Republic of Panama
UCP/MINSA

Panama Metropolitan Area Wastewater Management Improvement Project

【Technical Cooperation Project】

(Phase 2 (Project Implementation Phase))

Project Completion Report

November 2018

Japan International Cooperation Agency

(JICA)

Nihon Suido Consultants Co., Ltd.

Republic of Panama
Panama Metropolitan Area Wastewater Management Improvement Project
Report

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[ATTACHMENTS]

Abbreviation

AAUD	Autoridad de Aseo Urbano y Domiciliario
ACP	Autoridad del Canal de Panamá
ANAM	Autoridad Nacional del Ambiente
ARAP	Autoridad de los Recursos Acuáticos de Panamá
ASEP	Autoridad Nacional de los Servicios Públicos
BOD	Biochemical Oxygen Demand
CA	Capacity Assessment
CAF	Corporación Andina de Fomento
CD	Capacity Development
COD	Chemical Oxygen Demand
CONADES	Consejo National de Desarrollo Sostinible
C/P	Counterpart
DAC	Development Assistance Committee
DBO	Design Build Operation
DIPROCA	Direcciòn de Protecciòn de Calidad Ambiental
DISAPAS	Dirección del Subsector de Agua Potable y Alcantarillado Sanitario
EPSP	Empresa Pública de Saneamiento de Panamá
GOJ	Government of Japan
GOP	Government of Panama
IDAAN	Instituto de Acueductos y Alcantarillados Nacionales
IDB	Inter-American Development Bank
JBIC	Japan Bank for International Cooperation
JCC	Joint Coordination Committee
JDWWTP	Juan Diaz Waste Water Treatment Plant
JICA	Japan International Cooperation Agency
JOCV	Japan Overseas Cooperation Volunteers
MEDUCA	Ministerio de Educación
MIAMBIENTE	Ministerio de Ambiente
MINSA	Ministerio de Salud
MoU	Memorandum of Understanding
MP	Master Plan
NGO	Non-Governmental Organization
OJT	On the Job Training
O&M	Operation and Maintenance
PDCA	Plan-Do-Check-Action
PDM	Project Design Matrix
PO	Plan of Operation
PS	Pumping Station
SANBAHIA	Saneamiento de la Ciudad y la Bahia de Panamá

SAPROF	Special Assistance for Project Formation
SIG	Sistema Integrado de Gestión
SOAP	Servicios Operativos de Alcantarillado de Panama
U.S.EPA	United States Environmental Protection Agency
UCP	Unidad Coordinadora del Proyecto Saneamiento de la Ciudad y la Bahía de Panama （2017～：Unidad Coordinadora del Programa Saneamiento de Panama）
WB	World Bank
WWTP	Wastewater Treatment Plant

1 Outline of the Project

1.1 Outline of the Project

The outline of the project is as shown below.

Project name: Panama Metropolitan Area Wastewater Management Improvement Project [Technical Cooperation through JICA's Loan Account]

Period: Phase 1 (Detailed Planning Survey phase) June 2015 to November 2015
Phase 2 (Project Implementation phase) February 2016 to November 2018

Target country and area: Panama Metropolitan Area and Panama West Province (See Fig. 1.1.1)

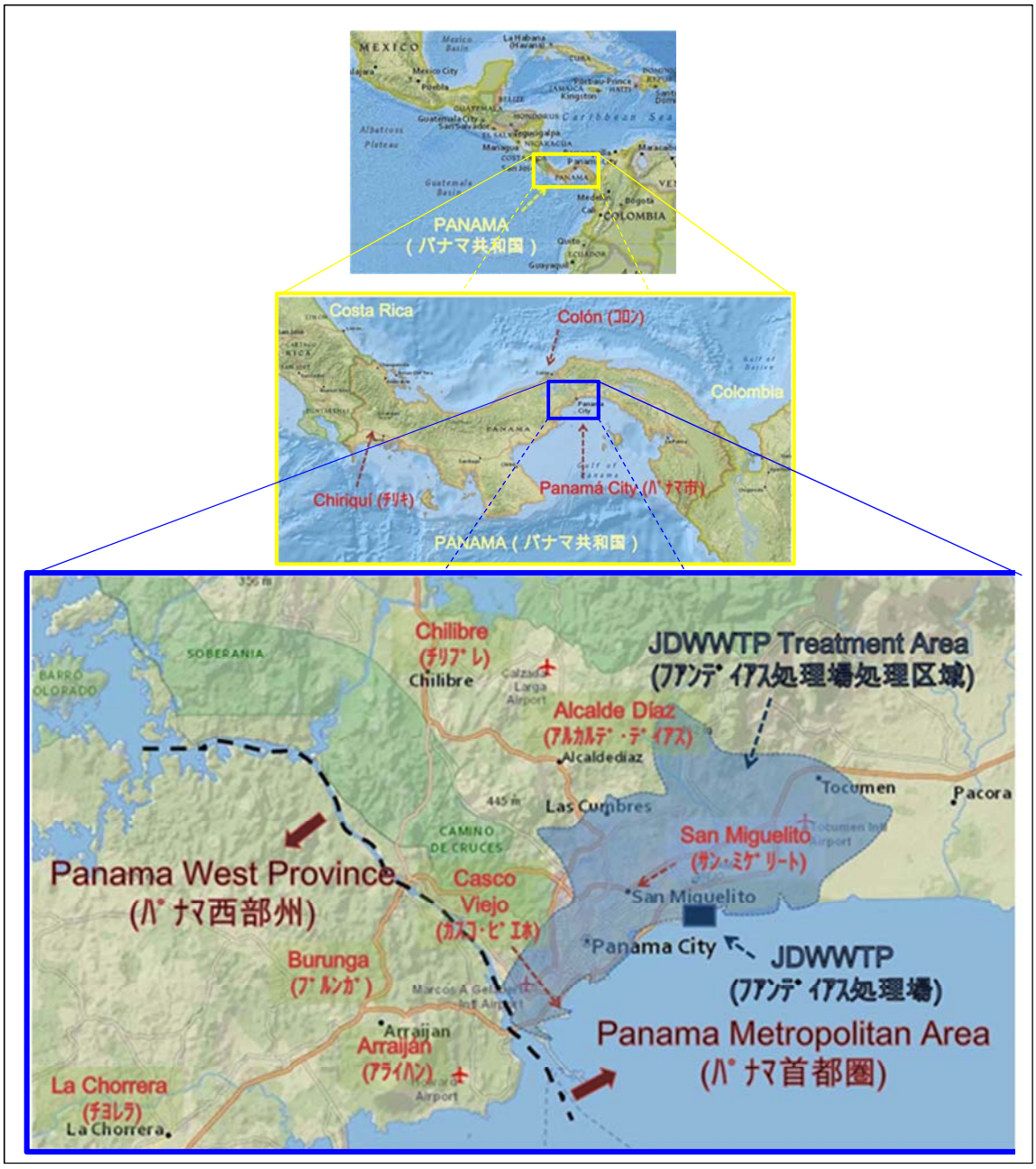


Fig. 1.1.1 Map showing location of target area

1.2 Background

Although approximately 36% of the population of the Republic of Panama (approx. 1.3 million out of a total population of 3.61 million, as of 2015) is concentrated in the Panama metropolitan area, sewer pipes were only laid from 1903 onwards as a measure to combat yellow fever and malaria during construction of the Panama Canal, and untreated sewage was discharged into the city's rivers and into Panama Bay. As a result, the city had an extremely unpleasant odor and improvement of a sewerage system and wastewater treatment facilities in the Panama metropolitan area became an urgent issue from the perspective of a hygienic environment. Under these circumstances, in June 2007 JICA granted an ODA loan for the Panama City and Panama Bay Sanitation Project (approved amount: 19,372 million yen; hereinafter, ODA loan project) and supported full-scale construction of Panama's first wastewater treatment plant. Under the ODA loan project, a wastewater treatment plant with a maximal treatment capacity of approx. 238,000 m^3/day by secondary treatment (standard activated sludge system) and the main sanitary sewers were constructed. The wastewater treatment plant was completed in May 2013 and operated by the contractor under a Design-Build-Operate (DBO) contract (4 years) under the supervision of the coordinating unit (UCP) in the Ministry of Health (MINSA), the implementing agency.

In the plans when the ODA loan project was initiated, it was intended that MINSA would set up a wastewater team in the Institute for National Water Supply and Sewerage System (IDAAN) during the project implementation period, and operation of the facilities would be transferred from MINSA to IDAAN by the contractor after the end of the maintenance contract. However, because of major organizational and financial issues in the field of water supply, reform of IDAAN was delayed and it became difficult to move ahead with the transfer. It was planned to transfer wastewater projects to IDAAN in the future, but because IDAAN had no system for managing wastewater projects, MINSA had decided that, for the time being, UCP in MINSA would implement wastewater projects in the Panama metropolitan area, including O&M of the sewerage facilities constructed in the ODA loan project. However, when UCP was first established, it was not expected that UCP would be the operator of wastewater projects in the Panama metropolitan area, so it had no expertise in O&M or in monitoring of sewerage facilities or asset management. For this reason, improvement of UCP's overall capacity in O&M of wastewater systems had become an urgent issue.

In light of this situation, in March 2014 a request was filed by the Panama government for a technical cooperation project using Japanese technologies to (1) develop an industrial wastewater monitoring system through a pilot project related to industrial wastewater or hospital wastewater in the Panama metropolitan area, and (2) to develop an effective O&M and asset management system for MINSA to draft an investment plan for wastewater management projects and secure an O&M budget.

The technical cooperation project aiming at sustainable wastewater management in the Panama metropolitan area, will strengthen and improve UCP's capacity in wastewater management and its capacity to implement measures against wastewater sources, such as industrial wastewater, in the metropolitan area.

Upon receiving the request, JICA carried out a basic planning survey in November 2014. In

January 2015 JICA agreed with MINSA and UCP to implement a technical cooperation project related to ODA loan and signed a Memorandum of Understanding (MoU). The detailed planning survey phase was then implemented from June to November 2015 and the Minutes of Discussions (M/D) changing the MoU were signed.

1.3 Overall Goal of the Project and Project Purpose

The overall goal of the project and the project purpose are shown below.

Table 1.3.1 Overall Goal of the Project and Project Purpose

Overall goal	Mitigation measures for Panama Bay's pollution are conducted sustainably in Panama Metropolitan Area.
Project purpose	UCP's capacity of administration and O&M management for the facilities constructed by "the Panama City and Panama Bay Sanitation Project" is improved.

1.4 Implementing Agency and Related Agencies

The counterpart organization and implementing agency of this project is UCP. UCP is an organization under the jurisdiction of MINSA and the project is implemented with the cooperation of MINSA as a whole. Other related agencies are the Institute for National Water Supply and Sewerage System (IDAAN) and the Ministry of Environment (MiAMBIENTE). The related agencies are shown in Fig. 1.4.1.

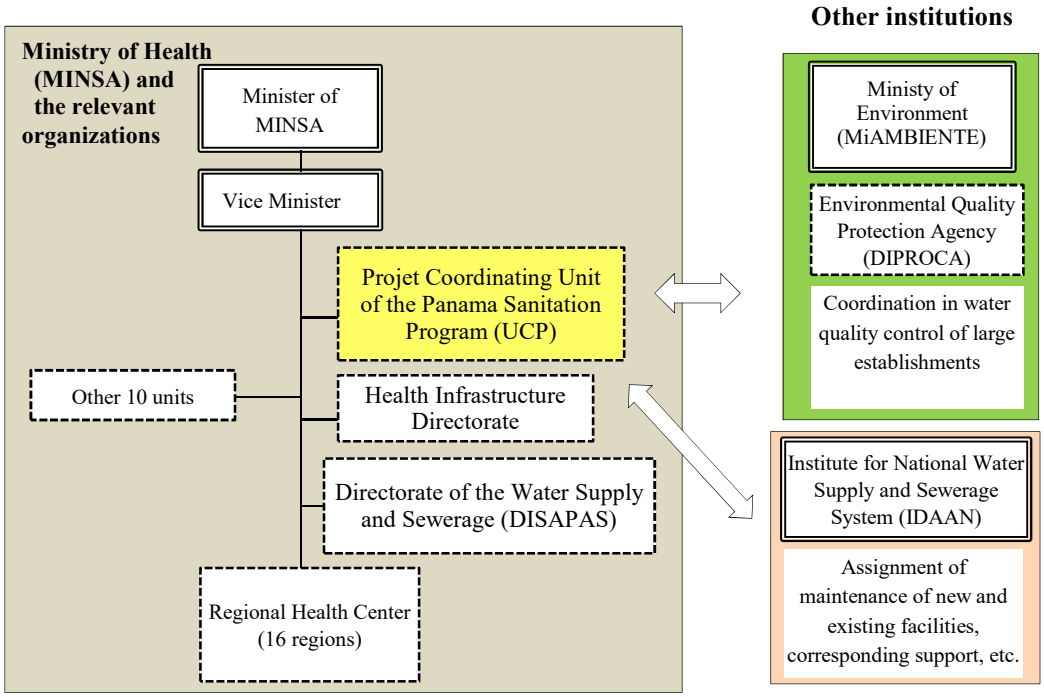


Fig. 1.4.1 MINSA and UCP and their relationship with related agencies

UCP, the project coordinating unit, was established in 2001 as the implementing agency of the Panama City and Panama Bay Sanitation Project. As well as being entrusted by IDAAN with O&M in this project, UCP currently supports IDAAN in O&M of existing facilities. In implementing these duties, IDAAN can be regarded as a related agency. UCP also collaborated with DIPROCA in MIAMBIENTE on water quality regulations for large-scale wastewater sources. In addition, it collaborated with MINSA's Health Infrastructure Bureau on establishment of treatment facilities for hospitals. In March 2016, UCP changed its name to Panama Sanitation Program Coordination Unit and began to work toward systematic sewerage development throughout Panama, including West Province.

2 Results of the Project

2.1 Project Inputs

2.1.1 Inputs on the Japanese Side

An overview of the inputs on the Japanese side is shown below.

1) Dispatch of experts

Dispatch period: Total 51.4 MM (Project Implementation phase)

Experts: 5 persons in total

Chief advisor / Institutional management

Deputy Chief Advisor / Environmental education

Wastewater quality control

O&M of sewerage facilities / financial management / Asset Management

Wastewater treatment technologies

2) Training

An outline of the training is shown below (For details, see 2.3.5).

Table 2.1.1 Outline of training

Item	Description	Date
Training in Japan	First training in Japan	6 to16 June 2016
	Second training in Japan	24 July to 3 August 2017
Training in third country	Visit to SANEPAR (Water and Sanitation Company of Parana State, Brazil)	21 to 25 November 2016
Training in Panama	First seminar	9 December 2016
	Second seminar	22 November 2017
	Third seminar	17 September 2018

3) Facilities, equipment, etc.

A Johkasou, decentralized domestic wastewater treatment system developed in Japan, (capacity: 150 m^3/day) and its installation work were provided for Nicolas A Solano Hospital. The equipment shown in Table 2.1.2 was used in OJT and transferred to the counterparts on completion of the project.

Table 2.1.2 Portable equipment

No	Equipment	Amount.	Period
1	Portable multi-parameter water quality meter	1	Phase 1
2	Sample collector	2	
3	Simple water quality test kit	6 sets each	
4	Portable spectrophotometer	1	Phase 2
5	COD reactor	1	
6	Reagents for above	1 set	
7	Portable pH meter	2	
8	Portable EC meter	3	
9	Portable DO meter	2	
10	Ultra-sonic flow meter (for non full water pipe/ditch)	1	
11	Ultra-sonic flow meter (for full water pipe)	1	
12	Power Sprayer	2	
13	TV camera for summary inspection	2	
14	PC and display	1	
15	HDD	1	
16	UPS (Uninterruptable Power Supply)	1	

2.1.2 Inputs on the Panamanian Side

An overview of the inputs on the Panamanian side is shown below.

1) Counterpart staff (See Attachment 1)

Project Director (Minister of Health)
Project Manager (UCP General Coordinator)
Project Coordinator (UCP Sub-General Coordinator)
Total 25 counterpart staff (UCP staff)

2) Facilities, equipment, etc.

Project office (in UCP) / communication environment / multi-function printer
Simple laboratory / storage space for equipment

3) Project expenses

Office expenses (utilities, communications, multi-function printer (including paper) etc)

2.2 Plan of Operation (PO)

The Plan of Operation (PO) is shown in Table 2.2.1.

Table 2.2.1 Plan of Operation (PO)

Activities / Sub-Activities	Year	1st Year				2nd Year				3rd Year			
		I	II	III	IV	I	II	III	IV	I	II	III	IV
Output 1: Roles of organizations related to sanitation of Panama Bay are determined and a procedure to improve the institutional structure of implementation is improved.													
1-1 Study current laws and policies about aquatic environment, wastewater discharge, wastewater treatment and industrial wastewater in Panama	Plan												
	Actual												
1-2 Review the current master plan and ongoing projects regarding Panama Bay purification	Plan												
	Actual												
1-3 Study the current status, and future plans of the sewerage facilities (including pumping stations) and industrial wastewater treatment plants (if any) in Panama Metropolitan Area	Plan												
	Actual												
1-4 Review the current roles and duties of UCP and IDAAN regarding wastewater management	Plan												
	Actual												
1-5 Identify necessary duties for wastewater management and support clarifying the division of the roles of present and future responsible organizations	Plan												
	Actual												
1-6 Review the duties, institutional setups and personnel of UCP	Plan												
	Actual												
1.7 Create human resource development plan (draft) of UCP	Plan												
	Actual												
Output 2: Periodical water quality monitoring for wastewater pollution sources discharged into Juan Diaz Wastewater Treatment Plant (JDWWTP) is started.													
2-1 Survey the situation of large-scale sources, whose effluent is dischrged into JDWWTP	Plan												
	Actual												
2-2 Train UCP/MINSA staff members how to inspect and control effluent quality from large-scale wastewater sources	Plan												
	Actual												
2-3 Create data base on large-scale wastewater sources	Plan												
	Actual												
2-4 Create a guideline for water quality monitoring of large-scale wastewater sources	Plan												
	Actual												
2-5 Create the water quality monitoring plan for large-scale wastewater sources.	Plan												
	Actual												
2-6 Plan and Implement the pilot project of wastewater treatment for large-scale wastewater sources. (e.g. installation of an advanced treatment unit (JOHKASO) for a hospital)	Plan												
	Actual												
2-7 Study mitigation measures on large-scale wastewater pollutant sources (industrial, commercial and institutional sources flow into the JDWWTP), based on the pilot activity	Plan												
	Actual												
2-8 Implement water quality monitoring for large-scale wastewater sources	Plan												
	Actual												
Output 3: UCP's ability to manage the sewerage facilities (JDWWTP and the rest, i.e. sewerage networks, collectors, pumping stations and interceptors) is improved.													
3-1 Identify necessary items for O&M and asset management of sewerage facilities	Plan												
	Actual												
3-2 Draft a TOR proposal for the next O&M contract for sewerage facilities to support UCP's supervision.	Plan												
	Actual												
3-3 Draft a mid- and long-term renovation plan (draft), financial plan (draft) and O&M plan (draft) for sewerage facilities (JDWWTP and the rest) based on the data of sewerage facility management (e.g. plans for O&M cost, content of O&M contract, asset management, renovation planning, risk management, contingency measure, etc.)	Plan												
	Actual												
3-4 Implement OJT on the survey and diagnosis method for existing sewers	Plan												
	Actual												
3-5 Create O&M plan (draft) of existing sewer pipe network	Plan												
	Actual												
3-6 Study the recycle system of treated wastewater and sludge	Plan												
	Actual												
Output 4: UCP's capacity of education and beneficiaries awareness of water saving and proper use of sewerage facilities is improved.													
4-1 Conduct public awareness surveys about water saving and sewerage management	Plan												
	Actual												
4-2 Diagnose UCP's capacity as a baseline and define actions for strengthening UCP	Plan												
	Actual												
4-3 Conduct pilot activities to promote public awreness about water saving and sewerage manegement	Plan												
	Actual												
4-4 Create and implement PR activities plan	Plan												
	Actual												

Monitoring Plan	Year	1st Year				2nd Year				3rd Year			
		I	II	III	IV	I	II	III	IV	I	II	III	IV
Monitoring													
Joint Coordination Committee	Plan		●		●		●		●		●		●
	Actual		●			●				●		●	
Set-up the Detailed Plan of Operation	Plan	◎											
	Actual	◎											
Submission of Monitoring Sheet	Plan		○		○		○		○		○		
	Actual		○		○	○		○		○		○	
Monitoring Mission from Japan	Plan										○		
	Actual											○	
Joint Monitoring	Plan												
	Actual												
Post Monitoring	Plan												
	Actual												
Reports/Documents													
Detailed Planning Survey Report/Project Completion Report	Plan												
	Actual												△ ▲
Public Relations													
Establishment of the plan of public relations	Plan												
	Actual												
Implementation of the plan of public relations	Plan												
	Actual												

Plan
Actual

2.3 Details of Activities for Each Output

2.3.1 Output 1

1) Activity 1-1 Study current laws and policies about aquatic environment, wastewater discharge, wastewater treatment and industrial wastewater in Panama [Completed in the detailed planning survey]

2) Activity 1-2 Review the current master plan and ongoing projects regarding Panama Bay Purification [Completed in the detailed planning survey]

3) Activity 1-3 Study the current status, and future plans of the sewerage facilities (including pumping stations) and industrial wastewater treatment plants (if any) in Panama Metropolitan Area [Completed in the detailed planning survey]

4) Activity 1-4 Review the current roles and duties of UCP and IDAAN regarding wastewater management [Completed in the detailed planning survey]

5) Activity 1-5 Identify necessary duties for wastewater management and support clarifying the division of the roles of present and future responsible organizations [First year]

(1) Details and outputs of activities

a) Considerations based on MINSA/IDAAN Agreement

As the organizational structure of IDAAN, which is essentially in charge of wastewater management, was not sufficiently strengthened at the time the project was formed, UCP, the unit organized for the construction of the sewerage facilities, carried out O&M of the facilities after commencement of operation. One of the goals of the project, therefore, was to clarify the organization in charge of wastewater management in the Panama metropolitan area.

The MINSA/IDAAN Agreement (hereinafter, Agreement. Annex 6-1) was signed in August 2015. The Agreement clarified the division of roles of UCP and IDAAN based on the current legal system. The period of the Agreement is until IDAAN is capable of managing wastewater appropriately, effectively and sustainably. To all intents and purposes, with the exception of duties that require legal authority such as industrial wastewater regulations and household connection to the sewerage facilities, UCP is able to carry out wastewater management. A presidential decree (Annex 6-2) was issued in March 2016 clarifying the position of the Agreement and UCP.

The division of roles of the responsible agencies was clarified in the first year, based on the Agreement. UCP's duties, the remainder of IDAAN's duties, and duties requiring coordination and review are summarized in Table 2.3.1.

Table 2.3.1 Division of roles of the responsible agencies

Classification	Description
Duties performed by UCP	a) Planning: Management of progress of operations, implementation of ISO
	b) PR and hearings: PR to public and relevant parties
	c) General and financial affairs: General affairs, personnel affairs & human resources development, procurement & delivery, budgeting, accounting, cash management
	d) Legal affairs and contracts: Contract management
	e) Social environment: Environmental management, public awareness, risk management, handling of complaints
	f) Engineering: Ledger management by GIS, Model calculation, projects formation (approval of plans, budget formulation), support for O&M
	g) O&M: Facility management (pipelines, PSs, treatment plants), contract management, connection applications (including development activities, etc.), industrial wastewater monitoring (jointly implemented with IDAAN)
	h) Construction: Project management, project inspection
Remainder of IDAAN's wastewater management duties	a) Commercial division duties: Customer management (billing and fee collection), asset management, industrial wastewater monitoring (jointly implemented with UCP)
Duties requiring coordination or review	Connection support – CONADES project and role of IDAAN Industrial wastewater regulations – Correspondence to progress of JICA project Ledger management – Correspondence to progress of WB project

b) Considerations based on premise of turning UCP into a public enterprise

Duties were performed based on the Agreement, but the issue of UCP's budget execution was brought up by the Board of Audit, jeopardizing the survival of the organization. After that, a proposal to reorganize UCP, which until then had handled construction and O&M of the sewerage facilities appropriately and effectively, as a public enterprise (Empresa Pública de Saneamiento de Panamá (EPSP)) was put forward with the support of IDB, CAF and other international donors. A bill to turn UCP into a public enterprise was approved by the cabinet in August 2017. The EPSP bill is shown in Attachment 6-3.

The bill will make UCP into an independent wastewater management implementing organization with the authority to collect fees. This activity was supposed to be completed in the first year. However, in consideration of the bill to turn UCP into a public enterprise, Activity 1-6 was to be implemented from the second year onwards.

When UCP becomes a public enterprise, the remainder of IDAAN's wastewater management duties shown in Table 2.3.1 will all be implemented by EPSP.

As of October 2018 when this report was submitted, the bill had not yet been deliberated. In view of the fact that the presidential election will be held in May 2019, early enactment of the bill is considered difficult.

(2) Issues and responses to issues

The issues and responses to the issues in this activity are described in Activity 1-6.

6) Activity 1-6 Review the duties, institutional setups and personnel of UCP [First, second and third years]

(1) Details and outputs of activities

a) Review of organizational structure

The current organizational and personnel structure was reviewed in the first year. The basic organizational structure is as shown in Fig. 2.3.1 and the organizational structure has not changed during the project period.

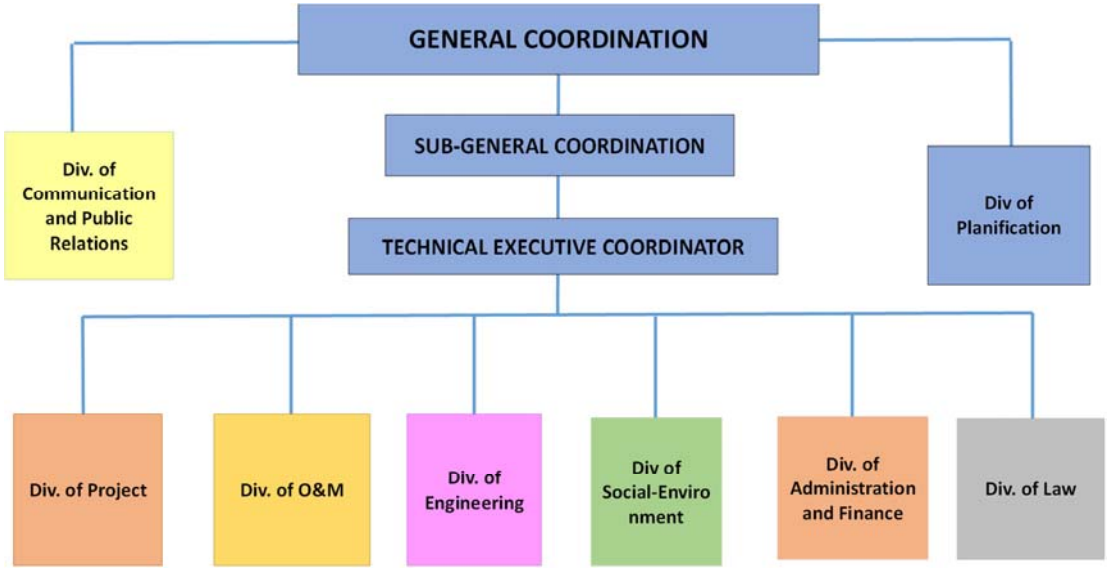


Fig. 2.3.1 Current organizational structure of UCP

From 26 persons at the time of the Basic Planning Survey in November 2014, the number of UCP staff rose to 49 in August 2015 at the launch of the project and increased by 33 in May 2018, making a total number of staff to 82. UCP plans to increase the number of staff to 121 to meet the current work volume.

