subject to the obligation and the administrators should inform the target users. It is also necessary to set the deadline for connection obligation. (In most municipalities in Japan, the maximum grace period is 3 years, without delay). (Reference project: No 3)
- In case conditions determined by

of water pollution and sewage measures. **[Non-concrete framework and system]** When there is no specific statement regarding subject, corresponding period that the subject have to give reaction by, and the penalties are included in the new or existing legal system, there may be a risk of inappropriate use of sewerage facilities (such as unregistered connection). **[Risk when waste water regulation is not complied by the user]** In waste water regulation, if the industrial waste water and domestic sewage is not properly regulated, there is a risk that the following events would occur. • Functional inhibition of treatment plant because of heavy metals/oil discharge. • Sewer pipe blockage		administrators are cleared (for example, the establishment of individual treatment facilities which undergo appropriate maintenance so that the minimum standard of the discharged water quality is fulfilled), flexible measures such as extending the exemption period should be considered. ② Improvement of the subsidy framework • When the connection to sewerage systems is obliged, the burden on service users may be huge because they need to cover the full cost of the construction. Sewer administrators should develop some subsidy program to partially cover the construction costs, and try to avoid generation of unfairness among users on the application process. • Though there are some examples of the Japanese ODA Loan that cover the cost of connection of households to piped water and sewerage such as Indonesia Denpasar Sewerage Development Project and Kandy Sewerage System in Sri Lanka, it is necessary to clarify ownership of sewerage facilities as well as to verify the need of such scheme using the Japanese ODA Loan. There is an example of assistance from Denmark that set a revolving fund for the projects in Thu Dau Mot Town (Binh Duong Province), Vinh Yen Town (Vinh Phuc Province) in Vietnam. Also there is a case that sewer service providers are subsidized by the output-based scheme of World Bank through results-based financing to reduce the economic burden of connection for poor households. ③ The application of penalties (for users without connection registration to sewer

		services) For unregistered users who connect to the sewer without proper notification to sewer services, sewer administrators should impose penalties and should consider suspending water supply services or imposing cost burden for these unregistered users. For plant operators who do not comply with the effluent discharge standards, the sewer administrator should also introduce penalty measures, such as stopping the sewage acceptance service. However, when donors such as JICA consider the introduction of regulatory measures such as including fine, imprisonment and water supply cut, donors should study the legal system of the country. **[Establishing an approach for industrial wastewater regulations]** For industrial wastewater, regardless of acceptance or non-acceptance in the sewage treatment plant, as the responsibility of government, appropriate management is required. To accept industrial wastewater, especially when accepting highly concentrated industrial wastewater flows into the sewage treatment plant, it will adversely affect the plant process, and there is also a possibility that the deterioration of the discharge water quality occurs. To prevent this and to perform appropriate management, the following efforts listed below are needed. ① Clarifying the definition of users (in particular the business entities), inspection items and sampling point as well as the numbers of samples. ② Creating an inspection checklist and managing the inspection results in the

		database ③ Establishing the criteria and penalty provisions such as business improvement order to ensure the technical validity as well as the compliance to proper operation. (Reference project: No. 4) ④ In case of factory waste water, the flexible system design should be made considering the factors such as maximum allowable concentration level of BOD (biological oxygen demand), SS (suspended solids) and heavy metals, and minimum discharged waste water volume should be determined (for example, the factory with 50 m3 / day or more should be set). However, it should be noted that, in Japan, under the Water Pollution Control Law, waste water regulation on business entities has been thoroughly enforced in each prefecture. In the case of developing countries, even if the framework and system exist, the lack of management ability of enforcement watchdogs can reduce the effectiveness of the legal system. It is necessary to consider the aspect of capacity building on the enforcer side as well. **[Effective Institution-building through wide range of hearing]** When building a regulatory system, it is necessary to involve the central government, industry and residents from the very beginning of the planning stage in order to set realistic regulatory standards. It is also necessary to involve local government officials who are in contact with the stakeholders to build a realistic and enforceable system based on learnings from past cases and considering probable risks.

		(Reference project: No. 1)
	Expected Effects	Beneficiaries of sewerage systems will properly utilize the sewerage facilities, and pay the corresponding fee (sewer fee) for the benefit. For illegal users, strict guidance should be implemented based on the legal system.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Guatemala	Water Environment Improvement in Metropolitan Area	Industry, participation from planning stages, waste water regulations, drainage monitoring, cooperation agreement
2	Mexico	Costal Water Quality Monitoring Network Project	Approval of guidelines, director of the approval process
3	Colombia	Aguablanca Water Supply and Sewerage Project	Illegal connection to the sewer pipe, educational activities, strengthening of law enforcement, toughing of the law
4	Mongolia	Study on the Strategic Planning for Water Supply and Sewerage Sector in Ulaanbaatar City	Industrial wastewater, clarification of regulated establishments, penalty of documented of the documented
5	Vietnam	The Project for Capacity Development of Sewage management in Ho Chi Minh City Phase 2	Describing the importance of step-by-step development, introduction of the latest technology, improvement of the penetration rate

Knowledge Lesson Sheet		
Sewage Management 3	**Organizational Strengthening and Capacity Development**	**Capacity Building of Implementing Agencies of Sewerage Projects**

Lessons Learned	
Type of Lessons Learned	**The lessons learned in the sector and sectoral characteristics**
Keywords	**Ensuring counterparts' own initiatives, capacity development, management capacity building by experts, explicit commitment of government**

Applicable Cases	Lessons (Countermeasures)	
When capacity building of implementation agencies such as governmental institutions as well as operating entities is conducted or needed	Timing of Application	Project planning stage Project implementation stage
	Countermeasures	For sewerage services operation and maintenance, it is important to provide support tailored to the experience and capacity of the implementing agencies.

Risks

[Risk when the understanding is inadequate for the entire sewerage project]

Because sewerage services operation consists of various aspects including construction, operation and maintenance, and related administrative procedures, if the understanding of the entire operation of implementing agencies is inadequate, there is the risk of delay of the project and improper maintenance.

[Risk deriving from inexperienced implementing agencies]

If more than one organization is

[Support for inexperienced implementing agencies]

Sewerage is a relatively new infrastructure compared to other infrastructure projects, and depending on the country, implementing agencies responsible for the sewerage services are not well organized, or the capacity is not yet enough due to lack of experiences. Also in some cases, organizations are small. When providing assistance in such countries, the following points should be considered.