The organizational structure was reviewed within the scope of the MINSA/IDAAN Agreement in the first year and the plan to turn UCP into a public enterprise was floated in the second year. As efforts are currently being made in this direction, the organizational structure was reviewed in anticipation of creation of the public enterprise. The organizational structure in Fig. 2.3.2 was proposed in the third year. The main proposed items are as follows.

- With the creation of the public enterprise, the post of General Coordination will be changed to General Manager. Likewise, Sub-general Coordination will be changed to Sub-General Manager and Technical Executive Coordinator to Technical Executive Manager.

- Clarification of personnel who will decide the policy of the public enterprise: General Manager, Sub-General Manager and Technical Executive Manager will make important decisions.
- The three persons mentioned above will meet regularly for discussions and exchange views with the manager in charge as necessary, and the General Manager will take the final decision.
- The Technical Executive Manager will supervise the technical division.
- The Sub-General Manager will supervise the non-technical divisions and when necessary, the technical division.
- The division of roles of the executive staff will be clarified by the above.

For details of the review and proposals, refer to the Attachment 2, Product A: Review of UCP organizational structure and proposal for formulation of business plan.

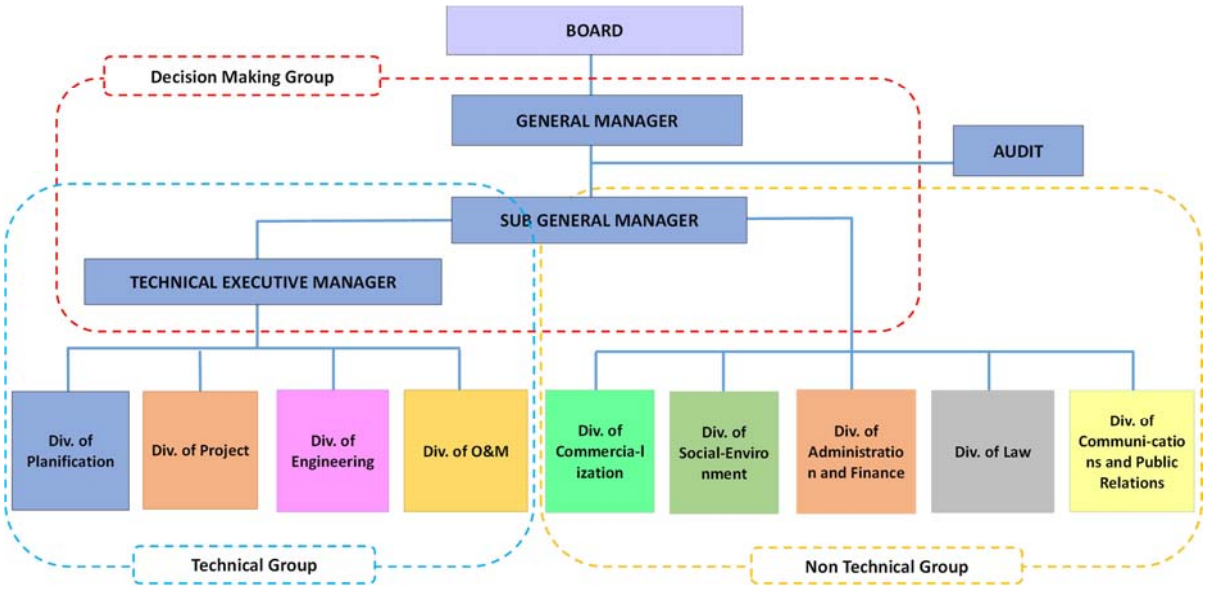


Fig. 2.3.2 Proposed institutional structure

b) Proposal for formulation of business plan

For EPSP to conduct wastewater management as a public enterprise, sustainable financial management is necessary. To steadily implement this goal, formulation and implementation of a business plan was proposed.

After first setting the business goals, the business plan will clarify the basic policies. The following five items were proposed as the basic policies (See Fig. 2.3.3).

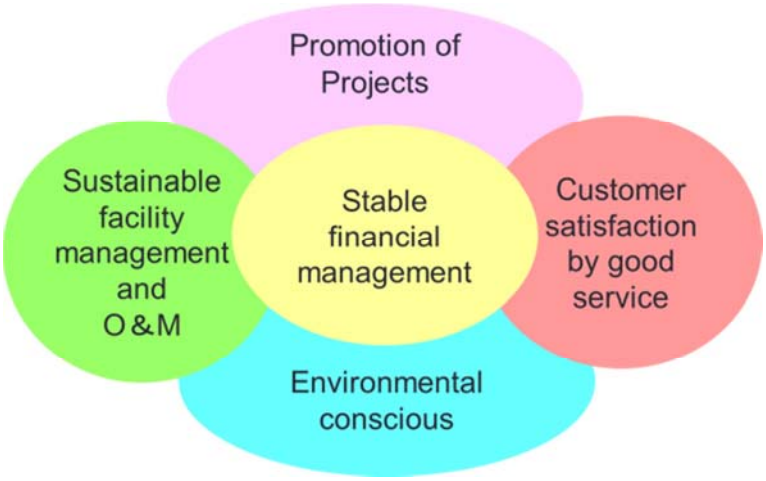


Fig. 2.3.3 Basic policies of business plan

(1) Promotion of projects
(2) Stable financial management
(3) Sustainable facility management and O&M
(4) Enhanced customer satisfaction by good service
(5) Environmental consciousness

Of these five, stable financial management and enhanced customer satisfaction by good service are the policies toward which UCP should direct its most strenuous efforts in future.

In addition, an action plan will be formulated for each basic policy. Examples of action plans for each basic policy were proposed.

The following initiatives were proposed as a means not only of formulating the business plan, but of steadily implementing the plan.

- ✓ Progress management of the action plans, including checking the performance indicators (PI)
- ✓ Positioning the action plans as staff performance goals
- ✓ Evaluating the business plan and staff on a performance basis

It was proposed that initiatives for an integrated management system (SIG), management information system (MIS) and human resource development are ranked as activities that support the business plan. The business plan is not an independent initiative; the aim is to implement the plan effectively by relating it to the management system traditionally undertaken by UCP. (See Fig. 2.3.4)

Fig. 2.3.4 Initiatives that support the business plan

SIG is an integrated management system for integrated implementation of three ISO, environmental management ISO14001, quality management ISO9001 and safety management OHSAS, certifications acquired for the first time in Panama by UCP. To avoid making the organization more complex and increasing the workload of the staff when implementing the business plan, it was proposed that the existing SIG is utilized as the system for implementing the business plan.

MIS is a system for integrating the various IT systems used in company management and it is utilized in decision-making at management level. It is assumed that existing and future IT systems are developed by different consultants. The business plan proposed building MIS that integrates individual systems into a single platform, ensuring data compatibility.

It was proposed that the action plans in the business plan are ranked as staff performance goals and utilized in human resource development. For details of the review and proposals, see the Attachment 2, Product A: Review of UCP organizational structure and proposal for formulation of business plan.

UCP is currently undertaking many initiatives, with various donors using various consulting companies. UCP is expected to play a role in formulating and implementing the proposed business plan as a tool for integrating existing and future initiatives and producing a synergistic effect.

(2) Issues

With support from multiple international donors, UCP is working toward becoming a public enterprise by creating a strategic plan, dealing with customers, etc. Many international consultants will provide support for many issues. Taking as an example the introduction of IT in UCP's work, issues associated with data compatibility and integration of individual tasks will arise. It will therefore be necessary to integrate many initiatives and develop an effective approach.

When implementing the strategic plan for creating a public enterprise and the business plan for running the public enterprise, risks of becoming a dead letter and viability issues are likely to arise. To effectively implement the plans, capacity-building and awareness-raising of UCP staff and well-thought-out implementation will be necessary.

(3) Response to issues

To effectively integrate and utilize the many initiatives required, the posts of deputy manager to oversee the technical division and non-technical divisions (Technical Executive Manager and Sub-General Manager) will be created institutionally. Strengthening of the system of decision-taking by the General Manager and the two deputy managers and building of MIS for integrating the IT systems were proposed, producing an effect beyond the scope of the individual systems.

When proposing the formulation and implementation of the business plan, how the plan will be implemented, utilization of the existing SIG management system and collaboration with human resource development were proposed, and the path to effective implementation of the plan while improving the capacity and awareness of the staff was shown.

7) Activity 1-7 Create human resource development plan (draft) of UCP [First, second and third years]

(1) Details and outputs of activities

Previously UCP's human resource development efforts focused on implementing effective staff training. 54 training courses were planned in 2016, including eight overseas training courses. A table showing the training implementation history from the staff perspective has been created, aimed at further enhancement.

All expenditure was suspended in 2017 due to the issue identified by the Board of Audit and the number of training courses declined, but in 2018 training courses are being implemented as planned thanks to the policy decision to turn UCP into a public enterprise.

Formulation of a human resource development plan was supported in the project with the aim of conducting more effective human resource development based on the UCP training plan.

The human resource development plan will contribute not only to the creation of a training plan but to improving the capacity of the human resources required by the organization. What should be included in the human resource development plan was proposed in the third year after clarifying what the organization was aiming for and what was required of the staff.

The basic policies that form the core of the proposed human resource development plan are shown below.

- Positioning the human resource development plan as a tool for promoting the business plan
  - Positioning of the action plans in the business plan as staff performance goals
- Performance-based incentives and staff evaluation
  - Ongoing planning of the building of a personnel evaluation system by UCP
  - Provision of some kind of performance-based incentives
- Placing the right people in the right jobs
  - Proposal of job rotation for each type of job
- Formulating a human resource development plan with an excellent training plan
- Continuous Kaizen (improvement) of UCP's duties

- Improved work efficiency by Kaizen, the Japanese Production System based on improvement proposals, etc.

Apart from the formulation of a training plan currently being undertaken by UCP, this is a new initiative. The human resource development plan will be useful for improving the quality and efficiency of UCP's work.

For details of the review and proposed content, see the Attachment 2, Product B: UCP's Human Resource Development Plan (Draft).

(2) Issues

With the rapid increase in UCP staff and plans for further increases, and amid plans to change the organizational structure and launch new operations, substantial human resource development is urgently required. The issues involved in achieving this are not only formulation of a substantial training plan, but effective development of human resources capable of indirectly supporting promotion of the business plan and promotion of business.

(3) Response to issues

Formulation of a comprehensive human resource development plan to achieve human resource development that matches the goals of the organization, support for promotion of the business plan and continued improvement of business operations was proposed.

2.3.2 Output 2

The aim of Output 2 is to launch periodical water quality monitoring of wastewater pollution sources discharged into Juan Diaz Wastewater Treatment Plant (JDWWTP). The various activities shown below, including a pilot project to install Johkasou at a hospital, were therefore carried out to ensure monitoring of industrial wastewater, to all intents and purposes previously not conducted in Panama. At the time of the Detailed Planning Survey in the project, there was no one in UCP in charge of industrial wastewater, but a responsible person was appointed in March 2016, in conjunction with the launch of the Project Implementation Phase, and activities were initiated.

1) Activities 2-1 and, 2-3 Survey the situation of large-scale sources whose effluent is discharged into JDWWTP, and create a database on large-scale wastewater sources [First year]

(1) Details and outputs of activities

The database of large-scale wastewater sources was created in the first year by extracting businesses as potential monitoring targets from the available multiple existing data. The reference materials used were the reports on effluent quality based on DGNTI-COPANIT 35 and 39 as the Panamanian technical standards for wastewater obtained from MiAMBIENTE from 2011 to 2015, the masterplan update (05/2015), the membership list of Syndicate of Panama Industrialists (SIP), and water users of over 500,000 gallons per month extracted from IDAAN Commerce Department register. Businesses were extracted from the materials as potential targets for water quality monitoring of large-scale wastewater source.

Wastewater treatment facilities in large-scale development areas, and condominiums etc. were deleted, since they are targets to water quality monitoring in the case that discharge wastewater into public water areas but are normally not in the case that discharge wastewater into the sewerage system. As a result, a database was created with 89 businesses including hospitals as the initial target candidates for water quality monitoring. (See Attachment 2, Product C)

The database items deemed necessary were prepared with reference to the entries in Ledger for water quality monitoring in Japan. The items will be appropriately adopted or rejected, together with the listed business, in the course of use in water quality monitoring, and a database that matches the current situation in Panama will be created as well as experience accumulated.

Related to the database, the questionnaire for the business survey was created in the first year after discussions with the counterparts, based on the entries in Ledger for water quality monitoring in Japan. The questionnaire was attached with the greeting by UCP's General Manager as a cover and used for the survey.

(2) Issues

Existing data were compiled to create a database of large-scale wastewater sources, but in many cases notification based on COPANIT 35/39 is lacking and greater accuracy is required.

(3) Response to issues

The accuracy of the database will be enhanced by the questionnaires and visits to businesses in future Activities 2-5 and 2-8.

2) Activity 2-2 Train UCP/MINSA staff members how to inspect and control effluent quality from large-scale wastewater sources [First, second and third years]

(1) Details and outputs of activities

The legal system and institution and actual monitoring work related to Japan's wastewater quality monitoring were introduced in the seminars and weekly meetings in the first year.

In the seminars in the second year, items deemed necessary for implementation and items to be taken into consideration concerning water quality monitoring of businesses in Panama were explained in relation to the water quality monitoring plan (draft).

Also in the second year, the basic items of biological wastewater treatment and how to evaluate activated sludge treatment were explained in lecture form in the weekly meetings.

A water quality analysis system was established in the second year. Equipment centered on a combination of systematized absorptiometer and COD reactor was purchased and an old office in UCP was set up as a simplified laboratory. After training by the dealer, the equipment was used to analyze industrial wastewater and the effluent from Johkasou. The main item analyzed is COD and it is also possible to analyze nitrogen and phosphorus. As Panama is home to many food and drinks businesses, the main pollutants generated are organic. For this reason, the pollution level of the wastewater can be evaluated by COD, the representative indicator for organic contamination. As the object of Johkasou treatment is mainly organic matter, it can be handled in the same way. For this reason, analyses performed by the counterparts using this equipment were used in the evaluations, except for the cases required in COPANIT 35.



Fig. 2.3.5 Learning how to use the water quality analyzer and measuring by the counterparts

OJT for water quality monitoring on-site was held when water quality monitoring, including trials, was conducted with the counterparts in the second and third years. This kind of door-to-door survey was conducted a total of 10 times in half-day units. 16 companies were visited and the person in charge was interviewed at nine of them and treated water was sampled at two of them. At another company not yet connected to the sewerage facilities, the community board had reported bad effluent water quality, so sampling was attempted at the discharge point into the water channel. In the OJT with the counterparts, giving advice both beforehand and afterwards in order to help the counterparts understand what to ask and the processes, treatment facilities, wastewater, etc. Also efforts were

made to enhance their understanding of the contents of the water quality monitoring guidelines.



Fig. 2.3.6 OJT in business surveys

When Johkasou were introduced, OJT in sampling to measure the water quality and checking the operating condition of the facilities and the state of biological treatment was carried out and the counterparts checked the progress by measuring the water quality.

(2) Issues

When the project was first launched, neither IDAAN nor UCP performed any water quality monitoring. Awareness of compliance with COPANIT 39 on the part of businesses was therefore low and there was also a lack of communication between the authorities and businesses.

(3) Response to issues

Awareness of water quality monitoring within UCP was improved by training courses and OJT for the counterparts and the counterparts came to recognize the importance of communicating with businesses. Based on the outputs of this project, more effective water quality monitoring will be conducted in future by repeated visits to businesses.

3) Activity 2-4 Create guidelines (draft) for water quality monitoring of large-scale wastewater sources [First year]

(1) Details and outputs of activities

Water quality monitoring guidelines were drafted in the first year. The guidelines used by local governments in Japan were modified to suit the conditions in Panama and the entries were limited to basic items only (See Attachment 2, Product D).

It is assumed that items considered necessary will be added as needed and the content revised sequentially in the process of actually carrying out water quality monitoring. Even if the legal system on which monitoring is based changes or the wastewater management entity changes, the guidelines can be used with modifications and additions.

Section of monitoring plan were revised and added of the content in conjunction with moves toward creating a public enterprise for sewage works in the second year.

(2) Issues

Discussions were held with IDAAN bearing in mind the MINSA/IDAAN Agreement, the foundation of water quality monitoring, but the roles and sharing of responsibilities of UCP and IDAAN were not fully hammered out.

(3) Response to issues

The necessary items will be added while narrowing down the content to basic items, responding flexibly to changes in the system that forms the foundation of water quality monitoring, and conducting actual monitoring including trials. It will thus be possible to respond to changes in the institutional framework just by partial additions and modifications.

4) Activity 2-5 Create a water quality monitoring plan (draft) for large-scale wastewater sources [First and second years]

(1) Details and outputs of activities

The water quality monitoring plan was drafted in the second year based on the water quality monitoring guidelines (draft) created in the first year and the database of large-scale wastewater sources. (See Attachment 2, Product E)

Based on the premise of turning UCP into a public enterprise in the future, for the time being water quality monitoring will essentially be carried out at businesses whose consent has been obtained.

Some items related to monitoring of industrial wastewater to be included in the regulations of wastewater management entities were entered as items in Section 5 requiring consideration in future by showing text examples. These items were explained in the seminars, etc.

Preparation of the plan (draft) proceeded on the assumption that water quality monitoring will be implemented with the cooperation of IDAAN, based on the MINSA/IDAAN Agreement and presidential decree. However, with materialization of the proposal of turning UCP into a public enterprise and the worsening relationship between IDAAN and UCP, cooperation on monitoring became difficult, so the plan was filed away as a proposal at that point.

(2) Issues

As UCP currently has no legal authority regarding monitoring, there was concern about cooperation by businesses.

(3) Response to issues

As a certain level of consent was obtained in the trial, for the time being water quality monitoring in the plan (draft) will be implemented for businesses whose consent has been obtained. On the other hand, it is assumed and considered desirable that independent entities including the public enterprise will implement sewage works in future, and the items to be considered were shown.

5) Activity 2-6 Plan and implement the pilot project of wastewater treatment for large-scale wastewater sources [First, second and third years]

(1) Details and outputs of activities

The activities of the pilot project related to Output 2 are shown below. For the overall detailed records, see the Attachment 2, Product F: Wastewater treatment equipment management records.

a) From detailed planning survey to preliminary survey

The application technologies and installation site of the pilot project were studied during the detailed planning survey activities. As a result, it was decided to install a Johkasou with a capacity of 150 m3/day in Nicolas A. Solano Hospital in La Chorrera, Panama West Province.

In the first year of the project implementation phase, a subcontracting agreement for a soil survey of the installation site and the required EIA was implemented, and a local contractor was selected by competitive bidding. A bid for the Johkasou was made by JICA Procurement Department and the supplier was decided.

b) From installation to operation

Installation work began in February of the second year and was completed in May of the same year. Then, while launching operations, OJT for the counterparts was commenced.

(2) Issues

a) From detailed planning survey to preliminary survey

Initially, it was planned that the construction work would be completed in the first year, but due to overlapping of the investigation of UCP by the Board of Audit, a change of minister and other factors, the progress of EIA was significantly delayed and it was eventually carried over to the second year.

b) From installation to operation

Operation was launched in June of the second year, but the control mechanism in the machine room broke down due to wild fluctuations in the voltage of electricity supply, forcing suspension of operation.

In addition, other problems occurred: the inflow pump stopped due to infiltration of solid waste from the hospital.

(3) Response to issues

a) From detailed planning survey to preliminary survey

JICA Panama Office and the counterparts kept in close communication regarding the delay in EIA due to political reasons, and progress was seen by adopting approaches from various directions. When implementing similar projects in future, the time schedule needs to be considered taking into account this kind of risk.

b) From installation to operation

The voltage problem was dealt with by installing an uninterruptible power supply (UPS), with visible effect. Hospital waste was dealt with by a series of awareness seminars at the hospital and the installation of screens on the upstream manholes and a certain degree of progress was achieved, but installation of a grinder as a definitive countermeasure will be studied at the initiative of the counterparts.

In addition, an O&M plan after the end of the project has been created by the counterparts for the next four years and more.

(4) Other activities: Proposal for diffusion of Japanese technology

Johkasou, a Japanese technology, is a very effective decentralized treatment technology for limited area or where there is limited manpower to carry out maintenance. Such features make it highly applicable to various other countries. As part of this activity, a survey on the applicability of Johkasou technology was conducted and the following data obtained.

・Wastewater treatment for a prison

⇒UCP was consulted about the problems of wastewater treatment in a prison under the jurisdiction of the Cabinet Office and advice was also sought from JET.

⇒ Both Johkasou and the oxidation ditch method suited to the constraints of the site were proposed.

・Interviews with urban developer

⇒The contractor who installed the Johkasou in this project requested that Johkasou be considered as an alternative for wastewater treatment on newly developed residential area (350 houses) and discussions were held with the said developer regarding details of planning and wastewater treatment methods.

・Field survey on Taboga Island

⇒Like the prison, UCP was consulted about wastewater treatment on Taboga Island which has a thriving tourism industry, and advice was sought from JET.

⇒Meetings were held with the relevant parties to discuss Taboga Island's waste problem and a presentation on Johkasou was given at one of the meetings.

⇒A field survey was then conducted.

6) Activity 2-7 Study mitigation measures on large-scale wastewater pollutant sources (industrial, commercial and institutional sources flow into the JDWWTP), based on the pilot activity [Second and third years]

(1) Details and outputs of activities

Mitigation measures for large-scale wastewater sources were studied in discussions with the counterparts and divisions in charge mainly in the second and third years. Collaboration with the subdistrict office and improvement of restaurant grease trap management were also considered.

The main measures considered feasible for Panama were summarized in the third year as a Study of Mitigation Measures for Large-scale Wastewater Sources. (See Attachment 2, Product G). As the utilization of Johkasou in the mitigation measures for wastewater sources was mainly studied in the pilot project related to Johkasou, this was included in Activity 2-6. As touched upon in the foreword to the Study, collaboration with the community board in ordinary monitoring techniques presented difficulties and it was removed from the Study items, but it might be an effective option to support

encouraging businesses to connect to the sewerage facilities. Improvement of grease trap management was the theme of an action plan when the counterparts participated in a training course of JICA Knowledge Co-Creation Program and the counterparts are promoting it on their own initiative, so it is not included in the Study items, but it may be an effective means of remedying pipe blockages in areas with a concentration of restaurants and a separate report is anticipated.

(2) Issues

Items considered issues in the measures for industrial wastewater in Panama were raised and summarized in the Proposals for Consideration, one of the deliverables of Activity 2-7. Whether to proceed with the project by targeting improvement of the water quality of the rivers and channels in the city, one of the main goals of the wastewater project, is an issue.

(3) Response to issues

If the suggestions in the Proposals for Consideration compiled in this activity are implemented, the water quality of the rivers and channels where industrial wastewater is a particular cause of pollution is expected to improve.

7) Activity 2-8 Implement water quality monitoring for large-scale wastewater sources [Second and third years]

(1) Details and outputs of activities

Water quality monitoring was carried out in various forms on a trial basis from the second year and launched in earnest in the third year based on the Water Quality Monitoring Plan (Draft).

One of the trials, conducted in collaboration with the Community Board office requesting for cooperation, mentioned in Activities 2-2 and 2-7, was company visits with its staff, following a explanation by the staff on the situation of large-scale wastewater sources in the district. One company provided a briefing session and the factory, including the treatment facilities, was visited at a later date when it was possible to confirm that there was no major impact on the river. At another company, however, the COD of the sample taken at the discharge point into the water channel was very high and a major impact on the river was confirmed, but the company's agreement to an interview could not be obtained.

Businesses listed in the database were visited and, with their consent, trials involving interviews, on-site inspections and samplings were carried out. The counterparts distributed the questionnaire mentioned in Activity 2-2 in advance, but received no response from four companies. When the four companies were visited with the counterparts, two of the companies declined, but two agreed to interviews and one agreed to sampling at a later date. From this, it was presumed that, to a certain degree, consent can be obtained to implementation of water quality monitoring in accordance with the Water Quality Monitoring Plan (Draft) based on the consent of the other party.

Water quality monitoring based on the plan was launched in the third year. In the four surveys conducted with the counterparts, 10 companies were visited and consent to monitoring failed to be obtained at four companies for reasons such as the absence of the person in charge, but at the other

six companies interviews and on-site inspections were carried out as necessary.

According to the report presented by the counterparts at the seminar held in the third year, during the project period they visited 31 businesses including eight restaurants, distributed questionnaires to 21 businesses and received responses from eight businesses. In future they hope to conduct water quality monitoring more effectively by persistently visiting businesses and building a relationship of trust.

If an institutional base such as a public enterprise is developed, it will be possible to build a system to support water quality monitoring in conjunction with the establishment of service rules, thereby ensuring more appropriate measures for monitoring.



Fig. 2.3.7 Water quality monitoring of large-scale wastewater pollutant sources

(2) Issues

To effectively continue the water quality monitoring begun in this project, there are three issues. First is the progress of dialog with wastewater sources and business associations, second is collaboration with MiAMBIENTE which has jurisdiction over discharge into public water areas, and third is organization of sewage works entity with an independent institutional framework.

(3) Response to issues

With regard to the first issue, progress of dialog with wastewater sources and business associations, it is important that UCP persists with current water quality monitoring while conveying to businesses the bigger picture of the benefits to be gained by connecting to the sewerage system and observing wastewater standards, and the support they can receive from UCP. With regard to the second issue, collaboration with MiAMBIENTE, enhancement of the public desire for a pleasant environment by environmental education and increased public pressure on MiAMBIENTE are considered necessary. With regard to the third issue, organizing of the framework of wastewater management entities, consistent demands from donors including JICA are required.

2.3.3 Output 3

1) Activity 3-1 Identify necessary items for O&M and asset management of sewerage facilities [First year]

(1) Details and outputs of activities

A baseline investigation of the current operating condition and treatment status of the target WWTP was carried out and the issues identified at this stage were analyzed. During the investigation, suggestions for improvements were made to the counterparts as appropriate.

The results are shown in the Attachment 2, Product J: Medium and Long-term Sewerage Facilities Management Plan (Draft). An overview is given below.

a) List of sewerage facilities and equipment, such as WWTP, PSs, etc., O&M status, breakdown of running costs (chemicals, electric power, manpower, etc.), implementation of survey for future development plans

The results showed that electric power consumption is significantly higher than at WWTPs in Japan that use the same treatment method. The reasons for this are described in Activity 3-3.

A list of machines and equipment has been created in Excel format and the particular specifications of the equipment was able to be confirmed by the code number. Additionally, annual and monthly repair plans have also been drafted.

b) Implementation of investigation on preparation status of O&M outsourcing specifications for sewer pipes and PSs, monitoring status and preparation status of O&M manual

In the O&M outsourcing specifications for sewer pipes and PSs as of 2015, all the equipment, trucks, etc. were procured with UCP's budget and there was little burden on the contractor. On the other hand, for UCP supervision work, the O&M division has created a simple manual on work management.

c) Inflow rate to the WWTP, mass balance by inflow and outflow rate, and evaluation of treatment performance

According to JDWWTP's monthly report, it is difficult to grasp the condition of wastewater treatment and the mass balance because the water sampling date and/or analyzed water quality items are different for influent and effluent. For that reason, as UCP has supervised JDWWTP operation since May 2017, suggestions for improvements have been made to the counterparts so as to describe the evaluation by management indicators (such as mass balance and electricity usage per m3) in the monthly report. These are expected to be improved gradually.

d) Gathering of information related to revision of sewage service fees

IDAAN has authority over collection of sewage service fees and no progress has been made toward revision of the fees since 2015.

(2) Issues

As the O&M budget is financed by the Panamanian government, the counterparts currently have little motivation for cost reduction. Normally, it would be necessary to consider ways of balancing the income from sewage service fees and O&M costs.

(3) Response to issues

The basic concept of financial planning for wastewater management and the importance of fee income were discussed in the training in a third country held by SANEPAR, Brazil, and the training in Japan held in Yokohama.

In future, it is hoped that discussions will continue to be held on the sustainability of wastewater management based on the business plan and action plans together with the transition of UCP to a public enterprise.

2) Activity 3-2 Draft a TOR proposal for the next O&M contract for sewerage facilities to support UCP's supervision [First year]

(1) Details and outputs of activities

Until now, outsourcing of O&M has been carried out by detailed specification ordering. In future, more efficient outsourcing and improved cost effectiveness are anticipated by increasing the discretion of the contractor and receiving proposals from contractors by showing the TOR.

The TOR (draft) was formulated after JET had identified the points for improvement when carrying out surveys, and improvement of outsourcing methods was discussed with the counterparts.

The outputs are shown in the Attachment 2, Product I: TOR (Draft) and accompanying sheet for details. An overview of the outputs is given below.

a) Confirmation of the content of the existing outsourcing specifications and monitoring plan and investigation of the status of day-to-day O&M

TOR for the sewer pipes and PSs as of 2015 was classified into Component 1 (ordinary O&M) and Component 2 (repairs and maintenance). The purpose, scope, implementation, frequency, records, etc. of O&M were specified in the O&M division manual, and operations were managed by the counterparts according to the manual. However, looking at the monthly O&M reports, detailed records such as daily work reports and on-the-spot questionnaires were inadequate.

b) Confirmation of the items and content of the operation manual and maintenance manual and identifying the necessary items

There was no operation manual or maintenance manual for O&M of the sewer pipes and PSs. Inspection and investigation for O&M of the machines and equipment are carried out by the contractor based on the equipment specifications and O&M manuals are not required by the

Fig. 2.3.8 Repairing the collector

counterparts for work management. However, at present the main work for O&M of sewer pipes consists of handling complaints and dealing with the clogged pipes and in future it will be necessary to switch to O&M aimed at planned investigation and diagnosis.

c) Investigation of the current status of the equipment with the counterparts, discussion on the problems and need for repairs and support provided for appropriate management of the facilities and materials

When an outsourcing contract was signed with the SOAP Consortium (Operational Services of Wastewater of Panama: Degrement SAS and Degremont SA (Mexico)), the pumping facilities were inspected by UCP and SOAP. As a result, defects at the PS on the coast were repaired before the start of O&M and O&M of the pumping facilities was launched under good conditions. Furthermore, with regard to materials management, the equipment necessary for the SOAP office is gradually being provided.

d) Support for the creation of TOR (draft) in conjunction with the next O&M contract for the sewer pipes and PSs

TOR for the next O&M contract for sewerage facilities was drafted based on TOR for outsourcing of O&M of sewer pipes and PSs in Japan. Consisting of Chapter 1 General Provisions, Chapter 2 Safety Management and Chapter 3 Work Content, Chapter 3 sets out the common content, work plan and monthly O&M plan formulation and sewer pipe maintenance (planned maintenance, short-term maintenance, day-to-day maintenance) and also describes O&M work for the PSs and WWTP.

(2) Issues

No yardsticks that take into consideration the difficulty of the work are used in O&M of the sewer pipes. In addition, as there are no data to serve as performance indicators (PI), such as reduction in the number of road subsidences or number of complaints, at present it is not possible to create the same level of TOR as in Japan.

(3) Response to issues

At the suggestion of JET, the gathering of these basic data will be included in TOR (draft) when the next outsourcing order is placed, aimed at phased improvement. Furthermore, in the TOR (draft), as far as possible consideration will be given to enabling migration from specification ordering to performance ordering.

3) Activity 3-3 Draft a mid- and long-term renovation plan (draft), financial plan (draft) and O&M plan (draft) for sewerage facilities (JDWWTP and the rest) based on the data of sewerage facility management [First, second and third years]

(1) Details and outputs of activities

Renewal of the mechanical and electrical equipment consistent with JDWWTP inflow rate is planned by creating a mid- and long-term renovation plan (draft) and financial plan (draft) in

accordance with the development status of the sewerage facilities, leveling future investment and securing the necessary budget.

As the counterparts have no experience in formulating renovation plans, JET created a draft plan while discussing the problems. As well as identifying the inflow rate and water quality, phased mid- and long-term renovation plans based on inflow volume forecasts were discussed.

In the first year, as well as organizing O&M costs, such as current electric power consumption, chemical usage and sludge disposal, the counterparts were interviewed, a mass balance was made and current problems were explained.

In the second year, mid- and long-term renovation plans (draft) were created based on lists prepared by the counterparts such as the specifications of the main machines and equipment, and reduction of the growing volume of sludge was studied.

In the third year, leveling of future investment was carried out based on the financial plans drafted by the counterparts and the cost of constructing a sludge dryer, and securing of the necessary budget was discussed.

The outputs of Activity 3-3 are shown in Attachment 2, Product J: Mid- and Long-term O&M Plan (Draft) for Sewerage Facilities (hereinafter referred to as “Draft Facility O&M Plan”). An overview of the outputs is given below.

a) Outputs in the first year

Mid- and long-term inflow forecasts have been made to facilitate the calculation of the optimal scale of the facility renovation.

The calculation of the optimal scale of the facility renovation requires a projection of annual sludge generation based on inflow forecasts and mass balance in JDWWTP. JET noted that the volume of sludge returned from the final settling tank was almost equal to the inflow, because the sludge concentration in the return sludge of 4,000 mg/L was significantly lower than the design concentration of 7,500 mg/L. The team explained to the counterparts in the monthly meeting in August 2016 that this fact was the cause of the extremely high power consumption.

The main outputs are as follows.

- Power consumption was extremely high because operation was performed at a return ratio of 100% against a design return ratio of 50% in relation to MLSS of 3,200 mg/L in the aeration tank (return sludge concentration of 7,500 mg/L). ⇒In Phase 2 of JDWWTP, a rectangular instead of a circular settling tank was designed and improvement was achieved.
- UCP has begun considering adding reduction of power consumption per $1m^3$ to the O&M TOR against the advantage of scale of increasing the JDWWTP inflow volume.

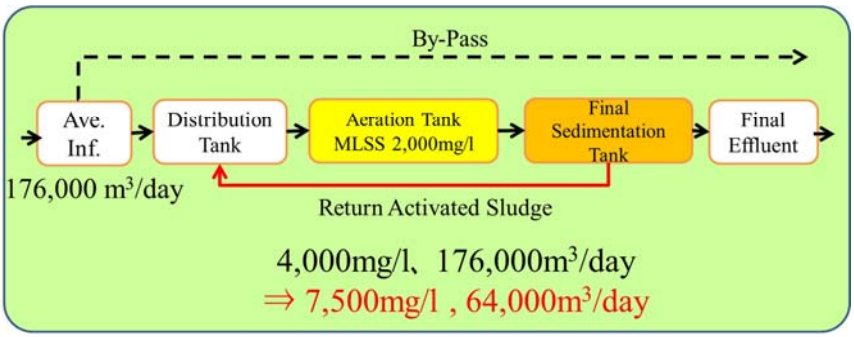


Figure 2.3.9 JDWWTP wastewater treatment flow and return sludge volume

b) Outputs in the second year

JET prepared a Draft Facility O&M Plan using the result of inflow forecasts into JDWWTP. The outline of the preparation process is described as follows:

- The result of inflow forecasts was used for the projection of sludge generation and other parameters and the preparation of a renovation plan (draft) that included the improvement of the capacities of facilities such as sludge dehydrator, digestion tank, and gas holder.
- A plan for the renovation of mechanical and electrical facilities was formulated on the assumption that their useful lives were 15 years. In the plan, considering there are four lines of treatment process, replacing one line at a time while other three are in operation was suggested. It was also suggested to implement the replacement of facilities installed in Phase 2 in the same way.
- In addition, the facilities management plan (draft) suggested the installation of sludge dryer in order to reduce the amount of sludge which will increase in the future. In the study, it was assumed that the biogas generated from sewage was to be used for sludge drying, and if the water content ratio of sludge was reduced to approx. 55 %, the volume of sludge could be reduced by almost 50%.

c) Outputs in the third year

The costs of electricity, chemicals, and sludge treatment were estimated with the increase in the inflow taken into account for the preparation of a mid- and long-term financial plan. The counterparts are preparing a plan for the required investment based on the cost of the construction of the existing mechanical and electric facilities of JDWWTP. The cost of the sludge dryer was added to the investment plan, and then leveling of future investment was studied. Based on the result, UCP has to secure the necessary budget in the future.

(2) Issues

The managerial staff of UCP have recognized the importance of mid- and long-term facility renovation and the necessity to secure the budget for the renovation.

UCP has recognized the increase in the volumes of inflow and sludge generation in future, the necessity for reducing sludge generation, the relatively short service lives of the facilities, and the

need for appropriate facility renovation and the review of sludge treatment and disposal methods at the time of renovation. In light of these items, a renovation plan needs to be formulated and funding secured by UCP in future.

(3) Response to issues

Because there will be no need for renovation in near future, JET recommends that UCP prepares financial and renovation plans taking the current state mentioned above into consideration.

4) Activity 3-4: Implement OJT on the investigation and diagnosis method for existing sewers. [First, second and third years]

(1) Details and outputs of activities

UCP is responsible for supervising contractors in the investigation and diagnosis of sewer pipes. Therefore, mastering an efficient and effective investigation and diagnosis method is an effective way to improve the capacity of UCP in O&M of sewerage facilities.

OJT on the investigation and diagnosis of sewer pipes was conducted using the portable equipment in areas where such problems as stagnation and overflow of water had been identified, and the technology for the investigation and diagnosis method was transferred to the counterparts in the form of lectures in the seminars.

The OJT in the first year was on locating problems with the measurement of river DO in the Rio Abajo Basin, which had been identified to be seriously contaminated. Training was also provided on the use of a power sprayer for the smoke testing.

OJT on the use of a full-conduit flowmeter was conducted in the Juan Diaz PS and Johkasou in the second year. The measurements taken in the OJT were explained in weekly meetings. OJT on the use of TV camera for summary inspection, electrical conductivity meter and the smoke testing was conducted mainly in the Don Bosco Area where sewer clogging was suspected. The results of the OJT were explained in weekly meetings.

The OJT in the third year on the use of an open channel flowmeter was conducted after the sensor of the meter had been repaired.

The outputs of Activity 3-4 are shown in the Attachment 2, Product K: Report on OJT on Sewer Pipe Investigation and diagnosis Method. An overview of the outputs is given below.

a) Outputs in the first year (five OJT sessions)

i) Method to locate problems by using a river DO survey

OJT on the method to locate problems by using a river DO survey conducted in the first year is described as follows:

OJT to locate problems by using DO measurements of river water was conducted in the Rio Abajo Basin (approx. 2,200 ha) identified by UCP as an area where many problems were found in the old IDAAN sewerage network.

The DO survey is characterized by the use of a portable DO meter, which enables DO measurement at 10 locations in half a day. In this way, the counterparts could acquire the technology

enabling them to easily locate an area where wastewater is leaked from a sewerage system.

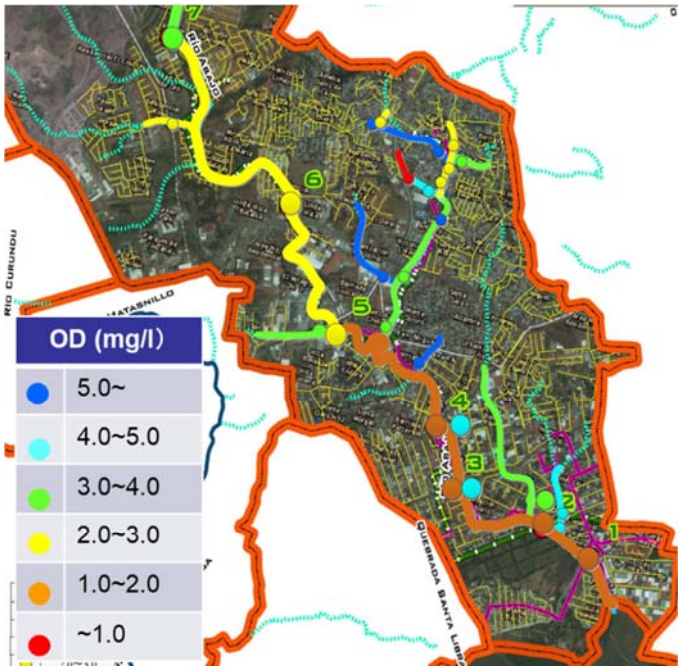


Figure 2.3.10 Scenes in OJT on the DO survey and map showing the survey result

The survey revealed that the problem of houses not connected to a sewerage system in the Rio Abajo Basin had a significant influence on the water environment. JET has recommended that UCP identify areas where this problem is particularly serious and request CONADES to take measures to alleviate this problem.

Figure 2.3.11 Meeting with CONADES

ii) Training on the use of power sprayer for smoke test

An engineer of the dealer for the power sprayer provided the training on its use to the counterparts. They confirmed that the power sprayer generated appropriate smoke from glycerin and water.

Figure 2.3.12 Training on the use of power sprayer for the smoke test and confirmation of smoke generation

b) Outputs in the second year (18 OJT sessions)

The OJT conducted in the second year is described as follows.

i) OJT on the use of full-conduit flowmeter

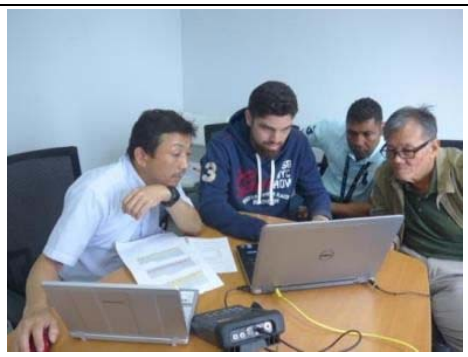
The OJT on the use of a full-conduit flowmeter was conducted several times at the Juan Diaz PS and the training regarding the sensor installation, data logger setting, and data collection was provided for the counterparts.

Outlet pipes in many of the PSs managed by UCP do not have a straight part long enough to measure the flow rate in them. Therefore, UCP understood the necessity of studying the installation of a flowmeter in designs of wastewater treatment plants and PSs to be constructed.

Installation of a flowmeter in Juan Diaz PS

OJT on data logger setting

OJT on installation of a flowmeter in a treatment unit Johkasou



OJT on analysis of flow rate data

Figure 2.3.13 OJT on use of full-conduit flowmeter

ii) OJT on the other equipment (Don Bosco Area)

JET conducted an inspection to identify the causes of overflow from sewer pipes in the Don Bosco Area with the counterparts.

The following problems were seen in the Don Bosco Area.

- The sewer pipes have been laid in line with the ground surface gradient, but overflow in times of rainy weather is seen in flat areas with a low gradient.
- The flow of groundwater is thought to have been obstructed by the construction of an expressway (banking construction) in the coastal area and the stagnant water in the sewer manholes is regarded as an effect of this.

Figure 2.3.14 Don Bosco Area (approx. 300ha)

ii)-1 OJT on use of TV camera for summary inspection

It was impossible to inspect sewer pipes with a TV camera in areas below 10 m above sea level

because of the stagnant water in the manholes. Therefore, the inspection with the TV camera was conducted in manholes at an elevation of 15 – 20 m above sea level. The sewer pipes in the inspected sites were found to be generally in good condition, although infiltration of water was observed. In this way, the need for the counterparts to see the condition inside the pipes was recognized and utilized in the survey.

Figure 2.3.15 OJT on use of TV camera

ii)-2 OJT on smoke testing

The smoke test was used for finding misconnection between sewer pipes and rainwater drain pipes. The counterparts frequently use this test because it enables visual identification of the misconnection. However, the inspection conducted in Don Bosco identified no misconnection. Therefore, infiltration of groundwater was considered the cause of the overflow.

Inspection in Don Bosco (no misconnection)

OJT on smoke test at an intersection

Figure 2.3.16 OJT on smoke testing

iii) OJT on use of EC meter for investigation of water infiltration

As water infiltration into sewer pipes had been observed in the inspection with the TV camera, an investigation with an EC meter was conducted to measure the content of infiltrated water in wastewater.

Figure 2.3.17 Investigation of water infiltration with EC meter (sample being analyzed with PC)

The measurements of EC of the wastewater sampled at nine locations suggested that groundwater accounted for more than 70 % of the wastewater at locations where the amount of groundwater infiltration was large and that the groundwater level at such locations was 15 - 17 m above sea level. These findings suggested that the overflow was caused not by the obstruction of sewer pipes but by the infiltration into the sewer pipes of groundwater, the level of which became very high during the rainy season because the Don Bosco Area is on reclaimed land. In addition, the counterparts understand that the degree of infiltration can be identified from the EC values and they plan to utilize this.

b) Outputs in the third year (five OJT sessions)

The OJT conducted in the third year is described as follows.

Figure 2.3.18 Installation of open channel flowmeter and data setting

OJT was conducted on the investigation of flow rate with an open-channel flowmeter. Before the OJT JET explained to the counterparts the difference between open-channel flowmeters and full-conduit flowmeters, which were used in PSs, and the decrease of the sensitivity of a sensor on a flowmeter installed in a sewer pipe caused by adhesion of rubbish and grease in wastewater. As the

flowmeter for open channels provided in this project is easy to handle, the counterparts plan to use it at various sites.

(2) Issues

The outputs of the above-mentioned OJT will be used in the implementation stage of the plan formulated in Activity 3-5.

(3) Response to issues

UCP already has a plan to use the outputs of the OJT in the implementation stage.

5) Activity 3-5: Create O&M plan (draft) of existing sewer pipe network [Second and third years]

(1) Details and outputs of activities

Responses to complaints raised by residents and repair of clogged sewer pipes account for a large proportion of the sewer pipe maintenance work at present. UCP needs to prepare an O&M plan (draft) for systematic maintenance of the existing pipes.

Prioritization by screening is necessary for systematic O&M. The main problems to be taken into account when performing the screening are summarized as follows.

- Insufficient discharge capacity of the existing sewer pipe network: gradient of the pipes in upper reaches > gradient of the pipes in lower reaches
- No connection between drainage facilities in houses and a sewerage system: in residential areas of low-income households
- Problems caused by groundwater infiltration: on reclaimed land
- Old sewerage systems: in old city

The outputs of Activity 3-5 are shown in the Attachment 2, Product L: Sewer Pipe Network O&M Plan (draft). An overview of the outputs is given below.

a) Outputs in the second year

In the second year, complaints regarding problems in the existing sewer pipe network of IDAAN in each district were analyzed. The analysis of the complaints also revealed that the problems were classified into a) those derived from lack of discharge capacity, b) those derived from discharge of untreated household wastewater, c) those of designing methods and groundwater infiltration and d) those in the high-pressure washing of the existing sewer pipes. JET explained a systematic screening of problems with various inspection methods used in the OJT on the investigation and diagnosis to the counterparts in a seminar.

b) Outputs in the third year

In the third year, a screening method for the sewer pipe network was prepared by adding the flow rate investigation with the open-channel flowmeter to the outputs in the second year and a sewer

pipe network O&M plan (draft) was presented.

(2) Issues

As there seems to be areas where many houses are not connected to a sewer pipe network existing in the area and reclaimed areas where high groundwater level is causing groundwater infiltration into sewer pipes all over Panama City, there is a need to investigate and diagnose the sewer pipe network in these areas one after another and take appropriate measures against identified problems.

(3) Response to issues

As UCP plans to manage the sewerage systems systematically and preventively, UCP shall survey and diagnose the existing sewer pipes one after another starting from areas where many problems have been identified, based on this draft plan and the outputs of the OJT.

The above-mentioned investigation and diagnosis are expected to be implemented elsewhere, for example, as a soft component of a WB project, based on the outputs of this project.

6) Activity 3-6: Study the recycle system of treated wastewater and sludge. [First, second and third years]

(1) Details and outputs of activities

JET made a projection of sewage sludge generation in Panama, explained the technology used for recycling treated wastewater and sludge in Japan to the counterparts, and assisted them in a study of technologies that they require.

In the first year, JET made a projection of the volume of future sludge generation and explained the technology for recycling treated wastewater and sludge used in Japan.

The team estimated the remaining service life of the Cerro Patacon Landfill Site and examined the quality of treated wastewater and sludge to see whether their quality was appropriate for recycling in the second year.

The team studied the marketability of the treated wastewater and sludge and evaluated the possibility of their recycling in the third year.

The outputs of Activity 3-6 are shown in Attachment 2, Product M: Report on the Study of Recycling Treated Wastewater and Sludge (draft). An overview of the outputs is given below.

a) Outputs in the first year

JET made a projection of sludge generation in JDWWTP and explained a method for recycling sewage sludge appropriate for Panama to the counterparts at the weekly meetings. The team also gave a lecture on the recycling of sewage sludge at the Catholic University. In addition, the team explained the recycling of treated wastewater and sludge in a seminar for the counterparts.

b) Outputs in the second year

The amount of seawater infiltrated into sewage was estimated at between 1,000 m^3/day at neap tide and 10,000 m^3/day at spring tide from the measurements of EC of sewage. This observation

suggested that reverse flow of seawater into the sewerage network through the bypass gates, etc., was the main route of the infiltration. Realizing the effective use of treated wastewater will require raising the height of weirs on these infiltration routes by approximately 1 m.

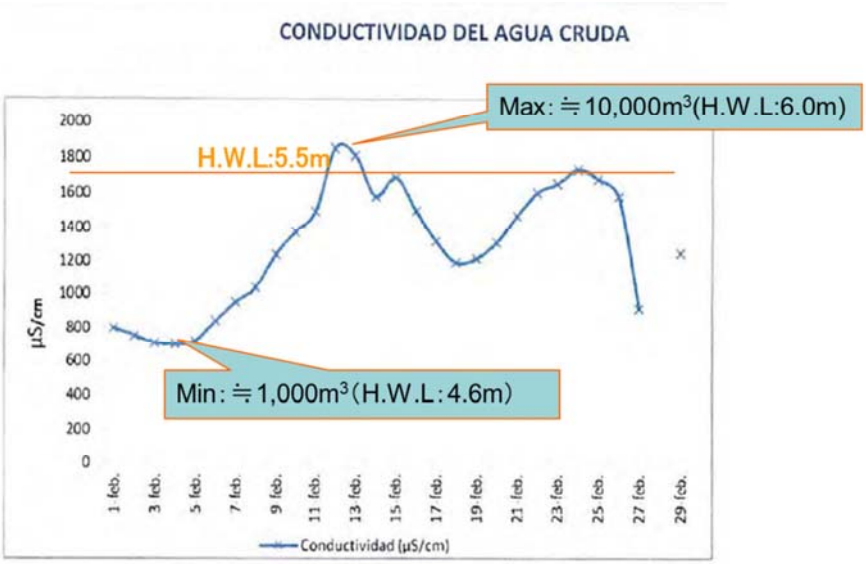


Figure 2.3.19 Relationship between reverse flow of seawater into the sewerage network in JDWWTP (EC values) and Tidal levels

A survey was conducted at the Cerro Patacon Landfill Site where the sewage sludge was disposed of to estimate its remaining service life. The volume of waste transported into the site had reached 2,000 t /day against the estimate of 1,200 t/day in the original plan and the site is planned to be closed in 2023. The third and fourth phases of the site are expected to have approximately five years of remaining service life. General waste is accepted at a price of 17 USD/t 24 hours a day at the site.

Figure 2.3.20 Phase 2 and 3 landfill sites viewed from Phase 1 site

c) Outputs in the third year

The Engineering Department hired a staff member responsible for the effective use of treated wastewater and sludge. Surveys on their marketability including interviews at cement plants, potential effective users of the sludge, and on the use of treated wastewater for road cleaning were conducted in the third year. Joint research with the Technological University of Panama on the fertilization effect was also commenced.

(2) Issues

A problem in promoting the recycling of treated wastewater and sludge is its low cost-effectiveness as the water rates and cost of sludge disposal are extremely low. The cost of treating sludge will be significantly higher than the cost of sludge disposal, which is currently at around 20 USD/t. This high cost, in particular, will be a problem in promoting the recycling of sludge and reducing the amount of sludge to be disposed of.

(3) Response to issues

UCP has assigned a person in charge of recycling sewage resources to the Engineering Department and has begun market researches and coordination with related organizations, and already begun a study on using sewage sludge as a raw material for manufacturing cement and fertilizer.

2.3.4 Output 4

1) Activity 4-1 Conduct public awareness surveys about water saving and sewerage management. [First year]

(1) Details and outputs of activities

A local subcontractor conducted the public awareness surveys in accordance with the implementation policy (on survey area, contents of questions, number of people to be surveyed, etc.) prepared in the detailed planning survey stage. Barriada 2000 in San Miguelito District, Panama City, in which a sewerage development project was in progress at the time of the detailed planning survey stage, was selected as the pilot area.