① If the implementing agencies (for example, the Sewer Corporation) lack business experiences at the time of project planning, it is necessary to form project management units which include implementing agencies personnel as well as knowledgeable personnel in operation and management of the sewerage projects from the institutions

involved, or if the project implementation requires collaboration with other organizations from different sectors, without sufficient experience and coordination capability, there is a risk of delay in the progress of the project implementation.		of central government. It is also important to conduct capacity building of the main counterpart institution through the project management unit. (Reference project: No. 8) ② JICA, depending on the project implementation phase and operation phase, should clarify the roles and responsibilities of each belonging unit/department in the implementing agencies, and also should make frequent consultations and guide them to enhance information sharing with each organization for the mutual learning of experiences and knowledge. (Reference project: No. 2) ③ When there is a need for technical cooperation of sewer development in the small local cities as well as in capital and major cities and capacity development becomes necessary for a large number of human resources responsible for the sewerage project, implementing another technical assistance to develop human resources should be considered. **[Strengthening of business operation capability management capability]** In order to perform proper business operations, it is important to grasp the required elements throughout project. Listed below are items related to the improvement of business management capacity. ① Improvement of project management skills Sewerage maintenance is an essential element to run a proper operation. It is necessary to develop guidelines and develop standards in order to properly carry out the maintenance. On top of these efforts, it is necessary to carry

		out capacity building, such as capabilities to manage the entire project cycle, prepare for bidding, construct facilities, and operate and maintain businesses. (Reference project: No. 1) ② Improvement of water quality management capability For cases where the treated water does not comply with the reference value but the administrators do not consider it as important issues, it is necessary to make efforts to change mindset and structure of administrators so that they comply with the standard. To that end, strengthening of external organizations which monitor the discharge water quality from the treatment plant, strengthening penalties, strengthening the self-inspection system and are necessary. If necessary, these measures can be combined to suit the circumstances of the recipient country. In order to properly carry out water quality management in sewage treatment, a system that can store accumulated data and records needs to be developed to share the past experiences and correspondence records, especially as a measure for emergency such as surge of water quantity, inflow of densely polluted waste water. ③ Strengthening of financial management capacity As it is necessary to strengthen the financial foundation as well as staff motivation and capacity, capacity development of the staff to monitor the revenue and expenditure for the appropriate expense management and cost recovery is needed. It is also important to confirm that depreciation cost is considered in the administrative costs.

		④ Promotion of citizen's understanding on fee collection Because the collection of fees is the most important financial base for sustainable operation of the sewerage facilities, it is important to make C/P staff understand the need of awareness to citizens. The method of awareness to the citizens should be in a simple manner to let them understand the benefits obtained by the sewerage system (health improvement, disease reduction, reduction of unpleasant smell). ⑤ Approach for the procurement of equipment and parts Especially for parts and equipment necessary to be procured from overseas, JICA should give a guidance to develop a list of available contacts regarding maintenance as well as the supplier list for spare parts before the project completion.
	Expected Effects	Appropriate business operations will be carried out via the improvement of organization and personnel ability.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Syria	The Study on Sewerage System Development	Clarification of the role of each stage, capacity development
2	People's Republic of China	The Study on Improvement of Marine Environmental Monitoring System for the Pearl River Estuary in the People's Republic of China	Improving the effectiveness of monitoring, information-sharing with related organizations, construction of the monitoring system

3	Thailand	Project for Improvement of Sewage Treatment Plants Management in Thailand	Setting of indicators, baseline data, sewer fee, payment obligations, operation and maintenance
4	People's Republic of China	Water Environment Restoration Pilot Project in Taihu Lake	Ensuring appropriate cooperation
5	Vietnam	The Project for Capacity Development of Sewage management in Ho Chi Minh City Phase 2	Describing the importance of step-by-step development, introduction of state-of-the-art technology
6	Mexico	Costal Water Quality Monitoring Network Project	Approval of guidelines, director of the approval process
7	Tunisia	Sewage System Development Project in Four Cities	Project delays
8	Vietnam	Enhancing Capacity of Vietnamese Academy of Science and Technology in Water Environment Protection (Phase 2)	Installation of adjustment units, integration of cross-departmental functions

Knowledge Lesson Sheet		
Sewage Management 4	**Cooperation Promotion**	**Cooperation Promotion Between Sewerage-Related Organizations**

Lessons Learned	
Type of Lessons Learned	**The lessons learned in the sector and sectoral characteristics**
Keywords	**Ensuring counterparts' own initiatives, leadership, information sharing, transfer of authority to local governments**

Applicable Cases	**Lessons (Countermeasures)**	
When multiple government institutions and other donors are involved in the project When the cooperation from the government, companies, citizens and universities and other research institutions are required to enhance the effectiveness and promotion of sewerage services When there is no staff with sufficient experience and knowledge in the ministries and institutions concerned	Timing of Application	Project planning stage Project implementation stage
	Countermeasures	For the smooth implementation of the project, when more than one executing agency become involved in the project, it is necessary to consider the elements such as authority, capacity, and mutual relationship to promote appropriate cooperation. **[Building cooperation by the leadership of the sewerage administrative agency]** In sewerage services management, as the service is carried out with inter-agency cooperation among the central government, local government, and other relevant ministries, coordination and proper management of information sharing among institutions are required. In order to promote the sewerage services, it is necessary to set higher priority on the sewerage field than other policy issues. In order to obtain sufficient financial resources and enable budget execution, implementing agency has to take a leadership to advance discussions and negotiations with relevant organizations. ① In case many institutions are involved in the sewerage policy, the Joint Coordination meeting should be organized for the purpose
Risks		
[The risk due to the lack of leadership] When implementing agencies lack leadership and enthusiasm in a joint meeting with other organizations, the importance of policy issues which sewerage sector faces may not be recognized and the priority will considered to be low compared with others sectors. It will offer the risk that sufficient financial resource		

cannot be obtained. **[The risk due to the lack of coordination among multiple donors]** When the treatment plant and sewer facilities development projects are implemented under different financial sources, there is a risk that the delay of either one of projects has adverse effect on all development. Example: In case treatment plant is developed by overseas donors, and sewer system is development by own financial source.		of information sharing and coordination of management/project policies. At this time, JICA should guide the counterpart institution to take a lead to advance discussions. In addition, JICA should coordinate to gain an agreement from related organizations that they cooperate for sewerage management and operation after the completion of the project. ② When addressing cross-sectoral issues (for example: water resource conservation, sea conservation), formulation of the project management unit should be considered for the purpose of holding discussion based on common understanding. In order to avoid confusion and confliction on information, discussion should be based on real and particular data and JICA should give coordination and advice when needed. (Reference project: No. 2) ③ When local government is the implementing agency, through the discussion in joint meetings with central government and ministries, the authority and roles of each party should be clarified. As the local government will operate local sewerage system in the future, JICA should give assistance and guidance to urge the delegation of authority. ④ Because the local government's organization is small, there are cases where shortages in human resource with technical know-hows are problematic. In such cases, it is urged to build a framework to secure cooperation from experienced personnel of the central government and /or local government for sustainable operation.