The survey results are shown in "Report on Public Awareness Surveys" (See attached Deliverable O for reference). An overview of the outputs is given below.

a) Water saving

Because piped water was not supplied 24 hours a day in the pilot area, each household had a tank to store water while the water supply was available and used it carefully. Consequently, the level of public awareness of water saving in the pilot area was high.

b) Discharge of wastewater

The public awareness of problems caused by wastewater discharged from households was found to be high in this area as 85 % of the households were aware of the potential adverse impact that wastewater discharged by them may have on the environment, sanitation, and water quality.

c) Water environment in the pilot area

The public awareness of environmental pollution was high as 99 % of the households considered that the environment was polluted at present. Meanwhile, they had mixed prospects for the future as the numbers of respondents expecting the improvement and deterioration of the environment were approximately the same.

d) Public awareness of wastewater management services

The finding that 32 % of the households surveyed believed that the sewerage system being constructed was of the conventional system of direct discharge into the sea suggested a relatively low public awareness of the disposal of wastewater. Not all the households had a correct understanding of the use of the sewerage system as 83 % of the household selected cooking oil as a substance that they could dispose of into the sewer.

e) Public awareness of the Panama City and Panama Bay Sanitation Project and JDWWTP

The public awareness of the project and JDWWTP was low as only 32 % and 11 % of the households responded that they knew the project and JDWWTP, respectively.

(2) Issues

The survey revealed that, while the public awareness of environmental pollution was high, the awareness that the environment could be improved was not widely held. As many households did not have the correct understanding of the roles and use of the sewerage system or did not know about this project or JDWWTP, the public awareness of the wastewater management services needs to be improved.

(3) Response to issues

JET has recommended methods for improving the public awareness including holding of workshops for residents and schoolchildren and distribution of publications intended for spreading knowledge and improving awareness of households to solve the above-mentioned problem.

2) Activity 4-2: Diagnose UCP's capacity as a baseline and define actions for strengthening UCP. [First year]

(1) Details and outputs of activities

UCP's capacity was evaluated at the beginning of the project in accordance with the policy (on evaluation items, grading, etc.) prepared in the detailed planning survey stage and actions for strengthening the capacity were planned and implemented.

The outputs of Activity 4-2 are described in "2.4 Achievement of the Project." The actions being taken by UCP at the beginning of the project are summarized as follows:

Table 2.3.1 Capacity Assessment of UPC (at the commencement of the project)

Activity	Description
Action Plan	Not prepared: UCP was taking actions in response to requests from outside, including those for participation in environmental events and tours of JDWWTP.
Contents of actions	UCP made a presentation on the roles of the sewerage system and explained the facilities in JDWWTP to the visitors. Outsourced contractors provided educational activities in environmental events on behalf of UCP. They showed videos conceptually depicting the adverse effect of water pollution and mangrove conservation activities and distributed project promotion goods (including caps with the project logo attached to them, T-shirts, and stationery) at a booth in these events.
Education on the use of sewerage	Not available
Actions in the communities in the sewerage development areas	UCP had almost no track record of providing educational activities in these communities. They had only responded to complaints. Although the TOR of the contractors of construction work required them to communicate with and provide environmental education to the area residents, it did not provide such requirements in detail.
Activities at educational institutions	Almost no track record of such educational activities by UCP: Although the TOR of the contractors of construction work required them to provide educational activities in schools near the work sites, UCP had found problems in the activities as it considered that their contents were not appropriate for children.

Activities for businesses discharging wastewater	While UCP had a plan for such activities, the plan had not been implemented.
Cooperation with other organizations	While UCP had participated in events organized by MiAMBIENTE and other organizations by invitation, there was no systematic cooperation between UCP and those organizations.

(2) Issues

UCP has conducted guided tours of JDWWTP without problems. Meanwhile, its activities in environmental events consist of conceptual contents that only emphasize generalized environmental problems included in existing environmental education packages and are not appropriate for their purpose of improving the public awareness of UCP's wastewater management services. In addition, as these activities are undertaken by contractors as part of their TOR, it is difficult not to have the impression that they implement such activities only out of the sense of duty. Above all, the lack of the awareness of these problems of UCP is the greatest problem.

The environmental education activities of UCP are not systematically implemented or their targets and purposes are not clearly defined. Awareness raising activities on the use of the sewerage have almost never been implemented for residents, businesses, and educational institutions in the sewerage development areas. No other effective activity has been observed in the areas either.

UCP outsources most of these activities to contractors. However, UCP is considered to have sufficient capacity to implement them by themselves as the quality of the presentations and services that it provides to visitors in JDWWTP is high.

(3) Response to issues

UCP shall consider the reasons for the existence of its department for environmental education, the purposes of providing the environmental education, the awareness of the sewerage users of the wastewater management services, and kind of awareness raising activities required to be taken. JET shall assist UCP in the planning, implementation, evaluation, and improvement of such activities.

3) Activity: 4-3 Conduct pilot activities to promote public awareness about water saving and sewerage management. [First, second and third years]

(1) Details and outputs of activities

JET implemented public awareness raising activities on water saving and sewerage management with the counterparts. The awareness raising activities were also implemented for the businesses that discharge wastewater. The team prepared the contents of the activities and evaluated their effects with the counterparts.

a) Outputs in the first year.

JET conducted a survey of public awareness of the sewerage system in the pilot area, analyzed the survey results, and prepared a presentation to enhance the awareness. The team organized the first

workshop (for students) in a primary school (Escuela República de Polonia) near the pilot area and used the presentation in the workshop. The team revised the presentation based on the reaction of the audience to the presentation and held the second workshop (for residents) at the same school. In both workshops, participants showed keen interest in and asked many questions concerning the water treatment in the wastewater treatment plant and things that may and may not be flushed down the sewer. Therefore, the team prepared draft teaching materials by adding detailed explanation of the treatment and items that may and may not be flushed down the sewer to the presentation. After discussion with a designer, the final version of the teaching material was published as a booklet.

b) Outputs in the second year

The use of the printed copies of the booklet in the guided tour of JDWWTP began in the second year. The project launched educational activities on environmental conservation using the booklet in primary schools in Calidonia Subdistrict (outside the pilot area) in cooperation with AAUD (where a JOCV in environmental education worked). Copies of the booklet were also distributed at the fish market of Panama City.

Figure 2.3.21 Guided tour of JDWWTP

The second edition (cartoon version) of the booklet was prepared by incorporating feedback on the original booklet collected in the various activities mentioned above, and printing the booklet. This second edition was made into a play, and students performed it in the third workshop (for students). The fourth workshop (for residents) was held in the second year.

JET held a discussion with the Ministry of Education on the extension of the environmental education to primary schools (outside the pilot area) in Panama City.

JET held a discussion with IDAAN on water saving and insisted on its importance in the 3R (reduce, reuse and recycle) promotion campaigns held at junior and senior high schools in San Miguelito Area.

The second edition of the booklet was well received by the public and additional copies were printed and distributed repeatedly. Production of video educational material based on the booklet began in the second year.


Figure 2.3.22 Distribution of the booklets

c) Outputs in the third year

The counterparts conducted an interview survey at the schools where the workshops had been held to verify the effect of the workshops. The survey revealed that the third workshop with the play performance had great impact on students by giving strong impressions to the audiences. Therefore, the fifth workshop (for students) was held at a primary school inside the pilot area (Escuela El Mirador) in the same form. The sixth workshop (for residents) was also held at the same primary school.


Figure 2.3.23 Workshop at primary school (in the form of a play)

After production of the video teaching material had been completed, JET held discussions with the board of education of San Muguelito District (in which the pilot area is located) on the extension of environmental education. In the second discussion, JET showed the video to the representatives of 47 primary schools in the district and distributed copies of the booklet to establish a network of cooperation.

Figure 2.3.24 Extension activities using video teaching material for the environmental education

JET continued cooperating with AAUD. They jointly implemented the 3R (water saving) education in addition to the booklet-based environmental education.

JET implemented awareness raising activities on the use of the sewerage system for those working at the Panama City Fish Market (including retailers, restaurant operators, and staff of the Panama Maritime Authority). The awareness of the participants of the need for improvement of the environment was high and they had a voluntary discussion for more than one hour after the presentation by the counterparts.

The second public awareness survey was conducted in the third year.

d) Distribution of the booklets

Copies of the booklets produced in this project have been distributed as mentioned below.

- February 2017 – first edition (picture book), 1,000 copies printed and distributed (by JET)
- August 2017 – second edition (cartoon), 1,500 copies printed and distributed (by JET)
- November 2017 – second edition, 1,000 copies printed and distributed (by JICA)
- December 2017 – second edition, 5,000 copies printed and distributed (by JET)
- June 2018 - second edition, 5,000 copies printed and distributed (by UCP)
- August 2018 - second edition, 10,000 copies printed and being distributed (by JET)

First edition (in a picture book)	Second edition (in a cartoon)

Figure 2.3.25 Booklets for environmental education and use of sewerage

(2) Impact of the project

JET conducted a public awareness survey to identify public needs, held workshops to address the needs, improved the presentations given in the workshops by incorporating the responses of the participants, used the improved presentations to develop teaching materials, held workshops using these materials, and used the feedback from the workshops to further improve the teaching materials. The counterparts developed their capacity and learned methods to improve their activities continuously through these PDCA-based activities.

The workshops for primary school students had a big impact on them and were received favorably by both students and teachers. The early workshops consisted of presentation by the counterparts. However, the participatory approach was incorporated in the workshop later and it was transformed into an occasion for voluntary activities including a play of students. Many students have written their names on the distributed booklets and taken good care of them. A significant number of students have read the booklet so many times that they can recite its text. They have understood the contents of the booklet so well that they can explain the roles of the sewerage system, mechanisms for wastewater transport, design of JDWWTP, and the roles of microorganisms in the activated sludge treatment to their parents in such occasions as the classwork presentation. These observations prove that the project has had impact everywhere.

Explaining the mechanism of wastewater treatment

Appeal for 3R-based water saving

Figure 2.3.26 Indirect effect of education on use of sewerage (classwork presentation at the Japanese school)

JET has already begun activities to extend the environmental education using the experience of the above-mentioned activities implemented and teaching materials (booklets and videos) prepared in this pilot project in cooperation with the Board of Education of San Miguelito District. At the same time, the team has begun discussion with the Ministry of Education on the planned extension of the activities to a larger area.

The educational activities of UCP have already spread to other areas of Panama City (Calidonia, Río Abajo, Mar Bella, etc.) through cooperation with JOCV and collaborative activities with AAUD.

The activities of UCP used to be unsystematic. However, the awareness and technical capacity of the counterparts has changed so significantly during the three years of OJT that they have come to be able to prepare future plans. The counterparts presumably had potentially high capacity before the project. JET's assistance has dramatically increased the use of this potential, which was rarely utilized in the past. This change is believed to be an impact of this project.

(3) Issues

While assisting the counterparts, JET repeatedly invited local residents to participate in the workshops through such means as informing guardians of students at local primary schools and obtaining support of local community leaders before holding the workshops. However, the number of local residents that participated in the workshop has never exceeded 20. This fact suggests that ordinary citizens are not so interested in the wastewater management services and improvement of the environment as school students and business operators.

Two public awareness surveys, a baseline survey and a follow-up survey, were conducted at the beginning and the conclusion of the project, respectively. As the baseline survey is a qualitative awareness survey for which high accuracy was not required, the sample number was only 100. Therefore, the statistical confidence of this survey is not high. For this reason, the results of the two surveys cannot be quantitatively compared. Nonetheless, rough comparison of the results revealed significant improvement in the awareness of the people in the project area of specific items including the use of sewerage. On the other hand, while some changes in a good direction were observed for

other items including “awareness of water supply services,” “awareness of water saving,” “adverse effect of wastewater on the environment” and “improvement of the environment with connection to the sewerage system,” these changes were small. In short, it has been difficult to draw the attention of adults or middle-aged and old residents to water-related problems and more difficult to make them aware of the problems.

(4) Response to issues

As it is impossible to implement the awareness raising activities to all sewerage users under any circumstances, JET recommends that the counterparts continue to focus their awareness raising activities on school children and business operators interested in water pollution.

4) Activity 4-4: Create and implement PR activities plan (draft) [First, second, and third years]

(1) Details and outputs of activities

JET created a PR activities plan (draft) (see Attachment 2, Product K for reference) using the rough draft of the PR activities plan prepared in the detailed planning survey preparation stage and implemented it with the counterparts.

a) Outputs in the first year

The PR activities for the project were implemented in various environmental education activities including workshops and guided tours of JDWWTP. A leaflet explaining the project and the function of the Johkasou was prepared for distribution to the press and copies of the leaflet were distributed to them at the ground-breaking ceremony of the unit. Four TV stations, two radio stations, and six newspapers (including on-line newspapers) covered and reported the ceremony. This press coverage publicized this project in Panama.

b) Outputs in the second year

The PR activities were implemented continuously as part of various environmental education activities. The PR activities implemented in the second year included the distribution of copies of the second edition of the environmental education booklet, preparation of the Japanese translation of the booklet, distribution of its copies at the Japanese school, PR activities in the fish market, distribution of the newsletters of project activities (in the workshops, in primary schools in the city, at the inauguration ceremony of the renovated fish market, at the venues of the events organized by JDWWTP, etc.), and establishment of a website of project activities.

c) Outputs in the third year.

The PR activities were implemented continuously as part of various environmental education activities. The PR activities implemented in the third year included distribution of copies of the second edition of the environmental education booklet, installation of PR panels (in primary schools in the pilot area and in the fish market), display of posters for raising of awareness of use of the

Johkasou, distribution of the newsletters of project activities, and updating of the project activity website.

Figure 2.3.27 Installation of PR panels and display of PR poster

(2) Issues

There were cases where installation of panels, which had been approved by local managers of installation sites (fish market), was disapproved by the supervisors (Panama City Government). In cases like these, it took very long to install PR panels after the plan was finalized.

(3) Response to issues

Deliberate planning (for quick implementation, direct negotiation with the supervisors and long-term perspectives) will be required to avoid the above-mentioned problem.

2.3.5 Implementing Training

The results of the training implemented in this project are shown below.

1) Training in Japan

(1) First Training in Japan

a) Training period

6 to 16 June 2016

b) Participants

A total of six managerial personnel of UCP including the General Manager

c) Schedule and contents

Table 2.3.3 Program of First Training in Japan

Date	Time	Form	Contents	Venue
June 5 (Sun.)			Arrival in Japan (at Narita Airport)	
June 6 (Mon.)	a.m.		Orientation and training briefing	JICA - Yokohama Center
	p.m.	Field trip	Visit to Yokohama Bay Area	
June 7 (Tue.)	a.m.	Lecture	Visit to Head Office of Nihon Suido Consultants (trip to JICA Headquarters) 11:00 –: Courtesy call	Head Office, Nihon Suido Consultants Co., Ltd.
	p.m.	Field trip	Visit to area around the Imperial Palace Trip (from Tokyo to Osaka)	
June 8 (Wed.)	a.m.	Field trip	[Lecture][Field trip] Regulations on effluent discharged from workplaces (Torishima Plant, Osaka Namari-suzu Seirensho Co., Ltd.)	Osaka City Sewerage Science Museum
	p.m.	Field trip	[Lecture] PR activities on wastewater management services for citizens and environmental education [Lecture] Presentation by the Panamanian participants [Field trip] Visit to the Sewerage Science Museum	Osaka City Sewerage Science Museum
June 9 (Thu.)	a.m.	Field trip	Fieldwork on a remote monitoring system of a PS	Pump Facilities Office, Sewerage Works Department, Waterworks Bureau, Kyoto City
	p.m.	Field trip	[Lecture] PR activities on water supply and wastewater management services for citizens [Lecture][Field trip] Stream rehabilitation project Get-together party in Kyoto City at night	Conference Room, Nishijin Textile Center
June 10 (Fri.)	a.m.	Field trip	Field trip to a plant manufacturing Johkasou	Shiga Plant, Kubota Corp.
	p.m.	Field trip	Field trip to a plant manufacturing raw materials of sewer pipes and pipe rehabilitation materials (Trip to the hotel via lakeshore of Lake Biwa after 16:00)	Shiga-Ritto Plant, Sekisui Chemical Co., Ltd.
June 11 (Sat.)	a.m.	Field trip	Field trip to water-related heritage sites in Kyoto (including the Lake Biwa Canal Museum, Lake Biwa Canal and Old aqueduct in Nanzenji Temple)	
	p.m.	Field trip	Field trip to water-related heritage sites in Kyoto (from Shimogamo Shrine to the Kamo River)	
June 12 (Sun.)	a.m.	Field trip	Visit to cultural heritage sites in Kyoto (from Kiyomizu Temple to Higasiyama/Gion Areas)	
	p.m.		Trip (from Kyoto to Yokohama)	

June 13 (Mon.)	a.m.	Lecture	Courtesy call to the Director General of the Bureau [Lecture] Briefing of the sewerage system in City of Yokohama, presentation by the Panamanian participants	Hokubu Wastewater Treatment Plant, Environmental Planning Bureau, City of Yokohama
	p.m.	Lecture	[Lecture] On PFI projects, explanation of Hub with panels [Field trip] Field trip to a digestion gas power generator (after moving to Hokubu Sludge Treatment Plant)	Hokubu Sludge Treatment Plant
June 14 (Tue.)	a.m.	Lecture	[Lecture] Effluent regulations, maintenance of sewer pipes	Hokubu Wastewater Treatment Plant
	p.m.	Lecture	[Lecture] Financing of wastewater management services [Lecture][Field trip] Use of treated wastewater (after moving to the Irie River) Get-together party in City of Yokohama at night	Hokubu Wastewater Treatment Plant
June 15 (Wed.)	a.m.	Lecture	Courtesy call to the Sewerage and Wastewater Management Department, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Site visit in Tokyo	MLIT
	p.m.	Lecture	Lecture on ledger system/asset management	JICA - Yokohama Center
June 16 (Thu.)		Presentation	Presentation of the training outputs, evaluation of the training and closing ceremony	JICA - Yokohama Center
June 17 (Fri.)			Departure from Japan (Narita Airport)	

d) Scenes in the training

	
Discussion with NPO staff members (June 8, 2016)	Field trip of the Osaka City Sewerage Science Museum (June 8, 2016)

	
Field trip of a PS of Kyoto City (June 9, 2016)	Lecture on operation and maintenance of PSs (June 9, 2016)

Figure 2.3.28 First Training in Japan

(2) Second Training in Japan

a) Training period

24 July to 3 August 2017

b) Participants

A total of 11: Head of the O&M Group and general staff members of UCP

c) Schedule and contents

Table 2.3.4 Program of Second Training in Japan

Date	Time	Form	Contents	Venue
July 23 (Sun.)			Arrival in Japan (at Narita Airport)	
July 24 (Mon.)	a.m.		Orientation and training briefing	JICA - Yokohama Center
	p.m.	Field trip	Visit to Yokohama Bay Area Trip (from Tokyo to Osaka)	
July 25 (Tue.)	a.m.	Lecture	History of the construction of wastewater treatment plants and water environment improvement On Ebie Sewage Treatment Plant	Osaka City Sewerage Science Museum
	p.m.	Field trip	Ebie Sewage Treatment Plant Visit to the Sewerage Science Museum Tenjin Festival	Ebie Sewage Treatment Plant Osaka City Sewerage Science Museum
July 26 (Wed.)	a.m.	Lecture	Human resource development in water supply and wastewater management services Public awareness raising and PR activities on water supply and wastewater management services	Head Office of the Waterworks Bureau, Kyoto City
	p.m.	Field trip	Use of equipment for the maintenance of sewer pipe networks	Ishida Treatment Plant
July 27 (Thu.)	a.m.	Field trip	Fieldwork on a remote monitoring system of a PS	Pump Facilities Office, Sewerage Works Department, Waterworks Bureau, Kyoto City

	p.m.	Field trip	Stream rehabilitation project Get-together party in Kyoto City at night	Conference Room, Nishijin Textile Center
July 28 (Fri.)	a.m.	Field trip	Field trip to a plant manufacturing Johkasou	Shiga Plant, Kubota Corp.
	p.m.	Field trip	Field trip to a plant manufacturing raw materials of sewer pipes and pipe rehabilitation materials	Shiga-Ritto Plant, Sekisui Chemical Co., Ltd.
July 29 (Sat.)	a.m.	Field trip	Field trip to water-related heritage sites in Kyoto (including the Lake Biwa Canal Museum, Lake Biwa Canal and Old aqueduct in Nanzenji Temple)	
	p.m.	Field trip	Field trip to water-related heritage sites in Kyoto (the Kamo River)	
July 30 (Sun.)	a.m.	Field trip	Visit to cultural heritage sites in Kyoto (Kiyomizu Temple, Yasaka Shrine and Gion Area)	
	p.m.		Trip (from Kyoto to Yokohama)	
July 31 (Mon.)	a.m.	Lecture	Welcome remarks of the director general of the bureau [Lecture] Briefing of the sewerage system in City of Yokohama, presentation by the Panamanian participants	Hokubu Wastewater Treatment Plant, Environmental Planning Bureau, City of Yokohama
	p.m.	Lecture	[Lecture] On PFI projects, explanation of Hub with panels [Field trip] Field trip to a digestion gas power generator (after moving to Hokubu Sludge Treatment Plant)	Hokubu Sludge Treatment Plant
Aug. 1 (Tue.)	a.m.	Lecture	[Lecture] Effluent regulations, maintenance of sewer pipes	Hokubu Wastewater Treatment Plant
	p.m.	Lecture	[Lecture] Financing of wastewater management services [Lecture][Field trip] Use of treated wastewater (after moving to the Irie River) Get-together party in City of Yokohama at night	Hokubu Wastewater Treatment Plant
Aug. 2 (Wed.)	a.m.	Field trip	Sewage Works Exhibition	Tokyo International Exhibition Center
	p.m.	Field trip	Embassy of Panama (courtesy call) Experience of Japanese culture	Embassy of Panama Asakusa
Aug. 3 (Thu.)		Presentation	Presentation of the training outputs, evaluation of the training and closing ceremony	JICA - Yokohama Center
Aug. 4 (Fri.)			Departure from Japan (Narita Airport)	

d) Scenes in the training

Field trip to Ebie Treatment Plant, Osaka City (July 25, 2017)

Field trip to the Osaka City Sewerage Science Museum (July 25, 2017)

	
Field trip of remote-control system in a PS in Kyoto City (July 27, 2017)	Field trip to a site of Stream Rehabilitation Project (July 27, 2017)

Figure 2.3.29 Second Training in Japan

2) Training in third country

(1) Visit to Parana State Sanitation Company, Brazil (Compania de Saneamento do Parana (SANEPAR), Brazil)

a) Period

21 to 26 November 2016

b) Participants

A total of 9

8 from UCP: the head of O&M Group and general staff members of UCP

1 from IDAAN: general staff member

c) Schedule and contents

Table 2.3.5 Program of Training in third country

Date	Time	Form	Contents	Venue
Nov. 20 (Sun.)			Arrival in Curitiba	
Nov. 21 (Mon.)	a.m.		Welcome remarks, presentation on the profile and business operation of SANEPAR, presentation by UCP	SANEPAR Head Office
	p.m.	Lecture Field trip	Outputs 1, 2 and 3 of the JICA project Explanation and field trip of the waterworks operation system	ditto
Nov. 22 (Tue.)	a.m.	Lecture	Lectures on survey, diagnosis and evaluation of pipe networks and the site of PRRU River Water Quality Survey	SANEPAR Head Office
	p.m.	Field trip	Field trip on demonstration of investigation and diagnosis of sewer pipes	Taruma
Nov. 23 (Wed.)	a.m.	Lecture Field trip	Briefing on anaerobic treatment Field trip to Atuba Sul Sewage Treatment Plant	SANEPAR Head Office Atuba Sul Sewage Treatment

				Plant
	p.m.	Field trip	Water Quality Laboratory Waterworks Museum	Taurma
Nov. 24 (Thu.)	a.m.	Lecture	Irai Dam Water Culture Museum – dam operation and maintenance Environmental education	Irai Dam
	p.m.	Field trip	Field trip to the dam Safety control of the dam	ditto
Nov. 25 (Fri.)	a.m.	Field trip	Small-scale sewerage system in Matinhos on the coast	Matinhos on the coast
	p.m.	Field trip	Morretes PS	Morretes
Nov. 26 (Sat.)	a.m.	Field trip	Curitiba City Planning (Bus transport and rainwater storing city planning parks)	In Curitiba City
	p.m.	Field trip	Curitiba City Planning (Bus transport and rainwater storing city planning parks)	ditto
Nov. /27 (Sun.)			Departure from Curitiba (to Panama)	

d) Scenes in the training

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Field trip to Water Quality Laboratory
(Nov. 23, 2016)</td><td>Field trip to Waterworks Museum (Nov. 23, 2016)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Environmental education at the Irai Dam
(Nov. 24, 2016)</td><td>Lecture on management of the Irai Dam
(Nov. 24, 2016)</td></tr>
</table>

	
Lecture on Matinhos Sewerage System (Nov. 25, 2016)	Field study in Morretes (Nov. 25, 2016)

Figure 2.3.30 Training in Third Country

3) Seminars

(1) First Seminar

a) Date

9 December 2016

b) Outline

JET organized a seminar on the latest technology for maintenance of sewer pipe networks, asset management, monitoring of large-scale pollution sources, basic knowledge of wastewater treatment, and recycling of treated wastewater and sludge.

	
Lecture on monitoring of large-scale pollution sources	Lecture on basic wastewater treatment

Figure 2.3.31 First Seminar

(2) Second Seminar

a) Date

22 November 2017

b) Outline

JET organized a seminar on human resource development plans, the impact on people's health caused by wastewater, requirements for the monitoring of large-scale pollution sources in Panama, and method for the diagnosis of sewer pipe networks in Panama.

	
Lecture on Human Resource Development plans	Lecture on methods for diagnosis of sewer pipe networks

Figure 2.3.32 Second Seminar

(3) Third Seminar

a) Date

12 September 2018

b) Outline

The counterparts took lead in this seminar. They made presentations on the details of activities implemented and plans for future activities for each output in the seminar.

	
Presentation by a counterpart (on Output 2)	Presentation by a counterpart (on Output 3)

Figure 2.3.33 Third Seminar

2.3.6 Meetings

1) JCC

JCC met as mentioned below.

Table 2.3.6 JCC meetings

Meeting	Date	Agenda	Implementation stage
1st	10 October 2015	Results of the detailed planning survey study Changes in PDM, Signature of MM	Detailed planning survey study
2nd	4 April 2016	Explanation of the Action Plan, Signature of MM	Full-scale implementation
3rd	6 December 2016	Activity report, Signature of MM	Full-scale implementation
4th	14 June 2017	Activity report, Signature of MM	Full-scale implementation
5th	4 December 2017	Activity report Handover of Johkasou, Signature of MM	Full-scale implementation
6th	19 June 2018	Activity report Handover of the equipment, Signature of MM	Full-scale implementation
7th	19 September 2018	Overall activity report, Verification of results of joint evaluation, Signature of MM	Full-scale implementation

2) Monthly Meetings

The monthly meetings were held as described below.

Table 2.3.7 Monthly Meetings

Meeting	Date	Agenda
1st	15 March 2016	Work plan of the first year Plan for the installation of Johkasou
2nd	8 August 2016	Activity report Installation of Johkasou Effective use of sewage sludge (seminar)
3rd	14 November 2016	Activity report Press tour for Johkasou
4th	24 May 2017	Work plan of the second year Action plan for the group training in Japan
5th	25 October 2017	Activity report Progress in the transition of UCP to a public enterprise
6th	18 May 2018	Activity report Explanation of the monitoring sheet

3) Weekly meetings

Weekly meetings were held as described below for information sharing, implementation of seminars, and reporting of the project outputs.

Table 2.3.8 Weekly meetings

Year	Assignment	Date	Number of participants	Remarks
First year	1	24 February 2016	7	
		2 March 2016	9	Explanation of Johkasou (by JET)
		9 March 2016	8	
		17 March 2016	11	Factory effluent regulations in Japan (by JET)
		23 March 2016	10	Report on LATINOSAN (by C/P)
		30 March 2016	10	Plan for PR activities of UCP (by C/P) Need for sanitation (by JET)
	2	14 July 2016	12	Progress in the installation of Johkasou (by JET) Impression of the training in Japan (by C/P)
		26 July 2016	18	Progress in the installation of Johkasou (by JET)
		4 August 2016	14	Progress in the installation of Johkasou (by JET) Factory effluent regulations (by C/P) Survey of DO of river water (by JET) Power consumption in JDWWTP (by JET)
	3	9 November 2016	15	Progress in the installation of Johkasou (by JET)
		17 November 2016	11	O&M of sewer pipes (by C/P)
		1 December 2016	17	Training in Third Country in Brazil
		14 December 2016	11	
2nd year	2	23 May 2017	10	Report on Group Training in Japan (by C/P)
		8 June 2017	10	Evaluation of biological treatment -Johkasou (by JET)
		19 June 2017	12	Survey of water infiltration with EC meter (by JET) Diagnosis of sewer pipes with simple camera (by JET)
		29 June 2017	12	Evaluation of activated sludge process (by JET) OJT on installation of flowmeter (by JET)
	3	26 October 2017	9	
		8 November 2017	6	Result of environmental education at schools (by JET)
		22 November 2017	13	
		6 December 2017	12	Functions of flowmeters (by JET)
3rd year	1	11 May 2018	4	Evaluation of the project (by JET)
		29 May 2018	13	Business plan (by JET)
		15 June 2018	7	Capacity assessment (by JET) Guidelines and monitoring plan (by JET) Wastewater treatment plant renovation plan (by JET) Equipment replacement plan (by C/P) Open-channel flowmeters (by JET)

4) Project Implementation Monitoring

A project implementation monitoring by JICA and City of Yokohama was conducted as mentioned in the table below.

<table>
<tr><td>Purposes of the dispatch of the project implementation monitoring team</td><td>(1) Analysis of the progress in achieving the project purpose and outputs at the time of the consultation survey and factors contributing to and obstructing the achievement
(2) Evaluation of the project on the five DAC evaluation criteria (relevance, effectiveness, efficiency, impact and sustainability)
(3) Recommendation for the actions to be taken by the Panamanian side until and after the completion of the project.</td></tr>
<tr><td>Survey period</td><td>9 days from 27 May (Sun) to 4 June (Mon.) 2018</td></tr>
<tr><td>Team members and responsibilities</td><td><table><tr><th>Name</th><th>Area of responsibility</th><th>Affiliation</th></tr><tr><td>KONDO Sei</td><td>Chief Advisor</td><td>Director, Environmental Management Team II, Global Environment Department, JICA</td></tr><tr><td>HAYASHI Takaaki</td><td>Cooperation planning</td><td>Associate Expert, Environmental Management Team II, Global Environment Department, JICA</td></tr><tr><td>MUROI Yasushi</td><td>Technical management I</td><td>Deputy Manager, Environmental Planning Bureau, City of Yokohama</td></tr><tr><td>IWASAKI Akihiro</td><td>Technical management II</td><td>Environmental Engineer, Environmental Planning Bureau, City of Yokohama</td></tr></table></td></tr>
<tr><td>Seminar</td><td>Date and time: 29 May (Tue.) 2018, 14:00 – 16:00
Theme: Lecture on effective use of sludge in City of Yokohama by Mr. Muroi in a weekly meeting</td></tr>
<tr><td>Wrap-up meeting</td><td>4 June (Mon.) 2018, 10:00 – 12:00
Agenda: Report on survey results and recommendations</td></tr>
</table>

2.4 Achievement of the Project

2.4.1 Progress in achieving Outputs and Objectively Verifiable Indicators

The tables below show the progress in achieving individual Project Outputs.

Table 2.4.1 Progress in achieving Output 1

Output 1 : Roles of organizations related to sanitation of Panama Bay are determined and a procedure to improve the organizational structure of implementation is proposed.	
Indicator	Actions taken and progress in achieving the indicator
1-1 Improvement of the organization, personnel to implement the tasks in UCP is proposed.	The Cabinet decided to enact a law of turning UCP into a public enterprise for the provision of high-quality wastewater management services and efficient and sustainable operation of the sewerage system. UCP is having in-house discussions on a business operation system of a public enterprise that UCP is currently aiming to become. A proposal has been prepared on the improvement of the organization and personnel of UCP required for it to perform the assigned duties as a public enterprise based on the results of the discussions. A business plan consisting of measures to facilitate business operation after the turning into a public enterprise has been proposed, though the preparation of such proposal is not in the activities for Output 1 of the original plan.
1-2 Human resource development plan (draft) of UCP is created.	The draft plan that ensures human resource development in all areas related to the wastewater management required for UCP to maintain smooth business operation has been created.
Overall evaluation: Output 1 has mostly been achieved.	

Table 2.4.2 Progress in achieving Output 2

Output 2 : Periodical water quality monitoring for wastewater pollution sources discharged into Juan Diaz Wastewater Treatment Plant (JDWWTP) is started.	
Indicator	Actions taken and progress in achieving the indicator
2-1 A database on large-scale wastewater sources is created.	The database was created in the first year. The counterparts have updated and accumulated data since then.
2-2 Draft guidelines for water quality monitoring of large-scale wastewater sources are created.	The draft water quality monitoring guidelines were created in the first year and some parts on the monitoring plan were revised in the second year.

2-3 Water quality monitoring plan for large-scale wastewater sources is created.	The water quality monitoring plan (draft) was created in the second year. In this plan, examples of the items that should be included in the regulations when UCP is turned into a public enterprise have been presented as issues to be considered in future.
2-4 The pilot project for wastewater treatment of large-scale wastewater sources is planned and implemented.	It was decided in the detailed planning survey study that Johkasou manufactured in Japan was to be installed in Nicolas Solano Hospital in La Chorrera City, West Panama Province, in the pilot project for wastewater treatment. The treatment capacity of the unit was set at 150 m^3/day based mainly on the scale and water consumption of the hospital. In the pilot project implemented after installation, the unit was used not only for treating the wastewater but also as a venue for demonstration for the extension of the use of the unit and OJT to learn measures to be taken on wastewater from places of business and the biological treatment. In the beginning, the unit could not be operated continuously for a long time because of the fluctuation of power source voltage. This problem was solved by protecting the control part of the unit with installation of an uninterruptible power supply (UPS). The operation of the treatment unit resumed in December 2017. Later, solid waste discharged from the hospital blocked the inflow pump. After this incident, UCP took the lead in the discussion on installation of a grinder. A record of the pilot wastewater treatment activity was created.
2-5 Mitigation measures on large-scale wastewater sources based on the pilot activity are formulated.	A study was conducted on measures to be taken at the large-scale wastewater sources and a report on the study was prepared. The report describes recommendations including those for better cooperation in taking measures at large-scale wastewater sources between organizations concerned with water quality monitoring, measures to be taken at business sites in areas to be connected to a sewerage system and responses to the violation of the water quality standards detected in the monitoring.
2-6 Water quality monitoring for large-scale wastewater sources is implemented.	The periodic monitoring of water quality at the large-scale wastewater sources began in 2018. The monitoring records were entered on a monitoring record page in the database to be used for updating information about businesses discharging wastewater. In this way, the monitoring records will be accumulated as database entries.
Overall evaluation: Output 2 has been achieved with the beginning of the monitoring of water quality at large-scale	

wastewater sources in 2018. The counterparts have been steadily accumulating knowledge concerning wastewater discharged from places of business through the accumulation of practical experience in the formulation of draft monitoring guidelines and visiting businesses.

Table 2.4.3 Progress in achieving Output 3

Output 3：UCP's ability to manage the sewerage facilities (JDWWTP and the rest, i.e. sewerage networks, collectors, PSs and interceptors) is improved.	
Indicator	Actions taken and progress in achieving the indicator
3-1 Items of sewerage facility management are identified.	The items of sewerage facility management have been identified and identified items have been used in the preparation of TOR (draft) and renovation plans (draft) mentioned below. Therefore, this indicator has been achieved.
3-2 Terms of Reference (TOR) are drafted for the next O&M contract for sewerage facilities.	JET presented TOR (draft) in the first year. Systematic O&M and preparation of short-term O&M plan were included in the O&M contract. It will be necessary to continue accumulating and analyzing data that form the basis of indicators of O&M.
3-3 A mid- and long-term O&M plan (incl. renovation plan and financial plan) for sewerage facilities is drafted.	A draft mid- and long-term O&M plan (including renovation plan and financial plan) for sewerage facilities was created. The mass balance in the WWTP in future was estimated with the increase in the inflow volume taken into account. A plan was presented on the projection of the costs of mid- and long-term renovation of required mechanical and electric facilities and maintenance costs including costs of electricity, chemicals and outsourcing which were expected to increase with the increase in the inflow volume. It will be necessary to secure funding for asset management.
3-4 OJT on the investigation and diagnosis methods for existing sewers is implemented.	OJT on the investigation and diagnosis methods for the existing sewers was implemented and a report on the OJT has been created. The technology for the survey using OD meter, flowmeters, TV camera, and EC meter and the smoke test has been transferred in the OJT on the survey method.
3-5 O&M plan (draft) of existing sewer pipe network is created.	An O&M plan (draft) of the existing sewer pipe networks was created. Problems on sewer pipes were detected and a plan (draft) was presented on a survey method appropriate for the nature of each problem.
3-6 The recycling system	A study was conducted on recycling of treated wastewater and

of treated wastewater and sludge is studied.	sludge and a report of the study was created. A draft plan on the recycling of treated wastewater and sewage sludge was presented and UCP began a survey of their marketability in the first year, which was earlier than planned.
Overall evaluation: The activities for Output 3 have been implemented smoothly and the output has been completely achieved by the conclusion of the project.	

Table 2.4.4 Progress in achieving Output 4

Output 4 : UCP's capacity of education and beneficiaries awareness of water saving and proper use of sewerage facilities is improved.	
Indicator	Actions taken and progress in achieving the indicator
4-1 UCP's activities of education and public awareness are continuously carried out.	It has been confirmed that UCP is implementing the activities continuously. This indicator is being achieved steadily.
4-2 Public understanding about water saving and sewerage management is improved.	The workshops organized for primary school students and business operators were well-received by the participants and their understanding of the subjects of the workshops has improved significantly. A report of the public awareness surveys was created. The comparison of the results of the questionnaire surveys conducted before and after the project implementation has revealed significant improvement in the public awareness of certain items concerning the use of sewerage system. The comparison has also revealed favorable changes in the awareness of many other items. However, the changes in this case are not large. In short, it is difficult to draw attention of the general public to the sewerage system and it is more difficult to raise awareness of it.
Overall evaluation: Output 4 is being achieved steadily. Various materials for environmental education have been created and the training of facilitators has been implemented as planned in this project so far. The future extension of the activities that have been implemented in the pilot area to the entire service area of JDWWTP will require an effort to establish a cooperative relationship with other organizations involved in the wastewater management services including MEDUCA.	

2.4.2 Progress in achieving Project Purpose and its Objectively Verifiable Indicators

The table below shows the progress in achieving Project Purpose.

Table 2.4.5 Progress in achieving Project Purpose

Project Purpose : UCP's capacity of administration and O&M management for the facilities implemented by "the Panama City and Panama Bay Sanitation Project" is improved.	
Indicator	Actions taken and progress in achieving the indicator
1. Organizational structure, duties and necessary staffing of UCP are drafted.	Organizational structure, duties and necessary staffing of UCP have been drafted.
2. Monitoring of wastewater quality is conducted regularly.	As mentioned above in “Progress in achieving Outputs,” the monitoring of wastewater quality at large-scale wastewater sources began in 2018 and the data collected in the monitoring have been accumulated in a database. The monitoring is expected to be implemented periodically in the future.
3. The sewerage facilities are managed based on the plans developed in the Project (i.e., the monitoring plan, O&M plan, etc.).	O&M of the facilities is planned to be outsourced in accordance with the mid- and long-term facility O&M plan (draft) and O&M plan for the existing sewers (draft). TOR (draft) for O&M is planned to be used in the preparation of the contract for the next term. UCP has assigned persons in charge of recycling treated wastewater and sludge to the Engineering Division and they began a survey of the marketability of the treated wastewater and sludge.
Overall evaluation: The implementation of this project is thought to have improved the capacity of UCP in the operation and maintenance of sewerage facilities steadily. The Project Purpose has been achieved. The environmental education in this project has achieved its output in the project. In addition, its effect has increased as its outputs have been used in activities of other organizations and JOCVs and is extending not only in the pilot area but throughout the Panama City. In this way, the environmental education has produced a large impact.	

2.4.3 Result of the Capacity Development

Measures that gave special consideration to capacity development (CD) were implemented in this project because it aimed at improving the wastewater management. Emphasis was placed on CD at the level of organization (see the conceptual diagram in Fig. 2.4.1), *i.e.,* the contents of operational activities, and measures with the potential for the expansion to the social level were implemented in

this project. The outputs of this project can be evaluated with the results of the capacity assessment (CA) implemented at various stages of the projects.

1) Assessment method

The capacity development in five categories, organizational structure, human resource development, water quality regulations, facility maintenance, and public awareness raising, was assessed in this project. In the assessment, each category was divided into two to four subcategories, each of which consisted of two to four assessment subjects. The capacity of the counterparts was assessed on a total of 50 subjects. Efforts were made to make the assessment as objectively as possible.

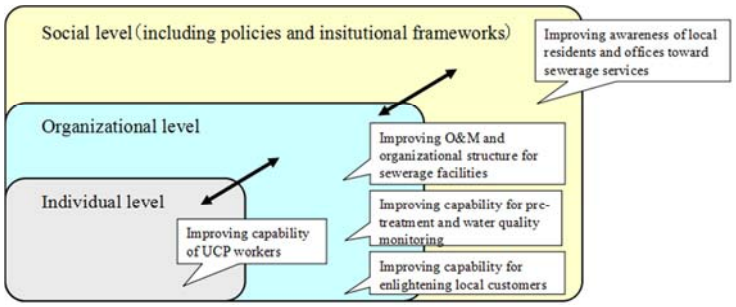


Figure 2.4.1 Schematic diagram of capacity development

a. Assessment subjects: A total of 50 subjects corresponding to the activities for Project Outputs were selected and classified
b. Level of achievement: Assessment on the scale of 0 to 4, 0: no action, 1: in planning stage, 2: activities begun to be taken, 3, partially achieved and 4: fully achieved
c. Assessment method: Baselines were set by JET as objectively as possible. The details of activities newly taken or improved in the project were verified and analyzed in the later assessments.
d. Time of assessment: Three times, in the beginning of the project (baseline assessment, in the first year), June 2017 (in the second year) and June 2018 (in the third year)

2) Assessment result

Table 2.4.6 shows the result of the assessment on each subject. The time of assessment is indicated with different colors. A subject with no gray marking (indicating the baseline survey result) is a subject whose assessment grade was 0 at the time of the baseline assessment. A subject with no green (indicating the result of assessment in the second year) or orange (indicating that in the third year) marking indicates that no progress had been made on the subject since the previous assessment. The table shows a general trend of increase in the level of achievement. However, it also shows that there is a room for further improvement for almost all the subjects.

Table 2.4.6 Assessment of capacity of UCP

Category	Subcategory	Subject	Achivement 1	2	3	4
Organizational structure (Output 1)	Personnel	Recognition of problems by executives				
		Number of personnel				
		Decision-making mechanism				
	Form of organization	Purposes and scope of work of the organization				
		Plan for reorganization				
	Cooperation within the organization	Atmosphere in workplaces				
		Sharing of duties and cooperation				
Human resource development (Output 1)	Human resource management/assignment	Appropriate use of human resources				
		Operation of a personnel assignment system				
		Number of skilled workers				
	Human resource development	Training plan				
		Training period				
Water quality regulations (Output 2)	Establishment of implementation method	Database				
		Guidelines				
		Monitoring plan				
	Human resource development	Development of capacity of individuals				
		OJT on monitoring				
		Preparation of countermeasures				
		Team development				
	Monitoring	Periodic monitoring				
		Database updating				
Facility management (Output 3)	Sewer mains and pumping stations	State of facilities and preventive maintenance				
		Inspection survey/diagnosis				
		O&M				
		Preparation and use of TOR				
		Materials and equipment				
	JDWWTP	State of facilities and preventive maintenance				
		Inspection survey/diagnosis				
		O&M				
		Preparation of renovation plans/cost identification				
		Effective use of treated wastewater and sludge				
	Existing sewer pipes of IDAAN	Inspection survey/diagnosis				
		Acquisition of survey technology				
		O&M				
		Standard manuals/record keeping				
		Survey equipment				
Public awareness raising (Output 4)	Information dissemination to sewerage users and citizens	Establishment and updating of a website				
		Preparation of awareness raising tools such as pamphlets				
		Education on water saving and sewerage				
		Periodic publication of newsletters				
		Use of audio-visual teaching materials				
	Participation of sewerage users and citizens	Tour of the wastewater treatment plant				
		Participation in events organized by citizens				
		Collaboration with local communities				
		Recruitment of respondents of questionnaires from the public				
	Cooperation with other organizations	Schools (Ministry of Education)				
		Participation in events organized by other organizations				
		NGOs, etc.				
	Information dissemination to operators of businesses discharging wastewater	Training for business operators				
		Distribution of reference materials on the use of sewerage system				

0: no action, 1: in planning stage, 2: activities begun to be taken

3, partially achieved and 4: fully achieved

Baseline June-2017 June-2018

In the following, the results of CA on all the assessment subjects and the subjects concerning each Project Output are shown as the changes with time in the frequency distribution of the level of achievement.

Figure 2.4.2 shows a significant overall development of the capacity of UCP in the assessment on all the assessment subjects. However, it should be noted that the development of capacity revealed by this assessment includes not only the development achieved by the implementation of this project but also that achieved by the self-help effort of UCP staff members and through assistance from other donors. The result of CA on the assessment subjects concerning each Project Output is described in the following. The results of the baseline assessment and the levels of achievement differ between Project Outputs.

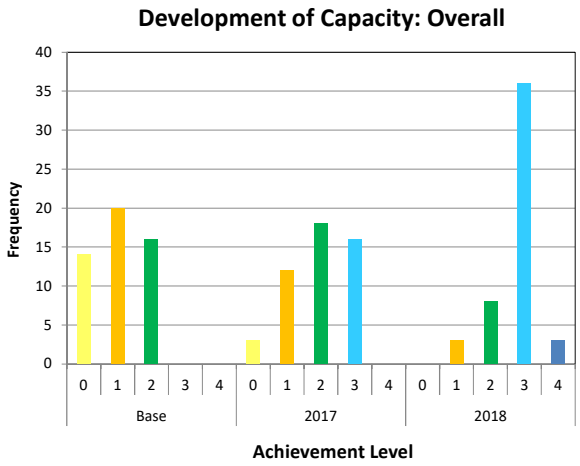


Figure 2.4.2 Overall development of capacity in all Project Outputs

3) Capacity development concerning Output 1

Figure 2.4.3 shows the development of the capacity concerning Project Output 1. The capacity in the organizational structure and human resource development was assessed concerning Project Output 1.

The development of the capacity in the organizational structure from the time of the baseline assessment is seen in the facts that

- A personnel plan was formulated and the number of personnel has increased steadily,
- The preparation for the introduction of a documentation system is in progress,
- The plan of turning UCP into a public enterprise was formulated, and
- Cooperation within the organization has been facilitated through the implementation of this project.

The capacity development concerning the human resource development from the time of the baseline assessment is seen in the facts that

- Personnel reassignment has been conducted and the number of qualified workers has increased, and
- The training plan has been improved and training period has been increased.

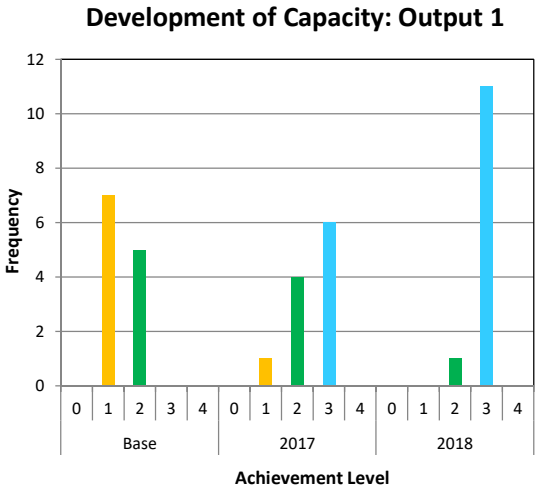


Figure 2.4.3 Capacity development concerning Output 1

4) Capacity development concerning Output 2

Fig. 2.4.4 shows the development of the capacity concerning Project Output 2. The capacity in the water quality regulations was assessed concerning Output 2.

The development of the capacity in water quality monitoring, which had not been implemented before the baseline assessment and, therefore, the grade of the level of achievement of all the assessment subjects was 0, is seen in the facts that:

- The monitoring method has been established and monitoring has begun,
- Persons in charge of the water quality monitoring have been assigned and their capacity in the monitoring has improved, and
- Monitoring data have been updated.

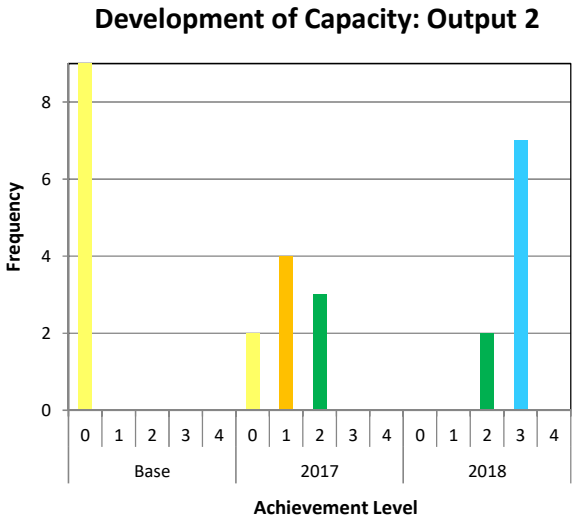


Figure 2.4.4 Capacity development concerning Output 2

5) Capacity development concerning Output 3

Fig. 2.4.5 shows the development of the capacity concerning Project Output 3. The capacity in the sewerage facility management was assessed concerning Output 3.

The development of the capacity from time of the baseline assessment is seen in the facts that:

- Outsourcing aiming at systematic O&M based on TOR has begun,
- A study on the effective use has been promoted, the renovation plan prepared and the amounts of required long-term investment and maintenance cost estimated, and
- The existing sewer pipes of IDAAN, which had hardly been maintained before this project, have partially been maintained and the counterparts have acquired the survey technology in the OJT for investigation and diagnosis.

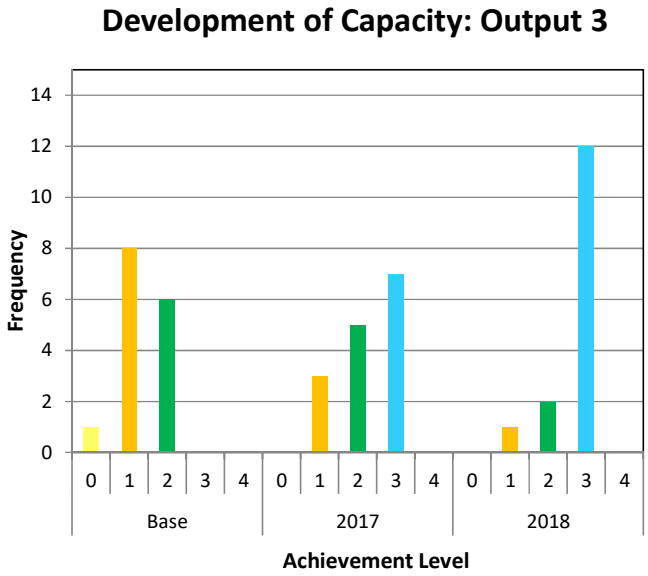


Figure 2.4.5 Capacity development concerning Output 3

6) Capacity development concerning Output 4

Fig. 2.4.6 shows the development of the capacity concerning Project Output 4. The capacity in public awareness raising was assessed concerning Output 4.

The development of the capacity from the time of the baseline assessment is seen in the facts that

- The development of environmental education booklets has improved the efficiency of the educational activities,
- The creation of an educational video from the booklets has improved the extension of the education dramatically,
- The tour of the treatment plant and awareness raising activities for adult residents have room for improvement in terms of contents and frequency,
- The quality of the educational activities at primary schools has improved dramatically, and
- Cooperation with AAUD has begun.

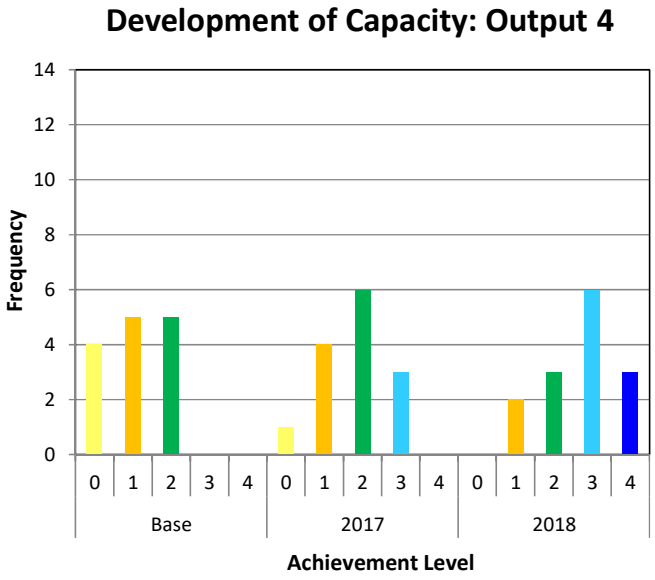


Figure 2.4.6 Capacity development concerning Output 4

2.5 History of Revision of PDM

The first meeting of the JCC of this technical cooperation project was held on 16 October 2015. The participants discussed the revision of the MoU (including that of the PDM) concluded in January 2015. Table 2.5.1 shows the revised PDM.