		[Support in cases where the financing institutions for development of treatment plants and sewer pipe facilities are different] In order to ensure the expected performance of developed treatment plants, it is necessary to avoid a significant delay in the development of sewer pipe facilities. Therefore, it is recommended that construction of treatment plant and sewer system should be planned and undertaken in parallel. If, on the other hand, financing institutions for the development of treatment plants and sewer facilities are different, there is a possibility that the delay in one project give adverse effects on the entire project. Thus, frequent meetings should be conducted to promote mutual understanding of the situation, particularly on the clarification of the projects scope with financing institutions, project progress and measures to prevent the risk of project delays.
	Expected Effects	By close communication among multiple institutions, information sharing becomes smooth.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Syria	The Study on Sewerage System Development	Clarification of the role of each stage, capacity development
2	People's Republic of China	he Study on Improvement of Marine Environmental Monitoring System for the Pearl River Estuary in the People's Republic of China	Improving the effectiveness of monitoring, information-sharing with related organizations, construction of monitoring system
3	People's Republic of	Water Environment Restoration Pilot Project in Taihu Lake	Ensuring appropriate cooperation

	China		
4	Vietnam	Enhancing Capacity of Vietnamese Academy of Science and Technology in Water Environment Protection (Phase 2)	Installation of adjustment units, integration of cross-departmental functions
5	Tunisia	Sewage System Development Project in Four Cities	Other donors, project delays, communication
6	Malaysia	Sewage treatment facilities Project	Experience of sewerage implementing agencies, development of support systems tailored to capacity

Knowledge Lesson Sheet		
Sewage Management 5	**Citizen Participation and Understanding**	**Implementation of Sewerage Projects by promoting Citizen Participation and Understanding**

Lessons Learned	
Type of Lessons Learned	**The lessons learned in the sector and sectoral characteristics**
Keywords	**Residents awareness, promotion of community participation through public hearing, sustaining organization by community, improving sewer connection ratio, illegal connection, strengthening the surveillance**

Applicable Cases	Lessons (Countermeasures)	
When local residents' understanding on sewerage services and sense of participation are low.	Timing of Application	Project planning stage Project implementation stage
	Countermeasures	For the success of the sewerage projects, it is important to promote community participation and better understanding on the sewerage projects and the related service for residents. **[Enhancement of the sewer connection consciousness by residents through a wide range of awareness promotion approach]** ① Benefits of the sewerage system for the residents appear in accordance with the stage of social development as follows; 1) improvement of hygienic environment, 2) control of inundation, 3) environmental improvement in neighbor rivers, 4) improvement of the urban environment, 5) water quality improvement in public water areas and drinking water source (water conservation), 6) resource recycling. Benefits will change and diversify. In addition, increase of real estate value benefitted by the environmental improvement can be conceivable. JICA should extend advice and support for sewerage implementing agencies to carry out the public relation activities
Risks **[Risk of understanding of the residents is insufficient]** Without a wide range of educational activities related to sewerage management, understanding from the residents cannot be gained, and in case of low participation, sewer connection rate cannot be expected to improve. In those cases, there is a risk that the sewerage project implementation itself fails. **[Risk when the effects of the sewerage services is hard to be understood by residents]** When applying the interceptor method, as the households around the		

area cannot visualize sanitary environmental change and improvement, and it may be difficult for the residents to grasp the effect of the sewerage services. In such case, there is a risk that the understanding for the cost burden cannot be obtained.		corresponding to the development stage of the countries, by keeping the points mentioned above in mind. ② To ensure a successful sewerage services and improvement of sewer connection consciousness, it is highly important to urge community participation and accelerate understanding on sewerage services. To that end, it is effective to implement measures mentioned below for the enhancement of local residents' awareness and environmental education to make residents aware that pollution of rivers and lakes is originated by their own actions and behaviors. (Reference project: No. 2) - Hold public hearings on sewerage services. - Promote media publicity such as newspaper, TV, radio, etc. - Facility tour of the sewage treatment plant - Briefing sessions on sewerage services with local leaders and representatives near the project site - Visits to individual households, etc. ③ As objectives are to remove the anxiety of local residents, avoid the delay of the project, it is suggested to involve the local residents from a relatively early stage (such as planning study stage of the treatment plant) to explain project objectives and benefits of business as well as the impact on the environment with efforts mentioned in ②, to enhance smooth coordination between residents and counterpart organizations. When, in case where the level of local understanding is not satisfactory, sewerage service entity should hold meetings with local community leaders and also should allocate budget to solve the issues.

		[Information dissemination and awareness-building activities for wide-regional environmental protection] ① If interceptor collection method is used, the there is no connection needed to individual houses and it is difficult for residents to visualize the effect and benefit in their own homes. Therefore, it is necessary to make residents understand the values of environmental protections and promote their understanding on the cost burden, explaining that introduction of sewerage systems is "more conducive to wider-regional approach to improve the public water quality" and that "it is their obligation to treat their own waste water." (Reference project: No. 1) ② For sewerage management institutions, it is necessary to gain understanding from the residents for not disposing oil and waste into sewer pipes. Oil and waste can cause the blockage of sewer pipes. In addition, in case of interceptor sewerage or combined system, contamination can occur in downstream of river due to overflow by heavy rain.
	Expected Effects	Residents' understanding on the sewerage services can improve, and the sewerage connection rate can also improve as community participation is enhanced. Also, cooperation from residents can be obtained smoothly in the sewerage services project.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Brazil	Study on Integrated Plan of Environmental Improvement in the Catchment Area of Lake	Local residents awareness, environmental education,

		Billing in Sao Bernardo do Campo	improving sewer connection rate
2	India	Yamuna Action Plan Project	Wide-ranging educational activities, promoting understanding, schools, radios and rallies
3	Kazakhstan	Astana Water Supply and Sewerage Project	Interest in water and sewerage services, business site briefings, facility tours
4	Colombia	Aguablanca Water Supply and Sewerage Project	Illegal connections to drains, educational activities, strengthening of crackdowns
5	AFD	Water & Sanitation, Sectoral Intervention Framework 2014-2018	Extensive entrainment of sewerage service users
6	WB	Three Cities Sanitation Project	Specific incentives for the need of sewerage service

Knowledge Lesson Sheet		
Sewage Management 6	**Operation and Management of Sewerage Projects**	**Establishment of Sustainable Pricing and Collection Methods**

Lessons Learned	
Type of Lessons Learned	**The lessons learned in the sector and sectoral characteristics**
Keywords	**Avoidance of the budget shortfall in the implementation stage, appropriate maintenance management system and development of a fee system**

Applicable Cases	Lessons (Countermeasures)	
When considering the pricing and fee collection of sewerage services from users.	Timing of Application	Project planning stage Project implementation stage
	Countermeasures	Establishing sustainable sewerage fees and collection method to enable stable sewerage services
Risks		**[Setting appropriate pricing and fee collection method to enhance sustainability of sewerage management]** ① Because it is difficult to solely collect sewerage charges for a sewerage implementing agency alone in developing countries, it is effective to consider including sewerage service charge in general water charges. This method of fee collection may be easy to implement, but water supply institutions may need to handle more claims from users and do not agree easily. Therefore, sufficient consultation and coordination should be conducted with water supply institutions. ② As one of the ways to recover the cost of the administrative burden of the sewerage services from polluters and beneficiaries, it is common to collect the fees in the form of sewage service charges. However, especially in the case of the interceptor method, it is difficult to identify specific polluters as
[Risk in case fees are not properly set to cover the maintenance costs] When appropriate pricing is not set or fees are not increased at the time of increasing treatment unit cost, there is a risk of sewerage projects becoming unsustainable. **[Risk when the set sewerage fee becomes a burden for the household]** If the configured sewage charges become excessively burdensome for households, payment stagnates, and there is a risk that fee collection is not carried out sufficiently enough. **[Low awareness of sewer connection]**		