Table 2.5.1 Revised PDM (1/1)

	Contents	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal	Mitigation measures for Panama Bay's pollution are conducted sustainably in Panama Metropolitan Area.	The situation of wastewater management is periodically reported	Periodical reports	
Project Purpose	UCP's capacity of administration and O&M management for the facilities implemented by "the Panama City and Panama Bay Sanitation Project" is improved.	1 Organizational structure, duties and necessary staffing of UCP are drafted. 2 Monitoring of wastewater quality is conducted regularly. 3 The sewerage facilities are managed based on the plans developed in the Project (i.e., the monitoring plan, O&M plan, etc.).	1 Draft organizational structure, duties and necessary staffing of UCP 2 Monitoring and management records 3 Hearing from staff members	The policies relating to wastewater management are not changed drastically.
Outputs	1.Roles of organizations related to sanitation of Panama Bay are determined and a procedure to improve the institutional structure of implementation is proposed.	1-6 Improvement of the organization, personnel to implement the tasks in UCP is proposed. 1-7 Human resource development plan (draft) of UCP is created.	1-6 Proposal for improvement 1-7 The human resource development plan (draft) of UCP	The institutional setups for the Project implementation are not changed drastically.
	2. Periodical water quality monitoring for wastewater pollution sources discharged into Juan Diaz Wastewater Treatment Plant (JDWWTP) is started.	2-1 A database on large-scale wastewater sources is created. 2-2 A draft guideline for water quality monitoring of large-scale wastewater sources is created. 2-3 Water quality monitoring plan for large-scale wastewater sources is created. 2-4 The pilot project for wastewater treatment of large-scale wastewater sources is planned and implemented. 2-5 Mitigation measures on large-scale wastewater sources based on the pilot activity are formulated. 2-6 Water quality monitoring for large-scale wastewater sources is implemented.	2-1 A database on large-scale wastewater sources 2-2 A draft guideline for water quality monitoring of large-scale wastewater sources 2-3 Water quality monitoring plan for large-scale wastewater sources 2-4 The record for pilot project of waste water treatment of large-scale wastewater sources 2-5 Study report for mitigation measures on large-scale wastewater sources based on the pilot activity 2-6 Water quality monitoring reports of large-scale wastewater sources	
	3. UCP's ability to manage the sewerage facilities (JDWWTP and the rest, i.e.. sewerage networks, collectors, pumping stations and interceptors) is improved.	3-1 Items of sewerage facility management are identified. 3-2 Terms of Reference (TOR) are drafted for the next O&M contract for sewerage facilities. 3-3 A mid- and long-term O&M plan (incl. renovation plan and financial plan) for sewerage facilities is drafted. 3-4 OJT on the survey and diagnosis method for existing sewers is implemented. 3-5 O&M plan (draft) of existing sewer pipe network is created. 3-6 The recycle system of treated wastewater and sludge is studied.	3-2 A draft Terms of Reference (TOR) for the next O&M contract for sewerage facilities 3-3 A mid- and long-term draft O&M plan for sewerage facilities 3-4 OJT report for the survey and diagnosis method for existing sewers 3-5 O&M plan (draft) of existing sewer pipe network 3-6 Study report for the recycle system of treated wastewater and sludge	
	4. UCP's capacity of education and beneficiaries awareness of water saving and proper use of sewerage facilities is improved.	4-1 UCP's activities of education and public awareness are continuously carried out. 4-2 Public understanding about water saving and sewerage management is improved.	4-1 Activity plan of UCP 4-2 Public awareness survey report	

Table 2.5.1 Revised PDM (1/2)

Activities		Inputs		Pre-Conditions
		Japan side	Panama side	
1-1	Study current laws and policies about aquatic environment, wastewater discharge, wastewater treatment and industrial wastewater in Panama.	1. Experts Consultants - Chief advisor / Institutional management - Assistant Chief Advisor / Environmental education - Wastewater quality control - O&M of sewerage facilities / Asset management / Financial management - Wastewater treatment Advisors - Advisors from the City of Yokohama 2. Training - Training in Japan - Training in Panama - Training in a third country 3. Equipment Necessary equipment to be determined	1. Counterpart staffs - Counterpart staffs for each member of Japanese expert - Management staffs for the wastewater quality monitoring system - Management staffs for the pilot activities 2. Facilities - A project office with necessary furniture, air conditioners, internet facility, etc. 3. Counter budget - Salaries and allowances for the Panamanian counterpart staffs - Costs for O&M of equipment provided by the Japanese side	The inputs from the Panamanian side are secured.
1-2	Review the current master plan and ongoing projects regarding Panama Bay purification.			
1-3	Study the current status, and future plans of the sewerage facilities (including pumping stations) and industrial wastewater treatment plants (if any) in Panama Metropolitan Area.			
1-4	Review the current roles and duties of UCP and IDAAN regarding wastewater management.			
1-5	Identify necessary duties for wastewater management and support clarifying the division of the roles of present and future responsible organizations.			
1-6	Review the duties, institutional setups and personnel of UCP.			
1-7	Create human resource development plan (draft) of UCP.			
2-1	Survey the situation of large-scale sources, whose effluent is discharged into JDWWTP.			
2-2	Train UCP/MINSA staff members how to inspect and control effluent quality from large-scale wastewater sources.			
2-3	Create a database on large-scale wastewater sources.			
2-4	Create a guideline for water quality monitoring of large-scale wastewater sources.			
2-5	Create the water quality monitoring plan for large-scale wastewater sources.			
2-6	Plan and implement the pilot project of wastewater treatment for large-scale wastewater sources. (e.g. installation of an advanced treatment unit (JOHKASO) for a hospital)			
2-7	Study mitigation measures on large-scale wastewater pollutant sources (industrial, commercial and institutional sources flow into the JDWWTP), based on the pilot activity.			
2-8	Implement water quality monitoring for large-scale wastewater sources.			
3-1	Identify necessary items for O&M and asset management of sewerage facilities.			
3-2	Draft a TOR proposal for the next O&M contract for sewerage facilities to support UCP's supervision.			
3-3	Draft a mid- and long-term renovation plan (draft), financial plan (draft) and O&M plan (draft) for sewerage facilities (JDWWTP and the rest) based on the data of sewerage facility management (e.g. plans for O&M cost, content of O&M contract, asset management, renovation planning, risk management, contingency measure, etc.).			
3-4	Implement OJT on the survey and diagnosis met			
3-5	Create O&M plan (draft) of existing sewer pipe r			
3-6	Study the recycle system of treated wastewater a			
4-1	Conduct public awareness surveys about water s			
4-2	Diagnose UCP's capacity as a baseline and defin			
4-3	Conduct pilot activities to promote pubic aware			
4-4	Create and implement PR activities plan.			

3 Results of Joint Evaluation

3.1 Purpose and Method of Evaluation

In the joint evaluation, the process and achievement of the project were comprehensively analyzed based on the comments of the Japanese and Panamanian sides with focus on the following:

- Evaluation of the level of achievement with the five DAC Criteria for Evaluating Development Assistance (relevance, effectiveness, efficiency, impact, and sustainability),
- Identification of factors facilitating and obstructing the implementation process, and
- Identification of lessons learned from the implementation process which may serve as a useful reference for other similar projects.

In the evaluation, questionnaire and interview surveys were conducted to collect opinions of the counterparts, experts, and people involved in wastewater management on the matters mentioned above from various viewpoints. The draft evaluation report was prepared based on the collected opinions. The members of the stakeholders' meeting had a discussion regarding this draft. The draft was revised incorporating the opinions collected in the stakeholders' meeting and the revised draft was submitted to JCC for deliberation and JCC finalized the report after deliberation.

3.2 Result of the Evaluation based on DAC Evaluation Criteria

3.2.1 Summary of Evaluation Result

Tables 3.2.1 and 3.2.2 show the results of the evaluation by JET and the Panamanian side and the details of the self-evaluation by JET, respectively.

Table 3.2.1 Result of the Evaluation based on DAC Evaluation Criteria

Evaluator	DAC evaluation criteria				
	Relevance	Effectiveness	Efficiency	Impact	Sustainability
Self-evaluation by JET	High	High	Relatively high	High	Fair
Evaluation by the counterparts	4.7	4.4	4.6	4.5	3.9
(Reference) Evaluation by the Project Implementation Monitoring Team	High	High	Relatively high	High	Fair

※The counterparts evaluated the project on a scale up to 5.

Table 3.2.2 Results of the evaluation based on DAC Evaluation Criteria (self-evaluation of JET)

	Relevance	Effectiveness	Efficiency	Impact	Sustainability
	Consistency with the needs of the counterparts, policies of GOP and the assistance policy of GOJ	Level of achievement of Project Purpose and purposes of each Project Output	Level of achievement of output relative to input	Social, economic, and environmental impact derived from the project implementation (either positive or negative or either predicted or unpredicted)	Whether Project Outputs can be sustained after the completion of the project
Project Purpose UCP's capacity of administration and O&M management for the facilities implemented by "the Panama City and Panama Bay Sanitation Project" is improved.	**High** The project is highly consistent with the water sector policy of GOP, "the 100-0 Program," and the assistance policy of GOJ, "improvement of living and sanitary environments in the Panama Metropolitan Area," and the needs of the counterparts for capacity development in the sewerage facility management.	**High** The counterparts' capacity in O&M of sewerage facilities has improved steadily in this project.	**Relatively high** High-quality output has been produced with the minimum human resource input. The JET managed to share information and problems with the counterparts not only in JCC but also in the periodic meetings organized by the counterparts in a timely fashion. Training in Japan and a third country has greatly facilitated the realization of Project Output.	**High** The cooperation between the project and organizations involved in wastewater management and other donors, which has been improved, has large impact on environmental and sanitation projects in Panama. The implementation of the training in Japan and a third country had great impact on the counterparts and citizens of Panama.	**Fair** The Project Purpose has been achieved. However, because of the uncertainty over the business environment including the progress of turning UCP into a public corporation, there is a certain risk regarding the sustainability of the outputs. Adjustment of the financing (appropriate setting and collection of the sewerage user fees) is required for the continuation of the duties of UCP itself.
Output 1 Roles of organizations related to sanitation of Panama Bay are determined and a procedure to improve the institutional structure of implementation is proposed.	**High** The relevance of Output 1 is considered very high because there are multiple organizations involved in conservation of the water environment including UCP, IDAAN, and MiAmbiente, and the responsibility sharing among these organizations has not been clearly defined and UCP is at a turning point as it is planned to be turned into a public corporation.	**High** While discussions were being held on the organizational structure of UCP on the assumption that it will be turned into a public corporation, a plan for the improvement of the organizational structure and personnel assignment of UCP was proposed based on the discussions for the performance of its duties to enable more effective and efficient service provision. A plan that ensures human resource development in all areas concerned with the wastewater management was created.	**High** Japanese experts with ample experience in sewerage administration examined the situation that the counterparts were in and the project implementing structure in future and proposed a business plan for effective and steady implementation of the services in future. The business plan may be used in the preparation of various plans by other donors.	**High** Plans and advice made in this output are expected to help UCP formulate its policy as a public corporation in future and have made an impact on its business operation in future. In practice, positive effect on the future business management is expected from the plans and advice as they include the use of the current SIG for operational improvement, focusing on management = finances and integration of individual IT systems into MIS.	**Relatively high** The output of the activities for Output 1 is expected to be used in the process of turning UCP into a public corporation in future. UCP is highly aware of the importance of human resource development as an organization responsible for wastewater management in Panama. Therefore, it is expected to implement the activities for this output continuously after the completion of this project. Meanwhile, attention shall be paid to the progress of turning UCP into a public corporation because it is deeply connected with the sustainability of this output.
Output 2 Periodical water quality monitoring for wastewater pollution sources discharged into Juan Diaz Wastewater Treatment Plant (JDWWTP) is started.	**High** The activities for Output 1 are very significant considering the current state in Panama and other developing country in which the treatment of factory effluent is an urgent issue to be addressed and the seriousness of the effect that large-scale sources have on wastewater treatment at sewage treatment plants.	**High** Preparation of the draft water quality monitoring guidelines and the draft water quality monitoring plan has begun. A water quality monitoring project of the counterparts has begun with the implementation of the pilot project. On the assumption that UCP is to be turned into a public corporation, a proposal was made on the matters concerning effluent from places of business to be included in regulations to be established for the implementation of effective water quality monitoring.	**Relatively high** It was possible to provide sufficient advice and OJT to the counterparts on work ranging from the work in the field to legal regulations by the dispatch of Japanese experts with full knowledge of the administrative and practical aspects of the effluent regulations. Meanwhile, the delay in the progress of the pilot project due to various factors and contamination of the system with solid waste had some influence on the output.	**High** This output seems to have produced larger-than-ever impact on UCP and relevant organizations. Such impact includes frequent conversation with MiAmbiente and establishment of a network with the restaurant industry, a source of wastewater. The Japanese technology was publicized with the coverage of the pilot project in the media and guided tours of the pilot project.	**Relatively high** The technology transfer that forms the basis of the water quality monitoring project has been completed. However, for the continuous realization of this output, as Output 1, the roles of UCP must be clarified and guaranteed in the process of its turning into a public corporation. A study needs to be conducted on strengthening the organizational structure for implementing the water quality monitoring continuously and fully.
Output 3 UCP's ability to manage the sewerage facilities (JDWWTP and the rest, i.e.. sewerage networks, collectors, pumping stations and interceptors) is improved.	**High** This output is very important for UCP in providing appropriate guidance to contractors and supervising their activities under the circumstances that UCP has to operate and maintain the first large-scale sewage treatment plant in the country and maintain a large quantity of sewer pipes in unknown condition with unknown history of maintenance.	**High** The capacity of the counterparts in facility management has improved through the creation of a mid- and long-term facility management plan, a study on recycling of sewage sludge and treated wastewater, and implementation of the OJT on survey and diagnosis of sewer pipes.	**High** It was possible to implement OJT efficiently and in a timely fashion with the guidance of the experts based on their full knowledge of sewerage systems, selection of equipment to be provided appropriate for the needs of the counterparts, and smooth procurement of equipment with assistance from JICA Panama Office.	**High** As the method for the survey and diagnosis of sewer pipelines proposed in this output has been included in the specifications of a consultant outsourcing contract of another donor, this output has impact outside this project.	**High** The activities required for the maintenance of sewerage facilities are integrated in this output. They should be implemented continuously after the completion of the project regardless of political situation.
Output 4 UCP's capacity of education and beneficiaries awareness of water saving and proper use of sewerage facilities is improved.	**High** Because the sewerage users are located in the upper reaches of the sewerage network, it is essential to raise their awareness of the wastewater management. The implementation of the project and work of the counterparts will be facilitated greatly by informing the people of the functions of the sewerage system, which are usually unrecognized, and gaining people's understanding of the importance of water environment conservation.	**High** UCP used to provide conceptual environmental education. The capacity of the counterparts in public awareness raising has certainly improved with the acquisition of practical methods to inform people of the roles of sewerage and UCP in this project.	**High** Synergic and complementary effect created in the collaboration with AAUD and other organizations has produced significant output. The video teaching materials and other teaching materials are used for the extension of the project outputs. From these observations, it is considered that the activities for this output have produced the maximum output with limited resources.	**High** The output including the collaboration with JOCVs, distribution of manga booklets that both adults and children can enjoy and performance of plays by student had large social impact. The outputs of this project are expected to be extended to other organizations and the entire Panama City with the creation and use of the general-purpose video.	**Relatively high** The target of the project has been extended outside the pilot area in cooperation with the Ministry of Education. UCP has learned this process. UCP is expected to work continuously after the completion of the project to achieve the goal of extending the output throughout the country using the capacity and the teaching materials developed in this project.

3.2.2 Relevance

Conclusion of the evaluation: High

The relevance of the project was evaluated with the level of consistency between the Project Purpose and Overall Goal of the project and policies of the recipient country, assistance policy of the Government of Japan (GOJ) and the needs of the target group, relevance to the counterpart organization (UCP), appropriateness of the approach to the needs and project design, and comparative advantage of Japanese technology. This project is consistent with policies of the Government of Panama (GOP) and the assistance policy of GOJ. The series of activities and their purposes are consistent with the needs of the relevant organizations. For these reasons, the relevance of this project is considered high.

1) Consistency with policies and development plans of the Government of Panama

Untreated wastewater discharged from the Panama Metropolitan Area where the population is concentrated and increasing has caused serious water pollution in rivers in the city and the Panama Bay. In response, GOP launched "The Panama City and Panama Bay Sanitation Project" with financial assistance including ODA Loan from GOJ and began the operation of JDWWTP in 2013. However, no system has been established to operate the wastewater management services. GOP plans to operate the wastewater management services in the Panama Metropolitan Area including the maintenance of the sewerage-related facilities constructed with the Japanese ODA Loan using UCP, the organization that constructed the facilities, as wastewater management entity.

Sanitation and wastewater treatment are a priority development area of GOP as the "100/0 program," the policy in the water sector of GOP, which aims at achieving Target 6.2 of SDGs, "achieve access to adequate and equitable sanitation and hygiene for all."

The conformity between the strategic targets mentioned above and the purpose and contents of the outputs of this project confirms a high consistency between the purpose of this project and that of the water sector policy of GOP.

2) Consistency with the assistance policy of the Government of Japan

"The Country Assistance Policy for the Republic of Panama (2014)" states "assistance for environment-friendly socioeconomic development" as a basic policy of assistance. In this document, the current state in Panama is described, "while measures have been taken to improve the living and sanitary environment with development of infrastructure for economic development, the load to the environment generated in socioeconomic activities has not been controlled appropriately. The document selects "sustainable economic development" as a priority area of assistance to assist the establishment of a load control system and states, "Assistance shall be provided to the development of economic infrastructure that improves the living and sanitary environment and facilitates sustainable economic development in the Panama Metropolitan Area." This project is considered a major project in the above-mentioned assistance program. These statements in the policy prove a high consistency between this project and the assistance policy for Panama of GOJ.

3) Consistency with needs

UCP/MINSA, the counterpart organization of this project, is expected to be the operator of the wastewater management in the Panama Metropolitan Area and Panama West Province. However, UCP was originally established as an organization managing the construction work in "The Panama City and Panama Bay Sanitation Project" and it was not expected to be a wastewater management entity. For this historic reason, UCP did not have expertise in O&M including monitoring and asset management of sewerage-related facilities. Meanwhile, the objective of this project is to transfer the technology for organizational management, human resource development, facility management, water quality control, and public awareness raising required for the wastewater management services. A comprehensive series of measures has been taken not only for the capacity development of personnel concerned with the wastewater management services, but for the reform and strengthening of organizational structures and systems, preparation of various draft plans and guidelines, strengthening of systems for water quality monitoring and facility management, and improvement of public awareness raising activities in this project.

Because this project consists of contents that respond to the comprehensive technical needs of the Panamanian side in various areas as mentioned above, it is considered consistent with the needs of the Panamanian side.

4) Comparative advantage of Japanese technology

Japan has long years' experience and a large stock of lessons learned from experience in wastewater management and treatment. It also has a track record of implementing numerous assistance projects in wastewater management and treatment in many countries. The experience covers not only technical aspects, but mechanisms for wastewater management and treatment including roles of administrative and private organizations and regulation by law. Such long years' experience and accumulated knowledge have been utilized effectively in this project.

A "Johkasou," a decentralized domestic wastewater treatment system developed in Japan, was installed in a hospital and the function of the unit in the alleviation of water pollution caused by a large-scale wastewater source until a sewerage network was extended to the source was studied.

It is considered that these facts have proved that the comparative advantage of the Japanese technology has been utilized in this project.

3.2.3 Effectiveness

Conclusion of the evaluation: High

The effectiveness of the project was evaluated by elucidating the level of achievement of the Project Purpose and the contribution of each project activity for a Project Output to the achievement of the output and comparing the level of achievement and contribution with the indicators in PDM.

1) Project Purpose and its indicators

The level of the achievement of the Project Purpose was mainly used in the evaluation of the effectiveness. As mentioned in Chapter 2, almost all the Project Outputs have been achieved and the

Project Purpose has been almost fully achieved in this project.

2) Facilitating and obstructing factors of each activity

The capacity required for providing the wastewater management services of the counterparts has improved greatly as seen in "2.4.3 Result of capacity development."

The organizational capacity required for the continuous O&M of the wastewater management services of UCP has also improved greatly.

A booklet prepared with Japanese manga-creation techniques and a video prepared from the booklet were used in the PR activities in addition to the conventional PR activities practiced by UCP including distribution of project promotion goods. The use of the booklet and video has drawn attention of residents and children to the wastewater management services and facilitated their understanding of the services. It has also spread understanding of the correct use of the sewerage and activities of UCP and has extended the potential of the environmental education activities dramatically.

In the political area, measures to demarcate duties and to reform organizations have been taken in accordance with the MINSA/IDAAN Agreement concluded in August 2015, the presidential decree issued, the cabinet decision on the submission of a bill for turning UCP into a public enterprise in March 2016, and the progress of this project. In this project, JET has managed to prepare a recommendation for strengthening organizational capacity to supplement and support these measures, and present a framework of contents of a business plan to be prepared and a method to implement the plan. However, as the National Assembly has deferred the deliberation on the bill for the transformation of UCP to FY 2018, attention shall be paid to the progress of the deliberation.

JET has also presented a recommendation that a system for water quality monitoring at large-scale sources be established while the turning of UCP into a public enterprise is in progress, and prepared a draft plan for monitoring at the places of business whose operators have agreed to the monitoring as a temporary measure until the system has been established.

UCP has begun a survey and study on the marketability of recycled sludge for its effective use in composting, application as fertilizer to trees in parks, and cement manufacturing. Follow-up meetings on effective use of sludge consisting of the representatives of MiAMBIENTE, IDAAN, the Ministry of Agriculture and Development, and UCP began in April 2018 with participation of engineers of US-EPA.

As IDAAN has authority over collection of sewerage fees and UCP has not been allowed to include the collected sewerage fees in its budget, the sewerage services have inevitably been publicly funded. An efficient way to collect user fees and a path to sustainable financial management have been created during the process of planning the transition of UCP into a public enterprise. This project has managed to present the foundation for the creation of future financial prospects by estimating the mid- to long-term O&M cost and facility renovation cost.

The problem of high groundwater level was found in the old reclaimed areas in the OJT on the method to survey and diagnose the existing sewer pipes in this project. It is considered necessary to take such measures as developing such low-elevation areas into pump-drainage areas to solve this

problem. As the same problem is expected to be found all over the city, it will be necessary to continue the investigation and diagnosis and secure the funds required for the preparation and implementation of a series of improvement measures. UCP plans to begin the investigation and diagnosis of sewerage systems in areas where the same problem exists from the end of 2018 in the soft component of a project assisted by the World Bank (WB).

The international financing banks including IDB, CAF and WB will finance Phase 2 of JDWWTP Project and the sewerage extension project in Panama West Province. In addition, IDB plans to finance creation of a strategic plan, CAF plans to finance creation of a business operation plan, and WB plans to finance the soft component of a project for the facility management. This project is expected to produce effects in the collaboration and mutual complementation with these assistance projects.

3.2.4 Efficiency

Conclusion of the Evaluation: relatively high

The efficiency of the project was evaluated from the effect of input of human resources and materials and training in Japan, effect and relevance of provided equipment, existence/non-existence of other efficiency facilitation factor, and overlapping of activities.

1) Human resource input

The Japanese side has provided experts in organization/systems, water quality control and effluent regulations, sewerage facility management/financial planning/asset management, wastewater treatment technology, and environmental education. The composition of the human resource input is considered appropriate for the contents of the technology transfer planned in the project.

The human resource input in this project is characterized by the assignment of a chief advisor and a deputy chief advisor and the composition is made up completely by staff members of the same company. The two supervisors complemented each other without causing problems in the chain of command.

The Panamanian counterparts consisted mainly of staff members of the O&M Division of UCP. Staff members of the Social-Environment Division and Communication and PR Division were among the counterparts. IDAAN and MiAMBIENTE have joined JCC as relevant organizations. The composition of the staff is generally appropriate for the outputs and activities planned in this project. The number of the counterparts, which was not sufficient at the beginning of the project, has increased gradually as the project has progressed.

2) Material input

The Panamanian side supported the smooth implementation of the project by providing appropriate office space for the project and allowing the project members to use office equipment.

In this project, a Johkasou was provided and installed in a hospital. The various administrative procedures and issuance of permits required for the installation were delayed due to the replacement

of the Minister of Health, an audit, etc. The commencement of the operation of the unit was also delayed by a delay in the electric wire extension work by the power distribution company. After the operation began, the operation of the unit had to be suspended for a long period because of accidents including a circuit switch burnt by the fluctuation of power supply voltage and contamination by solid waste in hospital wastewater. These incidents restricted the project activities to a certain extent.

In the operation of the Johkasou, it is planned that the hospital will maintain the sewer pipes on its premises, while the maintenance of the unit itself is planned to be outsourced with the budget provided by the hospital. It has been decided that SOAP which has an outsourcing contract with UCP takes the responsibility for maintaining the unit until the hospital secures the budget for the maintenance. During this period, as clogging of the inflow pump by solid waste in the wastewater occurred, UCP are seeking solutions for these problems with the installation of a grinder. UCP applied acclimatized activated sludge in the contact aeration tank twice at the time of the commencement of the operation of the unit. Whenever political and physical factors made the progress of the effective use of the treatment unit slower than planned, UCP led the solution of the problems.

3) Training in Japan and in Third Country

Training in Japan was held twice in the project. The first was for the managerial staff and the second was for staff responsible for actual work in the field. The training provided the counterparts with a valuable opportunity to see and learn the legal framework and roles of various organizations in the treatment and management of wastewater and services provided by the sewerage operators in Japan in the field. The training made it possible for them to learn the measures taken in the sewerage sector in Japan systematically in field trips to various organizations and facilities engaged in all aspects of the sewerage services including local governments, manufacturers of treatment units and sewer pipes, and sewage treatment plants in Yokohama, Kyoto, and Osaka.

The site of the training in third country was SANEPAR in the State of Parana in Brazil. The participants learned the method to survey and diagnose pipelines in a visit to a site of pipeline management work and improved their understanding of the necessity of sustainable operation and continuous improvement of the wastewater management and the methodology of environmental management and education. The significance of this training in third country was further increased by the participation of a staff member of IDAAN, an organization involved in the project, in the study in which the staff member visited various sites with the other participants from UCP.

4) Equipment procurement

The equipment required for the project implementation was generally provided at appropriate time. The DO meter, full-conduit flowmeter, EC meter, power sprayer for smoke testing, TV camera for summary inspection, open-channel flowmeter, and the potable equipment were used in the OJT on the investigation and diagnosis of the existing sewer pipes. The technologies for such activities as surveying each type of problem individually, locating problems, verifying the condition inside the pipes before and after the high-pressure cleaning were transferred to the counterparts smoothly in the

OJT. Equipment for water quality analysis has been used for monitoring of effluent from places of business and the operating status of Johkasou. The equipment provided in this project has already been utilized in the activities taken on the initiative of the counterparts.

The contamination of solid waste in wastewater in the hospital mentioned above has been reduced significantly with the information dissemination and awareness raising activities taken by UCP in the hospital. However, a certain risk on the operation of the Johkasou provided in this project remains as the contamination has not been completely eliminated.

5) Existence/non-existence of complementary effect and overlapping activities

The environmental education activities in this project were implemented in mutual cooperation with the JOCVs in the environmental education area (especially, the one assigned to AAUD) as mentioned in the section below as a secondary impact.

This project has already made a direct complementary effect as the investigation and diagnosis method recommended in this project is included in the TOR for the outsourcing of consulting services in the soft component of a project by WB. Consideration is made in this project to avoid overlapping of activities and realize a complementary effect with the creation of a strategic plan to be implemented by IDB by recommending an idea and a method that can be utilized in the creation of a business plan to be created after the strategic plan.

3.2.5 Impact

Conclusion of the evaluation: High

The impact of the project implementation was evaluated with the prospect of achieving the Overall Goal and secondary impact (on policy, organization, system, finances, society, economy, and the environment) of the implementation.

1) Positive impact

The prospect of achieving the Overall Goal is described in detail in Chapter 4. Since the basic technology and knowledge required for O&M of the sewerage systems was transferred to UCP in this project and UCP is implementing measures to strengthen its organizational capacity steadily, the possibility of achieving the Overall Goal is considered high.

Mutual cooperation between this project and activities of JOCVs has produced a large impact in environmental education. This impact is considered a secondary impact. The cooperation began with the use of the original material for public awareness raising created in this project. The improvement of the effectiveness of the material with the use of manga presentation, and later with the creation of a video based on the improved material have led to the full-scale use of the materials in many areas of public services and geographic areas. In the end, the implementation of this project is considered to have an impact of raising awareness of the importance of wastewater management and conservation of the water environment not only in the pilot project area but in the wider area of Panama City.

2) Negative impact

While the Cabinet decided to submit a bill to turn the wastewater management entity into a public enterprise, the submission of the bill to the National Assembly was deferred to FY 2018. As the Presidential Election scheduled for 2019 draws near, it is not certain whether the bill will be enacted soon. If the bill has not been enacted before the Presidential Election and the process of enactment does not progress, the time of achievement of the Overall Goal may be deferred.

There is no serious negative impact that is considered a secondary impact.

3.2.6 Sustainability

Conclusion of the Evaluation: Fair

The project is evaluated on its political, organizational, technical, and financial sustainability.

1) Political sustainability

The "100/0 program," the policy of GOP in the water sector, states the necessity of effective wastewater management. As tourism is an important industry in Panama, wastewater management is and will be an important issue for infrastructure, and "the Panama City and Panama Bay Sanitation Project" is likely to be continued.

2) Organizational sustainability

Progress in the institutionalization of the wastewater management entity in a way appropriate for their current state is considered essential for ensuring the organizational sustainability. The organizational sustainability of the project is evaluated with the progress in the institutionalization.

UCP, the counterpart organization, is developing its human resources with the systematic in-house training framework that it has established. The outputs of this project are highly likely to be inherited in the organization if a plan for human resource development is prepared and implemented as recommended in this project.

3) Technical sustainability

The technical sustainability of this project is considered high because the employees of UCP, the counterpart organization of this project, remain with UCP for a long period.

4) Financial sustainability

UCP is financing the wastewater management including facility construction not with the revenue from the sewerage user fees but by public expense. A study is being conducted on the introduction of a new financing system for UCP after it is turned into a public enterprise. In this new system, the user fee revenue is used for the wastewater management and public funds are to be used for filling the gap between the revenue and expenses expected immediately after the transition. A sustainable financial plan is expected to be presented in a strategic plan and a business plan to be formulated for the transition. If this financial plan is implemented fully, sustainable financial management will be realized, though certain risk remains.

3.2.7 Evaluation by Counterparts

1) Evaluation method

The evaluation of the project by the Panamanian side was implemented in the form of four counterparts in managerial positions responding to a questionnaire on the project. The questionnaire consisted of the questions asking respondents' evaluation of the project on the five DAC evaluation criteria, questions asking for the factors facilitated and obstructed by the project implementation and special notes. The survey was conducted in May 2018. For details of the survey and its results, see the document attached hereto.

2) Summary of the evaluation results

The Panamanian side evaluated this project highly, in general. They gave grade 4 or 5 on the scale up to 5 to almost all the evaluation subjects. Table 3.2.3 summarizes the evaluation by the counterparts.

The evaluation on the sustainability of systems and organization was at the intermediate level (the average grade of around 3) below grade 4, presumably reflecting the fact that the discussion on the system design for the wastewater management entity had not reached a conclusion by the end of the project period. In the questions concerning sustainability, the capacity of UCP to maintain and improve capacity was evaluated at 3.3, because one of the respondents gave the grade of 1 considering it difficult for UCP to maintain and improve the capacity without external assistance. Similarly, the average grade of 3.5 in the evaluation of the effectiveness of Output 1 is considered a reflection of the state of the discussion on the wastewater management entity in Panama. The counterparts gave the average grade of 4 or above to all the other subjects.

Table 3.2.3 Summary of the evaluation by the counterparts

1. Relevance	Grading
1-1 Consistency with the policies of GOP	4.7
Comments: "A legal void remains in the system required for the appropriate O&M of the project invested in by the people of Japan." and another comment	
1-2 Consistency with needs	4.7
Comments: "The outputs of this project meet the needs of UCP very well," and 3 other comments	
1-3 Consistency with the assistance policy of GOJ	—
Note: The counterparts were not asked to answer this question.	
1-4 Appropriateness of the project design/changes in external environment	—
Comment: on Output 1: "Lack of political will to allow the construction of systems required for UCP to perform its duties"	
1-5 Comparative advantage of Japanese technology and use of experience	—
Comments: "Technology Johkasou, and repair/renovation of sewer pipes including the SPR method," and 3 comments	
1-6 Use of the output of technology transfer	—

Comments: Installation of Johkasou in sparsely populated areas and SPR of the sewer pipe networks in the entire city, and 3 other comments	
2. Effectiveness	Grading
2-1 Progress in achieving Project Purpose	4.7
Comments: "Most of the Outputs have been achieved in accordance with the PDM." and 2 other comments	
2-2 Progress in achieving Output 1	3.5
Comments: "The roles have been decided, but this framework in the legal system has not been made official." and another comment	
2-3 Progress in achieving Output 2	4.7
Comment: "The survey of pollution sources is suspended because of the difficulty in obtaining permission to enter places of business."	
2-4 Progress in achieving Output 3	4.3
Comment: Same as Output 1	
2-5 Progress in achieving Output 4	5
Comments: The persons in charge of environmental education acquired and developed new technology with guidance of the JET members." and 2 other comments	
Contributing and obstructing factors for each activity	—
Comments: "Training in Japan and Brazil was indispensable for the development of management capacity of UCP. The outputs will be useful for the future improvement. What is lacking is a legal framework." and 3 other comments	
3. Efficiency	
[Japanese input]	
3-1 Human resource input	

Evaluation item	Grading
Number of experts assigned to the project	5
Their specialties	5
Duty sharing among them	5
Dispatch period	4.8
Timing of dispatch	4.8
Frequency of communication	5

3-2 Training in Japan, 3-3 Training in Third Country

Evaluation item	Type of training and grading		
	1st Training in Japan	2nd Training in Japan	Training in Third Country
Number of participants	5	5	5
Selection of participants	5	4.5	4.7
Timing of training	5	5	5
Training period	5	5	5

Areas and contents of training	5	5	5
Comment: Completely organized training including a variety of contents: In the training consisting of lectures on theory and field trips to plants and facilities, we could observe all that was taught in the lectures in the field from the beginning (on 1st Training in Japan) The same comments on 2nd Training in Japan			
3-4 Actual outputs achieved with the use of knowledge acquired in Training in Japan and in Third Country			
Comments: "Some of the PR methods used in Japan including the awareness raising activity using the walls of two treatment plants and interviews with sewerage workers have been included in the PR plan." and 2 other comments			
3-5 Material and equipment input (Johkasou), 3-6 Material and equipment provision (excluding Johkasou)			

Evaluation item	Types of equipment/materials and grading	
	Johkasou	Materials and equipment excluding Johkasou
Type of equipment	5	4.5
Operational specifications	5	4.5
Maintenance specifications	4.7	4.5
Quantity	4.7	5
Timing of procurement	5	5

【Panamanian Input】

3-7 Human resource input

Evaluation item	Grading
Number of people assigned to the project	4.5
Their technical capacity	4.5
Duty sharing among them	4.5
Duration of assignment	4.5
Frequency of communication	4.5

3-8 Budget for project activities including the operating cost and cost for the maintenance of equipment

Evaluation item	Grading
Amount of disbursement	4
Timing of disbursement	4

【External factors that had influence on the project】

3-9 Existence/non-existence of complementary effect and duplication of activities

Comments: ・There was no duplication of activities.
・There was no complementary effect with other projects

4. Impact	Grading
4-1 Prospect of achieving Overall Goal	4.5
Comment: It depends heavily on when Output 1 is achieved.	

4-2 Secondary impact	—
Secondary impact in the political, organizational and environmental aspects was mentioned. Comments: "Better relationship has been established with local communities and private companies." and 4 other comments	
5. Sustainability	Grading
5-1 Political sustainability	4.3
Comments: "The outputs of this project must be sustained, or a crisis in the public hygiene may occur." and 2 other comments	
5-2 Sustainability of systems	2.8
Comments: "COPANIT 35/39 should be revised. Overall revision of the legal framework of the sector is required." and 2 other comments	
5-3 Organizational sustainability	3.5
Comments: "There is a need to increase human resources to strengthen the organizational structure." and 4 other comments	
5-4 Organizational structure of each relevant organization	—
Comments: "IDAAN shall be transformed into a real public enterprise." and other comments on MINSA and ASEP	
5-5 Technical sustainability	5
Comments: "We will implement the activities that the existing regulations allow us to implement as much as possible." and 2 other comments	
5-6 Does UCP have experience in or a future plan for providing training?	—
Comments: "Yes. Training is a permanent mission of UCP." and 2 other comments	
5-7 Will UCP be able to maintain the required technical capacity and improve it?	3.3
Comments: "Yes. But, if the framework of the system is changed, more external assistance will be required." and 2 other comments	
5-8 Concerning the maintenance and improvement of the technical capacity of relevant organizations for the sustainability of the project outputs after the completion of the project	—
Comment: "Development of a training program and recruitment of young human resources are the key for meeting needs, and technical needs in particular, in future."	
5-9 Financial sustainability	4
Comments: "As sufficient budget has been allocated to the activities of UCP, the government will allocate sufficient budget for the achievement of the master plan in future." and another comment	
5-10 Is UCP studying the prospect of financial balance of the wastewater management?	—
Comments: "Yes. But if the legal framework is reformed, the prospect will have to be reviewed immediately." and another comment	
5-11(1) Activities and input required for improving sustainability	—
Comments: "Basically the enactment of the UCP Act and amendment of the acts in the water and sanitation sectors." and another comment	
5-11(2) Possibility of obstructing sustainability and concerns over sustainability	—
Comments: "Political factors." and 2 other comments	

6. Process	Grading
6-1 Contributing factors	—
Comments: “The involvement of staff members of UCP in the project was essential.” and 8 other comments	
6-2 Obstructing factors	—
Comments: “The administrative formalities are time-consuming. It takes too long to obtain approval in many governmental procedures. For example, the installation of the Johkasou was delayed because it took a long time to complete some of the required administrative formalities.” and 3 other comments	
6-3 Was the communications among stakeholders sufficient?	5
Comment: “Yes. The members quite often had good well-organized conversation and always spoke of the intention of the plans.	
6-4 Was the progress monitoring performed appropriately?	5
Comment: “Yes. The weekly meetings were very useful for continuous monitoring.	
6-5 Was the project management system (including JCC) appropriate?	5
Comment: none	
6-6 Was the risk control of the project performed sufficiently?	5
Comments: Sufficient outputs have been produced despite several changes of the scope of work and busy schedule of the counterparts. and another comment	
6-7 Innovative approaches taken to facilitate project activities, innovation in the process to be noted, lessons learned from the implementation of the project, etc.	—
Comments: “JICA needs to obtain strong commitment from government officials concerned.” and another comment	
7. Other matters to be noted	
7-1 What kind of activity should have been included in the project to make its effect larger? What should be improved in the project to sustain its outputs?	
Comments: “The progress in the achievement of Output 1 shall be monitored continuously and the potential of the new public enterprise shall be evaluated.” and 4 other comments	

3.3 Major Factors that influenced the Implementation and Effect of the Project

In the following, the factors that had positive and negative effect on the project in the implementation stage are discussed.

3.3.1 Factors that Contributed to the Achievement of Project Purpose and Project Outputs

The first contributing factor is the gradual increase in the staff members of UCP involved in the project during its implementation. For example, there was no person in charge of monitoring of effluent from business site at the beginning of the project. Such a person was appointed on 15 March 2016, immediately after the commencement of the full-scale implementation of the project.

Another contributing factor is the active participation of the counterparts assigned to the project in the project activities.

Training in Japan for the senior counterparts conducted at an early stage of the project is

considered to have enabled them to learn the sewerage services in Japan and Japanese sewerage technology and have common understanding of the way that UCP should follow at an early stage and helped greatly to establish good communication between the Panamanian and Japanese sides involved in the project.

One of the counterparts participated in the JICA's Knowledge Co-Creation Program during the implementation period of this project. This counterpart selected guidance on the use of grease traps in restaurants for the training on the creation of an action plan. Immediately after this counterpart returned to Panama, it was decided to include this action plan in this project as a measure to be taken by UCP, and the plan was implemented during the project.

UCP is taking a series of measures required for turning itself into a public enterprise one after another. IDB and CAF are expected to assist UCP in the creation of a strategic plan and strengthening of the commercial department, respectively. Therefore, the measures for turning UCP into a public enterprise are expected to produce sufficient outputs.

3.3.2 Factors that Obstructed the Achievement of Project Purpose and Project Outputs

Measures to turn UCP into a public enterprise were being taken while this project was being implemented. However, the National Assembly did not have deliberation on the bill to turn UCP into a public enterprise at the time of preparation of this report. As it was not certain whether the bill would be enacted while the project being implemented, the activities for Outputs 1 and 2, in particular, were implemented on the assumption that UCP was to be turned into a public enterprise. If the transition is delayed, the implementation of the achieved outputs will also be delayed.

The equipment required for the pilot project was provided to UCP smoothly before its implementation with assistance from JICA Panama Office. Due to the delay in the EIA process and other problems, the treatment unit was installed later than originally planned. Problems such as fluctuation of power source voltage at the site and clogging of the inflow pump by solid waste contained in the sewage discharged from the hospital stopped the operation of the unit. These administrative, physical, and environmental factors obstructed the normal progress of the project activities. However, it is considered that the lessons learned from these events will be very useful when a similar project is implemented.

3.4 Evaluation of Output of the Project Risk Management

The progress monitoring and risk management performed in the implementation stage of the project are described in the following.

3.4.1 Issues to be Noted in the Project Implementation Process

In this project, weekly meetings in which all counterparts participated were held as a forum of information sharing. Monthly meetings of the JET members and the senior counterparts were organized to share the same understanding of the state and future direction of the project between the Panamanian and Japanese sides. As an effort to share information, seminars were held in some of the weekly meetings. In these seminars, JET members disseminated information including experience in

Japan and the counterparts reported project outputs.

The office space of the project was in the same room as the office of the O&M Division in the beginning. After the integration and relocation of all the offices in UCP, the project was provided with an office space in this integrated office space. In both cases, the JET members were able to communicate with counterparts at any time as both of them worked in the same room.

This office location is considered to have enabled the implementation of the project with the common understanding shared between the Panamanian and Japanese sides.

3.4.2 Monitoring

The progress of the project was monitored every half year, in principle, using the monitoring sheet. The monitoring sheet was for the perusal of the Panamanian side, JICA Panama Office, Global Environment Department of JICA, and JET. The progress of the project was controlled with this sheet. Comments of JICA on the sheet were utilized in the later project activities.

JCC meetings were also held every half year to collect views on and requests regarding this project from the counterparts and representatives of the relevant organizations. The preparation of the monitoring sheet and meeting of JCC every half year enabled the implementation of the project activities with regular monitoring of the progress in achieving Project Purpose and indicators provided in the PDM.

In general, the monitoring including that of the progress of the project is considered to have been implemented appropriately.

3.5 Lessons Learned

(Mainly from the activities for Output 1)

- ✓ In this project, because of the insufficient capacity of IDAAN, the organization which should have been responsible for the wastewater management, UCP which was established as the organization responsible for the construction of the sewerage facilities has provided the wastewater management services including O&M. Assistance has been provided to UCP in this project. The plan to turn UCP into a public enterprise responsible for the wastewater management has been presented. However, this transition is not likely to happen in the near future. The balanced improvement of the entire water sector in Panama will require a scheme for capacity development including that of IDAAN, sustainable means to finance the services and sustainable measures to improve customer services.

(Mainly from the activities for Output 2)

- ✓ Panama has separate sets of standards for the quality of wastewater discharged from large-scale sources into public waters and into sewerage system. In this project, measures to make wastewater discharged into sewerage system compliant with the relevant standards have been implemented with a certain level of output. However, concerted measures on wastewater discharged into public waters and sewerage system have to be taken and stricter measures are required for the former than the latter. At present, as it seems that the measures

on wastewater discharged into sewers have been prioritized, measures to make the wastewater discharged into public waters compliant with the standards will have to be taken in future.

(Mainly from the activities for Output 2)

- ✓ The pilot project of installing Johkasou has failed to produce a record of stable long-term operation of the unit because significant time had to be spent on the EIA process and measures had to be taken against the unstable power source and inflow of solid waste. However, the experience acquired from solving these problems will provide valuable information for the installation of such units in other places in Panama and neighboring countries in future. The measures taken to eliminate wasteful water consumption and discharge of solid waste in wastewater in the hospital in which the unit was installed can be extended as a pioneering effort to wastewater treatment in a large-scale hospital in Panama. Because of the high expectation for the wastewater treatment technology using Johkasou in Panama, the outputs of this project are expected to be utilized.

(Mainly from the activities for Output 3)

- ✓ Because the sewerage facilities in Panama are operated by the private companies called the water barons, the quality of the sewerage services is maintained at a certain level. However, as there was room for the improvement of efficiency and effectiveness of the O&M of the facilities, assistance has been provided for the preparation of TOR of the outsourcing contract for the next term. It is hoped that engineers of UCP will improve their capacity further and become able to improve the TOR continuously by themselves.

(Mainly from the activities for Output 3)

- ✓ Many international donor organizations have financed projects in the sewerage sector in Panama. In this project, assistance has been provided for the effective use of sewage sludge and improvement of the methods for management of sewer pipes in such a way as to show a better approach to the relationship between Panama and these donor organizations. It is important for an international assistance organization to have an attitude as shown in this project of providing assistance for the good of the Panamanian side.

(Mainly from the activities for Output 4)

- ✓ The environmental education activities used to consist only of generalized explanation and distribution of goods in some cases. This project has successfully shown a method of environmental education that makes people review their lifestyle for the reduction of environmental load and maintenance of the functions of the sewerage systems using effective media familiar to them and an approach based on cooperation with schools and local communities. It is hoped that the method developed in this project will be extended in Panama.

4 Recommendations for Achievement of the Overall Goal

4.1 Perspectives on Achievement of the Overall Goal

The project aiming at the sustainable management of wastewater in the metropolitan area of Panama contributes to the improvement of the capacity of UCP in O&M of sewerage facilities (including implementation of measures for industrial wastewater and other wastewater sources) and is an initiative consistent with the policies and technical needs of Panama. The overall goal is to conduct mitigation measures for Panama Bay's pollution sustainably in the Panama metropolitan area, and the objectively verifiable indicator is periodical reporting on wastewater and industrial wastewater management in the Panama metropolitan area.

So far in the project, documents necessary for achieving the overall goal have been created from various angles, including proposals for improvement of the institutional structure, human resource development plan (draft), water quality monitoring plan (draft) and monitoring records, hospital Johkasou management records, O&M plan for sewerage facilities (draft), OJT report on the investigation and diagnosis method for existing sewers, O&M plan (draft) for the existing sewer pipe network, action plan for public awareness (draft) and public awareness survey report.

The Panamanian side has accumulated rich experiences, and efforts have been made to develop a system toward establishment of a wastewater management entity, increase the number of UCP staff and actively participate in the project, and in addition, the counterpart turnover rate is low.

Based on the above, despite the political risk of developing legislation to establish a wastewater management entity, if it goes ahead, the overall goal will be achieved.

4.2 Operation and implementation plans on the Panamanian side for achieving the overall goal

The Panamanian side is working on institutional enhancement, which is most important for sustainable management, in the form of turning UCP into a public enterprise. The many activities required to achieve this goal are being steadily implemented including the division of roles and creation of a progress schedule. Examples are given below.

- ✓ Creation of laws for establishing EPSP - Already implemented
- ✓ Building of commercial management (customer management) method - To be implemented
- ✓ Formulation of strategic plan - Already begun
- ✓ Determination of organizational structure - Under consideration
- ✓ Establishment of service rules - To be implemented
- ✓ Building of asset ledger - To be implemented
- ✓ Establishment of board of directors - Already considered

All these activities are essential for establishment of the independent entity required for sustainable and effective management of the sewerage sector, and this is the part that is currently lacking in UCP management. By steadily advancing these initiatives, sustainable wastewater

management will be achieved and the overall goal will also be achieved.

4.3 Recommendations made to the Panamanian side

Based on the outputs of the project, implementation of the following items by the Panamanian side is recommended in order to achieve the overall goal.

1) Strengthening the organizational structure of a sustainable wastewater management sector

✓ Building an independent organizational entity

To improve public services, enhance the efficiency and sustainability of wastewater management and ensure the continuity of the project outputs, it is necessary to build an independent organizational entity capable of flexible decision-making. The public enterprise that UCP is currently aiming to become is consistent with this basic policy and it is hoped that efforts will be made towards its realization.

✓ Continuing the efforts necessary to turn UCP into a public enterprise

UCP is currently making the necessary efforts to become a public enterprise and some have already been completed. In particular, as the formulation of service rules and the creation of customer files and an asset ledger, as yet unfinished, will form the core of corporate management, it is hoped that efforts will continue to be made.

✓ Implementing sustainable financial management

It is important that the creation of financial statements based on accrual accounting, discussion of pricing that allows for a balance between medium and long-term revenue/expenditure forecasts, and the securing of sustainable capital are focused on the creation of a public enterprise, and efforts should be made toward its realization. The beneficiaries will not only be the public who are the users, but also the factories that discharge wastewater. As the purpose of the wastewater management is conservation of the water environment, consideration should be given to rules governing the scope of operations borne by users through fees. Reference can be made to examples in Japan which has a generous government subsidy system and which stipulates business operations where public expenditure can be used under rules such as effluent regulations.

✓ Formulating and implementing the business plan to achieve the provision of high quality services

The business plan proposed through technical assistance should be formulated and implemented toward strengthening and improving sustainable wastewater management with a focus on turning UCP into a public enterprise.

✓ Need for efforts to strengthen and improve management based on SIG activities

The activities of the integrated management system (SIG), consisting of acquisition of three ISO certifications, are contributing to improved operations in terms of quality, environment and safety management. Looking ahead to UCP becoming a public enterprise, sustainable financial management and provision of high quality services will be issues. Based on current SIG activities, it is recommended to incorporate efforts to continually strengthen and improve wastewater management into the business plan.

✓ Building an integrated information system for evidence-based decision making, business management and efficient wastewater management

It is advisable to prepare to build a system for integrated operation of the various information systems required for future wastewater management (customer information, water demand, fee collection, facilities ledger, personnel salaries, document management, etc.) and the existing GIS pipeline information system and accounting system, and to achieve key performance indicator-based management and decision making and efficient wastewater management.

2) Continuous strengthening of UCP's capacity to implement projects

✓ Improving the technical level of supervision for greater efficiency of outsourced business related to O&M

The main work of UCP staff will be supervision of subcontractors involved in O&M of the facilities. Utilizing the outputs of initiatives including OJT in this project, it is desirable that the technical level of O&M continues to be raised through technical transfers within UCP to achieve efficient wastewater management.

✓ Maintenance of the functions of the facilities and phased expansion and renovation plans

Efforts shall be made to draft an appropriate renovation plan and secure funding from the perspective of asset management in order to maintain the functions of the facilities which will start to deteriorate in future. At this time, the sludge treatment and disposal plan shall be given particular consideration to reducing and reusing sludge, from the perspective of securing disposal site.

✓ Actively collaborating with wide-ranging JICA schemes such as JICA Knowledge Co-Creation Program and JOCV

Outcomes outside the expected target range of the project are being generated through collaboration with various JICA projects, such as action plans implemented by the participants in JICA Knowledge Co-Creation Program and collaboration with Japan Overseas Cooperation Volunteers (JOCV) involved in environmental education

✓ Continuing the 100/0 program to ensure household connections to the sewerage facilities

The project to connect every household to the sewerage facilities based on the 100/0 program is effective from the perspective of a rapid effect after development of the sewerage facilities and ensuring administrative fairness, and it is desirable that the project is continued.

3) Strengthening monitoring of large-scale wastewater sources

✓ Formulating regulations for wastewater management including water quality regulations

In Panama, there are often the cases where only basic laws have been enacted and what are known in Japan as cabinet orders, regulations and ordinances, such as enforcement regulations, are often inadequate, and it is also observed in the wastewater management. When a public enterprise is established by law, it is necessary to formulate service rules to carry out work as described above. In regulating the water quality, the public enterprise shall be recognized as an entity in charge described in COPANIT-39 which stipulates the discharge standards to sewerage facilities. In addition, it is desirable that the service rules thus formulated include items related to water quality monitoring. More precisely, the obligation

of businesses to comply with laws and ordinances, items narrowing down the number of businesses targeted for monitoring, and items stipulating the authority and obligations of wastewater management entities and business entities are considered necessary. For example, when determining obligation for compensation in the event that a business entity causes damage to the sewerage facilities or its operation, measures may be taken to enhance motivation for improvement through collection of a surcharge for the water quality deterioration from the business found to have exceeded the standards through water quality monitoring.

✓ Strengthening collaboration with relevant organizations on measures for large-scale wastewater sources

In order to implement measures for large-scale wastewater sources fairly and effectively, collaboration is necessary with wastewater management entities (IDAAN and MINSA) in areas outside the control of UCP and MiAMBIENTE which has jurisdiction over discharge into public water areas. In particular, the pressure for regulating the discharge into public water areas is important not only from the perspective of motivating wastewater-discharging industries to connect to the sewerage facilities, but also showing the effectiveness of wastewater management. From the perspective of improving the water quality in public water areas, an approach that prioritizes new connections, mitigates the pollution load on rivers and provides guidance on improvements for businesses after connection is desirable.