There is a risk that stable sewerage services may not be provided if the connection awareness or consciousness is low. Thus, fee and charges collection may not be performed well.		there are erroneous and non-approved connections in developing countries, which does not allow proper recovery of the corresponding fee. In such cases, fee collection through the tax system (for example, environment tax) can also be effective. It is necessary to establish a proper fee collection method to enable sustainable operations based on detailed studies on the countries' frameworks. ③ Maintenance of sewerage facilities requires a large amount of financial resources, and there is a strong possibility that the fee set at the planning stage may not be enough to cover the actual costs required for operation. Therefore, JICA should make efforts in the planning stage to urge on the possibility of fee increase as well as its importance with the concerned government officials and obtain their agreement in advance. **[Improving the fee collection rate through application of fees acceptable to the cost burden capacities of general households]** For a general household, the sewerage fee should be set in accordance with the cost burden capacity to improve the fee collection rate. In addition, application of different fees for specific projects, such as commercial and industrial businesses, could be an alternative to improve fee collection. For sewer-connected households, in order to properly grasp water usage, JICA should encourage sewerage institutions to promote installation of water meter. **[Promotion of citizen's understanding on**

		the improvement of the sewerage connection rate] Keeping in mind that it is time-consuming to increase the sewer connection rate, as referred in the lessons sheet 5 (Citizen Participation and Understanding), it should be noted that continuous educational activities are required. **[Enforceable collection of sewerage fees and charges]** A) In developing countries, there are cases where local governments have no measures to force the residents with connection obligations and payment to the sewerage systems. There is a need to prioritize the formation of the legal system, including penalties. (Reference project: No. 1) B) In Jakarta, Indonesia, sometimes the implementing entities take actions such as blocking the sewer connection's mounting tube so that the sewage does not flow. In Japan, sewage maintenance costs are divided into sewage and rainwater costs: the former is a 'private' expense paid by users, and the latter, in principle, is a public expenditure. Moreover, the fee for sewer usage covers about 45% of the sewage maintenance costs (2011). Although day-to-day maintenance costs are disbursed from it, depreciation cost and interest payments to financial institutions cannot be completely financed with this usage fee; deficits and rainwater expenses, thus, are paid via general account of local municipalities (money transferred). In developing countries, as financial foundation of local governments is even more vulnerable,

		and it is essential to seek economization of the cost for the entire sewerage project as well as maintenance and operating costs in order to reduce the necessary amount of subsidies from the local government,. Therefore, it is essential to consider the introduction of low-cost technologies and should also establish appropriate fee framework based on the principle that the beneficiaries alone bear at least the sewage expenses among the maintenance costs.
	Expected Effects	• Implementation of appropriate pricing and collection for sewerage projects becomes sustainable. • Residents recognize the significance of the sewerage and will properly pay the fee and charges.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Thailand	Project for Improvement of Sewage Treatment Plants Management in Thailand	Sewerage fee, payment obligations, operation and maintenance
2	Costa Rica	Technical Assistance for Implementation of Sub-Project of Sensibilization Related with ODA Project, Metropolitan San Jose Environment Improvement Project	Pricing, willingness to pay
3	Colombia	Aguablanca Water Supply and Sewerage Project	Illegal connections to drains, educational activities, strengthening of enforcement, toughing the law
4	People's Republic of China	Changsha Diversion Works and Water Quality Environmental Project	Operation and maintenance system, securing budget, development of water charges system, ensuring implementation of fee collection

Knowledge Lesson Sheet		
Sewage Management 7	**Operation and Management of Sewerage Projects**	**Establishment of Sewerage Maintenance System**

Lessons Learned	
Type of Lessons Learned	**The lessons learned in the sector and sectoral characteristics**
Keywords	**Sharing knowledge with the field staff, updating guidelines, contracts on building/reviewing/updating the database system , provision of equipment and facilities from the maintenance point of view**

Applicable Cases	Lessons (Countermeasures)	
When providing assistance in relation to institutional, organizational, technical matters for maintenance management.	Timing of Application	Project formation stage Project planning stage Project implementation stage Post-project completion
	Countermeasures	Establish the appropriate maintenance system to carry out sustainable sewerage operation

Risks

[Risk arising from lack of institutional framework and documentation]

When the development of new institutional framework as well as related manuals does not advance in a timely manner or developed manuals are not used properly, there is a risk that newly established facilities do not function nor operate.

[Risk arising from lack of awareness to comply with water quality standards in the maintenance administrator]

[Supporting institutional framework and manual development for maintenance management]

It is important to check the development status of the sewerage-related systems and institutional framework as well as necessary manuals in the target country, and offer the appropriate assistance to develop such systems and manuals, reflecting the actual conditions and limits of the counterpart institutions, in reference to Japan's experience if necessary.

As it is important that the manual documentation created be continuously used by the counterpart organizations, through technical assistance projects, it is necessary to transfer knowledge on maintenance (maintenance methods for equipment, application of monitored water quality data to the maintenance management, etc.)

When maintenance administrators do not comply with the water quality standards, there is a risk that sewerage facilities may not be properly managed and operated. **[Risk of technology not transferred/inherited]** When system for sustainable maintenance is not established due to retirement or change of technical personnel, there is a risk that knowledge/experience/know-how will not be inherited properly. **[No utilization of the developed database]** There is a possibility that maintenance work cannot be implemented properly if the purpose and significance of the developed database, which collected the important data on the sewer facilities and pipes, are not well understood and not reflected to the maintenance management. **[Lack of spare parts in case of emergency]** If the organization, such as local government lacks financial resources without proper budget allocation for maintenance, there is a risk that maintenance works and spare parts procurement cannot be carried out, thus causing difficulties.		**[Rigid control of water quality standards by the maintenance administrator]** It is crucial for those responsible for sewage operations and maintenance to establish an organizational structure that is accountable for the quality of treated sewage water. Furthermore, areas of legal responsibility of environmental administration agencies that monitor effluent quality should be analyzed, and establishment of a system that guarantees management and monitoring of water quality standards by a third party should be encouraged. **[Outsourcing of maintenance]** In developing countries, it is very difficult to secure sufficient staff solely with public officers with practical experience of sewerage operation and management, due to retirement of experienced staff, and the shortage of technical staff in general. In case shortage of necessary staff, budget and equipment for maintenance is a critical issue, outsourcing could be an considered as alternative, and it would be necessary to deliberate on the scope of the consignment. However, because the government holds the oversight responsibility, supervision based on regulations—such as guidelines and audit checklists—is essential. It is important to confirm the development status of these regulations, and provide guidance on how to create and utilize these regulations, as necessary. **[Building the database and its continuous updates considering utilization for financial management]**

		Since the construction of the database offers a means to appropriate information management, such elements in the aspect of securing the appropriate financial resources and budget, it is important to secure proper understanding from counterparts by explaining significance and importance. Followings are the examples of assistance utilizing database. ① As sewer pipe facilities are buried underground, once they are placed, it becomes difficult to grasp the conditions and delay in detecting deterioration and damage can generate negative effects, such as groundwater contamination and road subsidence. Therefore, assistance should be provided to build database to record information of the installed sewer pipes (pipe type, pipe diameter, length, etc.), to develop a maintenance plan accordingly, and to support for application procedures for necessary budget allocation based on evidence. In addition, in accordance with maintenance plan, JICA should provide guidance to perform the programmatic maintenance work. ② Because information in the database needs to be updated regularly, the contract between local consultants that build the database and implementing agencies should not only be guaranteed during the initial investment of the system development, but should also be considered for the post-completion period to enable information review and secure the budget related to the update. This allows appropriate budget application and allocation. (Reference project: No. 5)

		[Securing spare parts for corresponding the emergency] If damage or degradation is observed in the mechanical and electrical equipment in sewage treatment facilities, it becomes necessary to renovate and replace the whole or part of facilities. When implementing this procedure, it is required to avoid prolonged working period. It is necessary to provide guidance to sewerage institutions to set aside a certain amount of budget necessary for repair. Especially when procuring equipment from abroad, a list of contacts of sewer business entities related to maintenance, as well as a list of where to obtain spare parts must be established so that sewer operation will not suffer delays. (Reference project: No. 4)
	Expected Effects	With organization institutional framework in place (institutional framework, manual, database, emergency response), sewerage facilities are properly operated and maintained.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Thailand	Sewage Treatment Facilities Project	Sewerage fee, payment obligations, operation and maintenance
2	People's Republic of China	Nanning Environmental Improvement Project	Sewerage user fees, securing of fee structure, operation and maintenance
3	People's Republic of China	Changsha Diversion Works and Water Quality Environmental Project	Operation and maintenance system, securing of budget, development of water rate system, ensuring implementation of tariff collection
4	Malaysia	Sewage Treatment Facilities Project	Contacts and organization

			of lists of spare part deficiencies, equipment procurement, experience of executing institutions
5	Thailand	Training Center for Sewage Works	Data maintenance, contracts including data updates, ensuring budget and systems

Knowledge Lesson Sheet		
Sewage Management 8	**Operation and Management of Sewerage Projects**	**Introduction of Proper Sewage Treatment Technology**

Lessons Learned	
Type of Lessons Learned	**Lessons learned in the sector and sectoral characteristics**
Keywords	**Proposing of sewerage systems that commensurate with the skills of counterparts, application of techniques with easy maintenance and management, promoting understanding of step-by-step development, introduction of systems suitable for local social conditions, economic and technical considerations, lack of sewage inflow due to small water supply, prediction of future water quality, calculation of pollution load at each generation source**

Applicable Cases	Lessons (Countermeasures)	
When planning sewerage facilities or deliberating on the selection and review of treatment technologies	Timing of Application	Project formation stage Project planning stage Project implementation stage
	Countermeasures	Upon consideration of the introduction of treatment technology, the experiences of the target countries should be considered, and technological methods that reflect the actual skills should be applied.
Risks		**[Introduction of technologies from the perspective of sustainable sewage management]** ① When selecting the sewage treatment system, on the premise of that the objective is to achieve target standard of treated water quality, comprehensive deliberation on the reasonable treatment cost, required technical level for maintenance, and availability of equipment to be procured is necessary while the conditions of target regions will be considered . ② During the initial development stage, the development of sewer networks is not sufficiently advanced; the volume of inflow
[The risk of selecting sewage treatment technologies that lack management aspects] Because of economically burdensome maintenance costs by adopting advanced treatment systems and the construction of large-scale facilities from the initial development stage, fees that can be collected from residents will not be sufficient to cover the necessary maintenance costs—thus creating a		

risk that maintenance costs cannot be fully covered. **[The risk of applying technologies that have not been introduced in target countries]** When introducing technologies that have not been applied in target regions, there is a risk that training will require long time and that necessary equipment cannot be procured inside the country. **[Risks involved in cases where the technologies is selected by sewerage project entities without considering its viability and implications]** Despite the need to increase the sewerage system coverage rate with limited budgetary resources, the sewerage project entities may become interested in the latest technology that is expensive and unnecessarily. In these cases, there is a risk that proper maintenance will not be carried out due to the high maintenance cost and the difficulty in the procurement of equipment. . 【Risk arising from the prediction of sewage volume and sewage water quality and from the deviation of actual situation】 • Delay in water supply projects or deviation of actual water supply from planned water supply		water is much smaller than the plan; and recovery rates of fees are not sufficient. Considering these limitations, it is important to create plans that develop small treatment facilities at the early stage and step by step expand them in later stages. **[Introduction of technologies suitable for the skills and characteristics of target countries]** ① In Japan, activated sludge treatment and oxidation ditch process are generally used for wastewater treatment. Although in developing countries, there are cases that wastewater stabilization ponds and aerated lagoons are used, and for sewer systems, condominial sewerage and small-boar sewerage are applied. Therefore, with studying conventional systems that are already applied for the countries, then installing the treatment systems that meet the levels of counterpart countries, effective treatment plant operation will be attained with the minimum input for training. (Reference Project: No. 4) ② In built-up areas where the poor are concentrated, understanding for the introduction of technologies that reduce residents' burden can be obtained by consultations with these residents. By doing so, reduction of initial investments necessary by residents and the expansion of house connections can be achieved. (Reference Project: No. 6) **[Promoting understanding of appropriate technologies for counterparts]** If conducting discussions and explanations to counterparts about technologies to be introduced,

• Increase in the amount of groundwater contamination due to the deterioration of existing sewer pipes • Decrease in sewage service areas due to project budget shortfalls		on top of introducing the state-of-the-art technology, the importance of step-by-step development should be carefully explained. Considering the financial and technical level, as well as the past experiences of technological introductions of the target country and counterpart organizations, the introduction of treatment technologies that reflect the reality should be aimed, and guidance for continuous maintenance must be provided. (Reference Project: No. 1) **[Confirmation of the appropriate prediction and validity of water quality]** In predicting the sewage water quality in sewage treatment plant planning, source-based sewage studies, examinations on the changes in pollutant emissions associated with economic growth, as well as the validity of numerical data on water consumption must be carefully scrutinized. In some cases, the method of data calculation and monitoring techniques will be verified through interviews with counterpart institutions. In particular, when there is a large discrepancy between the planned and actual values, social and economic impacts (water-saving awareness of residents due to water meter installation, the volume of waste water of high concentration resulting from commercial and industrial activities fueled by economic growth and development)—not only technical and environmental factors—will be analyzed. (Reference Project: No. 4)
	Expected Effects	With the introduction of sewage systems suitable for the target site, sustainable operation and maintenance will become possible.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Vietnam	The Project for Capacity Development of Sewage management in Ho Chi Minh City Phase 2	Explanation of the importance of step-by-step development, introduction of latest technology, improvement of the penetrate rate
2	Republic of Korea	Sewage Treatment Plant Construction Project (Tancheon, Seoul	Groundwater flow, excess of designed flow volume, improvement of construction technology
3	People's Republic of China	Dalian Water Supply and Wastewater Treatment Project	Change of treatment method, cyclic aerobic method (A20 method), intermittent circulation extended aeration
4	Peru	Southern Lima Metropolitan Sewerage Improvement Project	Prediction of future water quality, reuse of treated water
5	Zimbabwe	The Project for Improvement of Sewerage Facilities in the Municipality of Chitungwiza	Selection of treatment method, maintenance ease, oxidation pond system
6	Brazil	Todos Os Santos Bay Environmental Sanitation Project	Condominium (Condominium) system, build-up area, poverty area, reduction of project cost

Knowledge Lesson Sheet		
Sewage Management 9	**Operation and Management of Sewerage Projects**	**Appropriate Management of Sewerage Development Projects**

Lessons Learned	
Type of Lessons Learned	**Lessons learned in the sector and sectoral characteristics**
Keywords	**Close communication, monitoring of counterpart organizations, follow-up, monitoring of licensing procedures, predictability of risk at the project planning stage**

Applicable Cases	Lessons (Countermeasures)	
When there are factors affecting the progress of projects (financial issues, the need for securing land and organizational change) When in case of yen-loan projects, the recipient government's ability to pay is determined to be insufficient for the development costs of both the sewerage treatment and sewer facilities	Timing of Application	Project formation stage Project planning stage Project implementation stage
	Countermeasures	Risk factors related to the progress and delay of projects will be analyzed, and appropriate project management will be conducted through advices to implementing counterpart institutions and follow-ups.
Risks		**[Land acquisition by close communication]** ① Efforts during the conceptual and planning stages of sewerage projects • Government institutions and project entities that have jurisdiction of sewerage projects should select multiple sewage treatment plant candidates at a relatively early stage of the project (project formation stage, planning stage). A forum will be set to provide descriptions of sewerage plans to landowners and representatives of residents of the candidate sites. This forum will enable government institutions and project entities to understand the needs and opinions of the residents, and will also avoid delays at various project stages. • During the project formation stage, implementing sewerage institutions will
[Risk in case land acquisition is not carried out properly] In cases where land acquisition takes time due to the lack of understanding of landowners and residents and the delay in administrative procedures, there is a risk of affecting the process of the entire project. **[In cases where the implementing agency is unfamiliar with sewerage developments]** If sewerage implementing agencies		

(government institutions and project entities) are not familiar with the administrative procedures and equipment procurement required for carrying out sewerage maintenance projects, delay in project progress or development will occur. **[Risk when the development of sewer facilities is significantly delayed]** Because the contract for sewer facilities (sewer pipe system) is separate from that of treatment plants, budget deficits may occur in the development of sewer facilities. If its development is delayed significantly when compared to the construction of treatment plants, there is a risk that the effects/benefits of both facilities will be reduced. **[Risk in case the development plan of the sewer facility is not coordinated among stakeholders]** In case the development plan for the sewer facility does not include the adjustment period with stakeholders, there is a risk of significant delay in the facility development.		explain the necessity and importance of sewerage projects to relevant organizations (such as the urban planning department) and will achieve greater understanding concerning land securement. JICA should extend offering advice and appropriate support to the implementing agencies, when needed. • Implementing agencies will create teaching materials so that citizens can understand the benefits of sewage systems (health improvement, reduction in maintenance responsibilities, odor reduction) and will disseminate them to residents. ② Efforts during project planning to implementation stages • Even in cases where land is secured, in order to ensure that administrative procedures and budget execution will be conducted, JICA will monitor the progress of counterpart institutions and implement follow-ups. **[Support for administrative procedures related to sewerage project development]** ① In cases where the sewerage implementing agencies have little experience in controlling and supervising sewage management, JICA can provide guidance and advice, for example, on the methods of equipment procurement and creation of administrative documents (work instructions, short list, contractual coverage, etc.) By providing detailed assistance, delays in project development can be avoided. ② Even in cases where partner countries have secured the entire construction costs through budget allocation, yen loans and other donor

		loans and have expressed commitments, in order to be certain, their financial conditions, procedures of budget enforcement, enforcement period and those in authority should be verified. **[Avoiding the risks of delays in the development of treatment plants and sewer facilities based on bulk contracts]** ① If the financing and payment capacity of the recipient countries' government institutions is determined to be sufficient, parts or all of the sewer facilities should be contracted under the same construction plan. ② If the construction of sewer facilities and treatment plants are under separate plans, in addition to splitting the construction of pipeline facilities to appropriate scale of the lot, the sequence of construction orders will be determined by taking into consideration the timing of completion and the start of both facilities. ③ For the construction plan of sewer facilities, in order to minimize the prevalence of situations where the unconnected sewer pipes are buried underground because construction is suspended due to budget deficits, construction should be started from the portions closest to the treatment plants. (Reference Project: No. 5) **[Importance of development plans of sewer facilities that take into consideration of the sewer pipe construction situation]** Compared to the construction of sewage treatment plants, the development of sewer facilities involves many stakeholders (such as landowners and residents), and coordination

		between these stakeholders takes time. Moreover, because differences in the construction environment in each district (traffic conditions, road width, etc.) for sewer pipe and drainage systems affect construction progress, sewer construction, in general, takes long for completion. Even if treatment plants are completed, the volume of sewage inflow may not increase due to the slow development of sewer pipes. Thus, it is necessary to elaborate and review the development plan that reflects the sewer pipe construction progress as well as the financial conditions.
	Expected Effects	• Project plans that foresee the potential risks will be established, and support that enables projects to progress smoothly will be provided to counterparts. • By matching the completion time of sewer and sewage treatment facilities, they can both express their inherent capabilities that have originally been planned.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Argentina	Project for Improvement of Hygienic Environment of the Reconquista River Basin	Economic crisis, debt payment, loan stop
2	Tunisia	Sewage System Development Project in Four Cities	Land acquisition, land ownership, understanding of social and cultural background, foreseeable risk
3	Indonesia	Project for Capacity Development of Wastewater Sector Through Reviewing the Wastewater Management Master Plan in DKI Jakarta	Wastewater management, sewer method, land acquisition, construction of sewage treatment plant
4	Philippines	Special Economic Zones Environment Management Project	Yen loan project, inexperienced implementing agencies,

			project delay, procurement methods
5	Brazil	Guanabara Bay Basin Sewerage System Construction Project	Shift in completion time, bidding procedures, budget shortfalls, sewage collection facility

Knowledge Lesson Sheet		
Sewage Management 10	**Evaluation Indicators**	**Indicator Setting and Evaluation Method to Understand the Effects of Sewerage Projects**

Lessons Learned	
Type of Lessons Learned	**Lessons learned in the sector and sectoral characteristics**
Keywords	**Indicator setting, baseline data, measuring point of water quality, setting of target value, scope of the effect of sewage treatment plants, monitoring**

Applicable Cases	Lessons (Countermeasures)	
In cases where setting of indicators to understand the effects, data collection and methods for greater understanding is not performed properly	Timing of Application	Project planning stage Project implementation stage
	Countermeasures	The indicators and methods to understand the project effects need to be appropriately set and evaluated. The results will be effectively utilized for following sewerage projects.
Risks		**[Use of Performance Indicators that can be adopted internationally]** In developing countries, there are cases where the collection of quantitative data for re-calculating the internal rate of return for economic analysis is difficult, or where the data is unreliable. Even in such cases, indicators for the effectiveness and operational effect of sewage facilities, as well as Performance Indicator can be actively utilized for the evaluation of the financial sustainability of sewerage projects. By doing so—and reflecting the degree of difficulty of obtaining data in developing countries—indicators that can be continuously monitored should be set and evaluated by the project entities from pre-evaluation to ex-post evaluation stages. Furthermore, during the ex-ante evaluation stage, the reference value of indicators (baseline data), target value of indicators and data
[Risk in cases the indicators and methods for understanding the effects are not appropriately set] If the indicators and methods for understanding the effects of sewage treatment plants are not set properly, there is a risk that the effects of the sewage treatment plant will be underestimated.		

		collection method (measurement method, measurement point, measurement time) should be clearly set, and the setting and collection method of these indicators must be agreed on in advance with recipient governments and sewerage project entities. **[Handling of impact indicators]** Regarding the understanding of project effects, setting of indicators, and the evaluation methods of the projects, the following cases have been observed in past project evaluations. ① To observe improvements in water quality, sewage inflow from outside the regional scope of the sewage treatment plant was identified as the cause. Consequently, the effects of the sewage treatment plant on the quality of river water were not observed clearly. ② There were different views on the interpretation of the purpose and effects of the projects, as well as on the monitoring methods of river water quality with the sewer project entities. As a result, survey items and research methods were not consistent between pre- and post-project implementation stages. Because appropriate comparisons could not be made, scientific and objective evaluations were not possible. When setting indicators related to the water quality of rivers, marine areas and lakes as impact indicators of sewage treatment plants, it should be noted that there are other factors involved in water pollution other than sewage discharge, such as population growth, change in the flow volume, construction of industrial facilities in neighboring areas, change in revenue

		water and implementation of relevant environmental policies. In addition, although certain contribution to the preservation of water quality of rivers and bay areas can be expected depending on the contribution rate of volume of water pollution, it does not necessarily promise improvements in water quality in target areas. Conducting evaluations based on this assumption, the way to interpret these impact indicators should be discussed with and agreed on with recipient governments beforehand.
	Expected Effects	The effects of sewage treatment plant projects will be properly evaluated.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	Thailand	Project for Improvement of Sewage Treatment Plants Management in Thailand	Indicator setting, baseline data
2	India	Yamuna Action Plan Project	Facility planning, water conservation standards for rivers, discharge criteria
3	People's Republic of China	Xi'an Environmental Improvement Project	Measuring point of water quality, target value setting, scope of the effect of sewage treatment plants
4	People's Republic of China	Tianjin Wastewater Treatment Project	Effect indicators, data on river water quality, monitoring

Knowledge Lesson Sheet		
Sewage Management 11	**Two-Step Loan**	**Two-Step Loan in Sewerage Projects**

Lessons Learned	
Type of Lessons Learned	**The lessons learned in the sector and sectoral characteristics**
Keywords	**Two-step loan, operational efficiency improvement, service efficiency improvement, fee optimization**

Applicable Cases	Lessons (Countermeasures)	
When providing support through two-step loan mechanism to project entities that provide sewer services or to private entities that introduce sewage treatment facilities in small- and medium-sized cities	Timing of Application	Project formation stage
	Countermeasures	The following points should be considered when carrying out the two-step loan.
Risks		Two-step loans can be utilized in developing countries to spread deployment of sewerage services by packaging the lending of development financial institutions into smaller-sized loans. Two approaches can be considered for the assistance of sewerage development that utilizes two-step loans.
[Issues concerning lending decisions made by prime borrowing institutions and their lack of understanding of the project effects]		One involves private entities and local governments of small- and medium-sized cities developing sewerage facilities.
When prime borrowing institutions—due to the local system or their ability—are unable to monitor the quality of individual projects, there is a risk that accurate lending decisions and understanding of the project effects may not be achieved.		Another involves providing small loans to the private sector for the construction costs of facilities in case small private factories decide to connect factory effluent to the public sewer system and then eliminate them.
[Lack of capacity of the local borrowers of individual projects (municipalities, etc.)]		Though both cases are difficult to implement as independent projects, it is possible to promote the spread of sewerage facilities by utilizing the two-step loan.
If the local borrowers lack the ability of facility planning and proposing financing plans, there is a risk that		On the other hand, the mechanism of the two-step loan is a sublet (“on lending”); the soundness of credit approval, monitoring and evaluation of the effects depend on the credit monitoring capability and technical capacity of

appropriate development plans will not be proposed. Moreover, these local borrowers may not have the technical capabilities and experience to perform efficient facility management after facility development.		the development financial institutions and urban development corporation. Thus, the following aspects should be taken into consideration. ① Authority and capacity of the prime borrowing institutions In case the development financial institutions or Urban Development Corporation are the prime borrowing institutions of yen-loans, local governments and private entities—which are the local borrowers—will develop facility development plans, and the prime borrowing institutions will review their contents. If, however, the prime borrowing institutions lack technical capabilities to examine the contents and do not have the ability to gather information on the target sites, it will be difficult to discern the defects in planning, such as excessive planning in supply and demand. Furthermore, delays in management improvement may even occur depending on the function and the level of authority of the prime borrowing institutions: even if price hikes in the sewer fees are recommended from the results of the financing examination, the prime borrowing institutions may not have sufficient enforcement power to implement actions based on these recommendations. Moreover, in the examination stage of loan application of smaller- sized loans for the construction costs of elimination facilities in the private sector, technical capabilities need to be reviewed. ② Local borrowers' ability There are issues concerning the lack of ability of local governments—which are the local borrowers—to plan and manage

		sewerage facilities. ③ Ability of the domestic consulting industry to provide advice and support to the local borrowers for drafting feasibility studies and for the operation and maintenance management In cases where the domestic consulting industry has not matured sufficiently to provide support for planning and operation of sewerage facilities to local governments (who are also the local borrowers), there is a possibility that proper planning of appropriate costs would not be conducted with the scale and speed expected from the two-step loans. In consideration of these issues, the following approaches should be considered. (1) Verify the authority and capacity of the prime borrowing institution, and consider extending consulting services that are necessary for the credit application review, project management during facility construction and monitoring project effects. The provision of Technical Assistance related to Japanese ODA Loan should also be considered. (2) Typically, in two-step loans, if local borrowers of individual projects (local governments, etc.) lack ability in planning facilities (F/S) and proposal drafting of financing plans, these local borrowers are expected to hire consultants to receive technical assistance for drafting the F/S. However, if the sewerage services sector is in its early stage of development (There are cases where sewerage facility development is seen as a low priority from the perspective of policymakers in local governments, and the level of need, thus, is also low. As a result, the

		domestic consulting industry has not yet matured.), there is a possibility that the local consulting industry is not mature enough to extend services to local governments in drafting the F/S. In such case, two-step loan financing may not be efficiently utilized with the scale and speed expected from the policy structure; thus, it is necessary to carefully consider the suitability of the application of two-step loans. **[Appropriate understanding the business effects in two-step loans]** Prime borrowing institutions perform credit application reviews and monitoring of the facility construction, but there are cases where these prime borrowing institutions fail to or are not assigned to conduct monitoring of the post-construction project effects. Therefore, it is important to define the roles of prime borrowing institutions in technical assistance and effects verification in order to carry out proper monitoring and evaluation. Besides sewerage projects, in the ex-post evaluation of the "Local Government Units Support Credit Program" implemented in the Philippines, it is recommended that, in order to systematically monitor and evaluate the substantial effects and sustainability of the projects, it is necessary to impose loan conditions such as requiring the submission of monitoring records for monitoring and to set and record evaluation indicators before the start of the project.
	Expected Effects	By considering corresponding measures, accurate loan decisions as well as the management of subsequent business effects can be made possible, and sewerage maintenance through the use of two-step loan will be

		promoted.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords
1	India	Urban Water Supply and Sanitation Improvement Program	Two-step loan, legal system, fee optimization, consulting services
2	Turkey	Municipal Sewerage and Wastewater Treatment Improvement Project	Two-step loan, sub-project
3	Philippines	Environmental Development Project	Two-step loan, private enterprises, capital investment
4	Philippines	Local Government Units Support Credit Program	Two-step loan, monitoring

Knowledge Lesson Sheet		
Sewage Management 12	**Private Sector Participation**	**Efficient Sewerage Development Via Participation of Private Entities**

Lessons Learned	
Type of Lessons Learned	**Lessons learned in the sector and sectoral characteristics**
Keywords	**Private consignment of sewerage projects, including costs of sewer and treatment facilities with the land and house sale prices of private real estate agents, cuts in government spending**

Applicable Cases	Lessons (Countermeasures)	
When private entities are considering of participating in sewerage projects	Timing of Application	Project planning stage Project implementation stage
	Countermeasures	With the participation of private entities in sewerage projects, improvements in efficiency in terms of facility construction and operation will be aimed. Moreover, the reduction of fiscal spending will be promoted via setting of housing costs, which include facility costs.
Risks		Private entities that participate in sewerage projects through private sector consignments are expected to device a mechanism of project operations and contracts and to reduce fiscal spending through excellent competitiveness, compared to government-led projects.
[Risk of private entities not being able to obtain assurance for cost burden from implementing agencies] In cases where private entities cannot attain assurance for cost burden from sewerage implementing agencies (government and sewerage project entities), they will not acquire benefits in terms of profitability, and there is a possibility that their entry into sewerage projects will not be realized.		**[Considerations when performing projects through PPP]** While sewerage projects require enormous capital and operation costs, sufficiently securing these costs proves to be a hurdle. In order for private entities to participate in sewerage projects, it is necessary to clarify the contents of the project and ideas of the implementation institution, especially 1) the contract form and 2) the cost burden in other implementing agencies.

[Risk arising from including the cost of sewerage facilities into home sale price] When the cost of sewage treatment facilities included in houses and land increases in terms of its proportion in the house and residential sale price, there is a possibility that home buyers and housing rental companies may select houses and land equipped with, for example, individual treatment facilities and underground filtration, which are relatively inexpensive. If the costs of sewerage facilities are included in the home sales price, it is important to take into consideration the costs of individual treatment facilities and underground filtration, and as well as the price competitiveness. **[Risk in case private entities implement the entire sewerage project]** If private entities implement projects for sewerage development, there is a risk that, due to the pursuit of profit and efficiency, the implementation process may face some difficulties.		① Contract form As for the contract form between counterpart implementing agencies and private entities, there are two types, as outlined below. 1) A contract for the entire project from construction to maintenance stages (such as concessions) or 2) a contract for only the operation and maintenance (management contract). For construction projects in the aforementioned 1) contract form, there are cases where private entities target and develop a) only treatment facilities or b) treatment facilities and sewer pipe facilities; yet, it is very difficult to recover the construction costs from sewerage fees in both cases of the single sewerage project. Thus, by limiting the scope of the project to only the maintenance in the latter contract form 2), the participation of private entities can be fostered in a relatively easy manner. However, as described below in ②, until the foundation of stable fee collection is established, cost burden by implementing agencies will remain essential. ② Securing cost burden by implementing agencies In cases where private entities operate all sewerage services, to ensure stable cost recovery, it is necessary that the development of house connection in target regions is nearly completed. Or, not only limited to sewerage usage fees, a tax-based collection system (such as environmental tax) should already be developed and put in place. If private sector participation is implemented under circumstances where the stability of these cost recovery mechanisms is not ensured, agreements in advance to guarantee collaterals from counterpart implementing agencies will

		be essential for project cost burden. For participation of private entities, it is necessary that the regulatory infrastructure—such as procedures, systems and regulations that are necessary for the planning and implementation of projects--are in place. Moreover, it is necessary to collect information and to consider possible measures beforehand about the transparency of the selection process of private entities and the decision making time required by the implementing agencies. **[Reduction of government spending through efficiency in facility construction and operation by private entities]** ① The entirety or part of the development of the sewer pipe, treatment plants and house connection will be implemented as one contract under private contracts. The simplification and shortening of the procedures will be promoted. ② By utilizing the private entities' know-hows in the operation of sewerage projects (such as performance management of procurement and facilities), a mechanism for the reduction in maintenance costs and appropriate sewerage tolling system should be established. **[Implementation under the responsibility of sewerage service institutions]** Among all sewerage facilities, sewer facilities, in particular, are buried underground; therefore, monitoring the condition post-completion becomes difficult. Thus, if water infiltration by rain water and ground water occur, enormous repair costs will incur, and excessive water flow into treatment plants will occur. Therefore, even

		in the case of private entities constructing the facilities, the construction will be under the responsibility of sewerage project institutions. Moreover, as construction and renovation costs will be large depending on the spec of the introduced facilities, it is necessary to make consultations in advance for cost burden sharing. **[Reference Case: Setting of home sales price including the cost of sewerage facilities]** There is a World Bank project case where the cost of sewer and treatment facilities are included in the residential land and housing sales price that are traded between real estate agents and buyers. However, if the sales price increases due to the inclusion of the development cost of sewerage facilities in the residential and land sales price, there is a possibility that the residents may give up the purchase. If the residents give up the purchase and select on site facilities with poor treatment capacity, groundwater contamination due to infiltration may occur. Thus, in order to properly configure the proportion of burden of sewage facility costs, careful preliminary survey should be conducted.
	Expected Effects	If private realtors include costs of sewerage facilities (pipe, treatment facilities) into the sales price, private entities performing private consignments will be able to quickly recover part of the investment costs of sewerage facilities. Moreover, by encouraging private entities to construct and manage the overall sewer system, contributions can be made to the reduction of financial expenditure of national and local governments.

Reference list of projects from which lessons were learned

No.	Country	Project Name / Source	Keywords

1	Vietnam	Performance of the Wastewater Sector in Urban Areas: A Review and Recommendation for Improvement (World Bank), February 2013	Entry into sewerage projects through the private consignment format, setting of home sales price including the cost of sewerage facilities