✓ Strengthening the system for more efficient and practical monitoring of large-scale wastewater sources

It is desirable to build an implementation system that sets the scope of outsourcing of water quality analysis, ensures visits to businesses by several staff members and secures the employment of professional staff members with adequate knowledge, toward full-scale monitoring of large-scale wastewater sources after the transition to a public enterprise.

4) Stable operation and appropriate management of Johkasou and its utilization

✓ Stable operation and appropriate management of Johkasou

Operation of the Johkasou will be resumed promptly after the grinder installation currently being prepared by UCP and its stable operation will be confirmed. Appropriate O&M such as periodical inspections and removal of sludge will be conducted and water quality management and operation records will be kept.

✓ Utilizing Johkasou knowledge

After the Johkasou operates stably, information such as operation data will be disclosed to the relevant persons.

As this is a pilot initiative to improve other hospitals in Panama, measures that were taken at the hospital where the Johkasou was installed to reduce unnecessary water and reduce solid waste dumped in the sewer will be disseminated.

5) Sustainable sewage sludge treatment, disposal and reuse

✓ Ensuring the sustainability and efficiency of sewage sludge treatment, disposal and reuse

It is necessary to examine sludge treatment and disposal methods based on the phased expansion and renovation plans for the existing facilities, but importance must be placed on sustainability and efficiency, such as allowing for reduced amounts of sludge according to the situation of the disposal site.

✓ Ensuring marketability and diversity in sewage sludge reuse

When considering sewage sludge reuse, as well as ensuring marketability and diversity and securing reuse destinations, consideration must be given to ensuring sustainability without being limited to a single reuse method.

✓ Examining conversion of sludge into cement raw material, etc.

As well as verifying the sludge components and ensuring safety toward conversion into cement raw material and fertilizer currently under consideration, it is necessary to confirm the market size and develop methods of use and users. Discussions will be held with relevant organizations in the public sector and with the private sector concerning the cement industry and conversion into fertilizer and efforts will be made toward realization.

6) Expansion and strengthening of environmental education and public awareness activities

✓ Wide-area dissemination to educational institutions

Educational activities conducted at elementary schools on a pilot basis in the project have steadily achieved results. On the other hand, considering the size of the JDWWTP service area, the extent of the impact is too small and it will be necessary to widen the scope of environmental education in future. In the second year of the project, cooperation was initiated with the Ministry of Education (MEDUCA), enabling the building of a cooperative framework in the third year, and dissemination should be actively promoted in future.

✓ Strengthening cooperation with water environment-related organizations such as IDAAN and MiAMBIENTE

It is recommended that activities conducted in this project, such as cooperation with JOCV dispatched to AAUD and similar organizations, are continued and environmental education and public awareness activities that spread effectively are expanded. As the project takes water conservation, which has major importance for dealing with future water problems, as one of its themes, it is also considered effective to utilize the project outputs and expand the activities in collaboration with organizations related to water environment management such as IDAAN and MiAMBIENTE.

✓ Implementing planned awareness activities and strengthening the implementation system

As activities for environmental education expand, a lack of relevant staffs in UCP has become an issue. It is suggested that activities are reinforced by formulating a plan for effective environmental education and awareness activities and strengthening the implementation structure, including staff. For visitors to the sewerage facilities, getting them to understand the mechanism of biological treatment by arousing their interest by showing them the microorganisms through a microscope, and improving the facilities to enable visits by younger children are also considered effective (Currently children under 11 cannot visit the facilities for safety reasons).

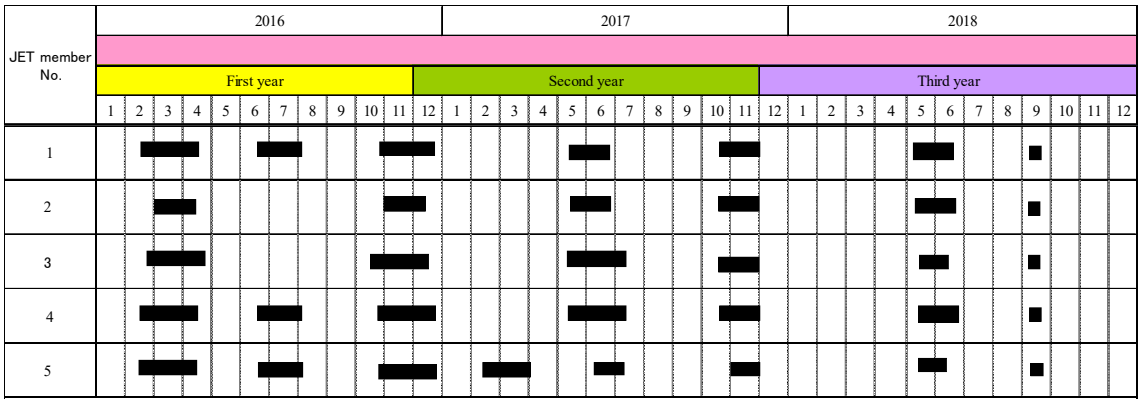
Attachment

Attachment1-1　JET member list

JET member list

No.	JET member	Role	Affiliation
1	Takashi DAIRAKU	Chief advisor / Institutional management	Nihon Suido Consultants Co., Ltd.
2	Koji KIMURA	Assistant Chief Advisor / Environmental education	ditto
3	Masayuki NAGAMOCHI	water quality control and wastewater regulations	ditto
4	Kenji UCHIDA	O&M of sewerage facilities / Asset management / Financial management	ditto
5	Riota ADACHI	wastewater treatment technologies	ditto

Dispatch record



	JET member No.		days				MM			
			year−1	year−2	year−3	total	year−1	year−2	year−3	total
Panama	1	plan	150	105	66	321	5.00	3.50	2.20	10.70
		rslt	165	97	59	321	5.50	3.23	1.97	10.70
	2	plan	90	90	75	255	3.00	3.00	2.50	8.50
		rslt	90	90	75	255	3.00	3.00	2.50	8.50
	3	plan	120	105	60	285	4.00	3.50	2.00	9.50
		rslt	120	119	46	285	4.00	3.97	1.53	9.50
	4	plan	165	105	66	336	5.50	3.50	2.20	11.20
		rslt	165	112	59	336	5.50	3.73	1.97	11.20
	5	plan	165	120	60	345	5.50	4.00	2.00	11.50
		rslt	181	108	56	345	6.03	3.60	1.87	11.50
	Total		690	525	327	1542	23.00	17.50	10.90	51.40
			721	526	295	1542	24.03	17.53	9.83	51.40

Attachment 1-2 UCP member list

C/P list

No.		Name	Role	Period	Year		
					1	2	3
1		Dr .Francisco Javier Terrientes	Project Director / Minister of Health	Feb. 2016 ~July 2016	△		
2		Dr. Miguel Mayo Di Bello	Project Director / Minister of Health	July 2016 ~Sep. 2018	△	○	○
3		Ms. Tatiana De Janon de Getmen	General Coordinator, UCP	Feb. 2016 ~Aug. 2018	○	○	△
4		Mr. Roberto Del Leon	General Coordinator, UCP	Sep. 2018 ~Sep. 2018			△
5		Mr.Agustín Ordoñes Navas	Sub-general cordinator, UCP	Feb. 2016~Sep. 2018	○	○	○
6		Mr. Carlos Singh Ospina	C/P of Output 3 UCP/Manager of O & M Division	Feb. 2016~Sep. 2018	○	○	○
7		Ms.Leslies González	C/P of Output 1 Supervisor of Administration and Human Resources, Administration and Finance Division	Feb. 2016~June 2018	○	○	△
8		Ms. Jill Carvajal	C/P of Output 1 Supervisor of Administration and Human Resources, Administration and Finance Division	Sep. 2018~Sep. 2018			△
9		Mr.Rolando Bocanegra	C/P of Output 1 Coordinator of IDAAN Networks, O&M Division	Feb. 2016~Dec. 2017	○	○	
10		Mr.Juan ramon	C/P of Output 1 Administrator of contract, O &M Division	Dec. 2017~Sep. 2018			○

Attachment 1-2 UCP member list

No.		Name	Role	Period	Year		
					1	2	3
11		Ms. Maria Victoria Mitre Núñez	C/P of Output 2 Inspector of interconnection to system, O&M Division	Mar. 2016~Sep. 2018	○	○	○
12		Mr.Yoel Velasquez	C/P of Output 2,3 In charge of pipeline(in charge of JOHKASOU), O&M Division	Feb. 2016~Sep. 2018	○	○	○
13		Mr.Diomedes Vergara	C/P of Output 3 Supervisor of O & M Division	Feb. 2016~ Sep. 2018	○	○	○
14		Mr.Bernaldo Henríquez	C/P of Output 3 In charge of pumping stations, O&M Division	Feb. 2016~ Sep. 2018	○	○	○
15		Mr.Ricaurte Martinez	C/P of Output 3 In charge of pipeline, O&M Division	Feb. 2016~ Sep. 2018	○	○	○
16		Mr.Max Garcia	C/P of Output 3 In charge of WWTP, O&M Division	Feb. 2016~ Sep. 2018	○	○	○
17		Ms.Litzi Garcia	C/P of Output 3 In charge of connection, O&M Division	Feb. 2016~June 2017	○		
18		Ms.Yasmina Rojas	C/P of Output 4 Manager of Socio-environmental Division	Feb. 2016~ Sep. 2018	○	○	○
19		Ms.Denise Canavaggio	C/P of Output 4 Manager of Publicity and Communication Division	Feb. 2016~ Sep. 2018	○	○	○
20		Ms.Alejandra Gutierrez	C/P of Output 4 Control and monitoring officer, Socio-environmental Division	Feb. 2016~Dec. 2016	○		

Attachment 1-2 UCP member list

No.		Name	Role	Period	Year		
					1	2	3
21		Ms. Ahimara Valdés	C/P of Output 4 Official of socio-environmental projects, Socio-environmental Division	Dec. 2016~ Sep. 2018		○	△
22		Ms. Perla M. Tuñón	C/P of Output 4 Official of control and follow up of socio-environmental projects, Socio- environmental Division	June 2017~ Sep. 2018		○	○
23		Ms.Sol Sierra	C/P of Output 4 Advertising and communication Division, Social communicator, Publicity and Communication Division	Nov. 2017~Sep. 2018		△	○
24		Ms.Ana Maria Urrutia	C/P of Output 4 Social Communicator, Publicity and Communication Division	Nov. 2017~Sep. 2018		△	○
25		Ms. Lizmara Anria Carrasquilla	C/P of Output 4 Official of socio-environmental projects, socio-environmental Division	June 2018~Sep. 2018			○
		Total			16	17	19

Attachment 1-3 Training list

1) Training in Japan

(1) First Training in Japan

a. Training period

6 to 16 June 2016

b. Participants

A total of six managerial personnel of UCP including the General Manager

c. Schedule and contents

Table 1 Program of First Training in Japan

Date	Time	Form	Contents	Venue
June 5 (Sun.)			Arrival in Japan (at Narita Airport)	
June 6 (Mon.)	a.m.		Orientation and training briefing	JICA - Yokohama Center
	p.m.	Field trip	Visit to Yokohama Bay Area	
June 7 (Tue.)	a.m.	Lecture	Visit to Head Office of Nihon Suido Consultants (trip to JICA Headquarters) 11:00 –: Courtesy call	Head Office, Nihon Suido Consultants Co., Ltd.
	p.m.	Field trip	Visit to area around the Imperial Palace Trip (from Tokyo to Osaka)	
June 8 (Wed.)	a.m.	Field trip	[Lecture][Field trip] Regulations on effluent discharged from workplaces (Torishima Plant, Osaka Namari-suzu Seirensho Co., Ltd.)	Osaka City Sewerage Science Museum
	p.m.	Field trip	[Lecture] PR activities on wastewater management services for citizens and environmental education [Lecture] Presentation by the Panamanian participants [Field trip] Visit to the Sewerage Science Museum	Osaka City Sewerage Science Museum
June 9 (Thu.)	a.m.	Field trip	Fieldwork on a remote monitoring system of a pumping station	Pump Facilities Office, Sewerage Works Department, Waterworks Bureau, Kyoto City
	p.m.	Field trip	[Lecture] PR activities on water supply and wastewater management services for citizens [Lecture][Field trip] Stream rehabilitation project Get-together party in Kyoto City at night	Conference Room, Nishijin Textile Center
June 10 (Fri.)	a.m.	Field trip	Field trip to a plant manufacturing advanced treatment units (johkaso)	Shiga Plant, Kubota Corp.
	p.m.	Field trip	Field trip to a plant manufacturing raw materials of sewer pipes and pipe rehabilitation materials (Trip to the hotel via lakeshore of Lake Biwa after 16:00)	Shiga-Ritto Plant, Sekisui Chemical Co., Ltd.
June 11 (Sat.)	a.m.	Field trip	Field trip to water-related heritage sites in Kyoto (including the Lake Biwa Canal Museum, Lake Biwa Canal and Old aqueduct in Nanzenji Temple)	
	p.m.	Field trip	Field trip to water-related heritage sites in Kyoto (from Shimogamo Shrine to the Kamo River)	
June 12 (Sun.)	a.m.	Field trip	Visit to cultural heritage sites in Kyoto (from Kiyomizu Temple to Higasiyama/Gion Areas)	
	p.m.		Trip (from Kyoto to Yokohama)	
June 13 (Mon.)	a.m.	Lecture	Courtesy call to the Director General of the Bureau [Lecture] Briefing of the sewerage system in Yokohama City, presentation by the Panamanian participants	Hokubu Wastewater Treatment Plant, Environmental Planning Bureau, Yokohama City

	p.m.	Lecture	[Lecture] On PFI projects, explanation of Hub with panels [Field trip] Field trip to a digestion gas power generator (after moving to Hokubu Sludge Treatment Plant)	Hokubu Sludge Treatment Plant
June 14 (Tue.)	a.m.	Lecture	[Lecture] Effluent regulations, maintenance of sewer pipes	Hokubu Wastewater Treatment Plant
	p.m.	Lecture	[Lecture] Financing of wastewater management services [Lecture][Field trip] Use of treated wastewater (after moving to the Irie River) Get-together party in Yokohama City at night	Hokubu Wastewater Treatment Plant
June 15 (Wed.)	a.m.	Lecture	Courtesy call to the Sewerage and Wastewater Management Department, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Site visit in Tokyo	MLIT
	p.m.	Lecture	Lecture on ledger system/asset management	JICA - Yokohama Center
June 16 (Thu.)		Presentation	Presentation of the training outputs, evaluation of the training and closing ceremony	JICA - Yokohama Center
June 17 (Fri.)			Departure from Japan (Narita Airport)	

(2) Second Training in Japan

a. Training period

24 July to 3 August 2017

b. Participants

A total of 11: Head of the O&M Group and general staff members of UCP

c. Schedule and contents

Table 2 Program of Second Training in Japan

Date	Time	Form	Contents	Venue
July 23 (Sun.)			Arrival in Japan (at Narita Airport)	
July 24 (Mon.)	a.m.		Orientation and training briefing	JICA - Yokohama Center
	p.m.	Field trip	Visit to Yokohama Bay Area Trip (from Tokyo to Osaka)	
July 25 (Tue.)	a.m.	Lecture	History of the construction of wastewater treatment plants and water environment improvement On Ebie Sewage Treatment Plant	Osaka City Sewerage Science Museum
	p.m.	Field trip	Ebie Sewage Treatment Plant Visit to the Sewerage Science Museum Tenjin Festival	Ebie Sewage Treatment Plant Osaka City Sewerage Science Museum
July 26 (Wed.)	a.m.	Lecture	Human resource development in water supply and wastewater management services Public awareness raising and PR activities on water supply and wastewater management services	Head Office of the Waterworks Bureau, Kyoto City
	p.m.	Field trip	Use of equipment for the maintenance of sewer pipe networks	Ishida Treatment Plant
July 27 (Thu.)	a.m.	Field trip	Fieldwork on a remote monitoring system of a pumping station	Pump Facilities Office, Sewerage Works Department, Waterworks Bureau, Kyoto City

Attachment 1-3 Training list

	p.m.	Field trip	Stream rehabilitation project Get-together party in Kyoto City at night	Conference Room, Nishijin Textile Center
July 28 (Fri.)	a.m.	Field trip	Field trip to a plant manufacturing advanced treatment units (johkaso)	Shiga Plant, Kubota Corp.
	p.m.	Field trip	Field trip to a plant manufacturing raw materials of sewer pipes and pipe rehabilitation materials	Shiga-Ritto Plant, Sekisui Chemical Co., Ltd.
July 29 (Sat.)	a.m.	Field trip	Field trip to water-related heritage sites in Kyoto (including the Lake Biwa Canal Museum, Lake Biwa Canal and Old aqueduct in Nanzenji Temple)	
	p.m.	Field trip	Field trip to water-related heritage sites in Kyoto (the Kamo River)	
July 30 (Sun.)	a.m.	Field trip	Visit to cultural heritage sites in Kyoto (Kiyomizu Temple, Yasaka Shrine and Gion Area)	
	p.m.		Trip (from Kyoto to Yokohama)	
July 31 (Mon.)	a.m.	Lecture	Welcome remarks of the director general of the bureau [Lecture] Briefing of the sewerage system in Yokohama City, presentation by the Panamanian participants	Hokubu Wastewater Treatment Plant, Environmental Planning Bureau, Yokohama City
	p.m.	Lecture	[Lecture] On PFI projects, explanation of Hub with panels [Field trip] Field trip to a digestion gas power generator (after moving to Hokubu Sludge Treatment Plant)	Hokubu Sludge Treatment Plant
Aug. 1 (Tue.)	a.m.	Lecture	[Lecture] Effluent regulations, maintenance of sewer pipes	Hokubu Wastewater Treatment Plant
	p.m.	Lecture	[Lecture] Financing of wastewater management services [Lecture][Field trip] Use of treated wastewater (after moving to the Irie River) Get-together party in Yokohama City at night	Hokubu Wastewater Treatment Plant
Aug. 2 (Wed.)	a.m.	Field trip	Sewage Works Exhibition	Tokyo International Exhibition Center
	p.m.	Field trip	Embassy of Panama (courtesy call) Experience of Japanese culture	Embassy of Panama Asakusa
Aug. 3 (Thu.)		Presentation	Presentation of the training outputs, evaluation of the training and closing ceremony	JICA - Yokohama Center
Aug. 4 (Fri.)			Departure from Japan (Narita Airport)	

2) Training in third country

(1) Visit to Parana State Water and Sanitation Company, Brazil (Compania de Saneamento do Parana (SANEPAR), Brazil)

a. Period

21 to 26 November 2016

b. Participants

A total of 9

8 from UCP: the head of O&M Group and general staff members of UCP

1 from IDAAN: general staff member

c. Schedule and contents

Attachment 1-3 Training list

Table 3 Program of Training in third country

Date	Time	Form	Contents	Venue
Nov. 20 (Sun.)			Arrival in Curitiba	
Nov. 21 (Mon.)	a.m.		Welcome remarks, presentation on the profile and business operation of SANEPAR, presentation by UCP	SANEPAR Head Office
	p.m.	Lecture Field trip	Outputs 1, 2 and 3 of the JICA project Explanation and field trip of the waterworks operation system	ditto
Nov. 22 (Tue.)	a.m.	Lecture	Lectures on survey, diagnosis and evaluation of pipe networks and the site of PRRU River Water Quality Survey	SANEPAR Head Office
	p.m.	Field trip	Field trip on demonstration of investigation and diagnosis of sewer pipes	Taruma
Nov. 23 (Wed.)	a.m.	Lecture Field trip	Briefing on anaerobic treatment Field trip to Atuba Sul Sewage Treatment Plant	SANEPAR Head Office Atuba Sul Sewage Treatment Plant
	p.m.	Field trip	Water Quality Laboratory Waterworks Museum	Taurma
Nov. 24 (Thu.)	a.m.	Lecture	Irai Dam Water Culture Museum – dam operation and maintenance Environmental education	Irai Dam
	p.m.	Field trip	Field trip to the dam Safety control of the dam	ditto
Nov. 25 (Fri.)	a.m.	Field trip	Small-scale sewerage system in Matinhos on the coast	Matinhos on the coast
	p.m.	Field trip	Morretes Pumping Station	Morretes
Nov. 26 (Sat.)	a.m.	Field trip	Curitiba City Planning (Bus transport and rainwater storing city planning parks)	In Curitiba City
	p.m.	Field trip	Curitiba City Planning (Bus transport and rainwater storing city planning parks)	ditto
Nov. /27 (Sun.)			Departure from Curitiba (to Panama)	

3) Seminars

(1) First Seminar

a. Date

9 December 2016

b. Outline

JET organized a seminar on the latest technology for maintenance of sewer pipe networks, asset management, monitoring of large-scale pollution sources, basic knowledge of wastewater treatment, and recycling of treated wastewater and sludge.

(2) Second Seminar

a. Date

22 November 2017

b. Outline

JET organized a seminar on human resource development plans, the impact on people's health caused by wastewater, requirements for the monitoring of large-scale pollution sources in Panama, and method for the diagnosis of sewer pipe networks in Panama.

(3) Third Seminar

a. Date

12 September 2018

b. Outline

The counterparts took lead in this seminar. They made presentations on the details of activities implemented and plans for future activities for each output in the seminar.

Attachment 2　List of Products

A　Review of UCP organizational structure and proposal for formulation of business plan
B　UCP's Human Resource Development Plan (Draft)
C　Database on large-scale wastewater sources
D　Guideline for water quality monitoring of large-scale wastewater sources (draft)
E　Plan for water quality monitoring of large-scale wastewater sources (draft)
F　Record for pilot project of waste water treatment of large-scale wastewater sources
G　Study report for mitigation measures on large-scale wastewater sources based on the pilot activity
H　Water quality monitoring reports of large-scale wastewater sources
I　Terms of Reference (TOR) for the next O&M contract for sewerage facilities
J　A mid- and long-term O&M plan for sewerage facilities
K　OJT report for the survey and diagnosis method for existing sewers
L　O&M plan (draft) of existing sewer pipe network
M　Study report for the recycle system of treated wastewater and sludge
N　Activity plan of UCP
O　Public awareness survey report

*Note: These products are provided in Spanish

Annex-1

Project Design Matrix

Project Title: Panama Metropolitan Area Wastewater Management Improvement Project

Implementing Agency: UCP, MINSA

Target Group: UCP, MINSA

Period of Project: April 2015 to September 2018 (3.5 years)

Project Site: Panama Metropolitan Area

Model Site:

Version 1

Dated 20 Nov 2014

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Mitigation measures for Panama Bay's pollution are conducted sustainably in Panama Metropolitan Area.	The situation of wastewater management is periodically reported.	Periodical reports			
Project Purpose					
UCP's capacity of administration and O&M management for the facilities implemented by "the Panama City and Panama Bay Sanitation Project" is improved.	Rules and duties of UCP are drafted. Monitoring of wastewater quality is conducted regularly. The sewerage facilities are managed based on the plans developed in the Project (i.e., the monitoring plan, O&M plan, etc.).	Draft rules and duties of UCP Monitoring and management records Hearing from staff members	The policies relating to wastewater management are not changed drastically.		
Outputs					
1.Roles of organizations related to sanitation of Panama Bay are determined and a procedure to improve the institutional structure of implementation is proposed.	Proposal to improve the organization and personnel to implement the tasks in UCP. Revised documents (Executive Order and/or mutual agreement) specifying the tasks of UCP/MINSA and IDAAN regarding the O&M of sewerage facilities.	Proposal for improvement Revised documents	The institutional setups for the Project implementation are not changed drastically.		
2. Periodical water quality monitoring for wastewater pollution sources discharged into Juan Diaz Wastewater Treatment Plant (JDWWTP) is started.	Mitigation measures and a monitoring plan against large-scale wastewater sources flowing into JDWWTP are formulated.	A monitoring plan and mitigation measures against large-scale wastewater sources			

3. UCP's ability to manage the sewerage facilities (JDWWTP and the rest, i.e.. sewerage networks, collectors, pumping stations and interceptor) is improved.	Items of sewerage facility management are identified. Terms of Reference (TOR) are drafted for the next O&M contract for the treatment plant JDWWTP. A mid- and long-term O&M plan for sewerage facilities is drafted.	Draft TOR for O&M of sewage treatment plant JDWWTP. A mid- and long-term O&M plan for sewerage facilities			
4. UCP's capacity of education and beneficiaries awareness of proper use of sewerage facilities is improved.	UCP continuously carries out activities of education and public awareness. Public understanding about sewerage management is improved.	Activity plan of UCP Public awareness survey			

NB) Wastewater includes sewage and effluent water generated from industrial and commercial activities.
Sewerage facilities include the sewage treatment plant, sewers, pumping stations, and any other facilities relating to wastewater management.

Activities	Inputs		Pre-Conditions
	The Japanese Side	The Panamanian Side	
1-1 Study current laws and policies about aquatic environment, wastewater discharge, wastewater treatment and industrial wastewater in Panama. 1-2 Review the current master plan and ongoing projects regarding Panama Bay purification. 1-3 Study the current status, and future plans of the sewerage facilities (including pumping stations) and industrial wastewater treatment plants (if any) in Panama Metropolitan Area. 1-4 Review the current roles and duties of UCP and IDAAN regarding wastewater management. 1-5 Identify necessary duties for wastewater management and propose present and future responsible organizations.	1. Experts Consultants - Chief advisor / institutional management - Wastewater quality control - O&M of sewerage facilities - Asset management - Financial management - Environmental education Advisors - Advisors from the City of Yokohama 2. Training - Training in Japan - Training in Panama 3. Equipment Necessary equipment to be determined	1. Counterpart staffs - Counterpart staffs for each member of Japanese expert - Management staffs for the wastewater quality monitoring system - Management staffs for the pilot activities 2. Facilities - A project office with necessary furniture, air conditioners, internet facility, etc. 3. Counter budget - Salaries and allowances for the Panamanian counterpart staffs - Costs for O&M of equipment provided by the Japanese side	The inputs from the Panamanian side are secured.

1-6 Review the duties, institutional setups and personnel of UCP based on transition of UCP's roles to IDAAN in future. 1-7 Revise documents (Executive Order and/or mutual agreement) specifying the tasks of UCP/MINSA and IDAAN regarding the O&M of sewerage facilities.		<Issues and countermeasures>
2-1 Survey the situation of large-scale sources, whose effluent is discharged into JDWWTP. 2-2 Train UCP/MINSA staff members how to inspect and control effluent quality from large-scale wastewater sources. 2-3 Make a pilot plan for pre-treatment (e.g., improved septic tank for a hospital to meet the technical regulation COPANIT 39-2000) and monitoring of wastewater quality (inspection visit without prior notice). 2-4 Conduct a pilot activity for pre-treatment and quality monitoring of wastewater at sources. 2-6 Study mitigation measures on large scale wastewater pollutant sources (industrial, commercial and institutional sources flow into the JDWWTP plant), based on the pilot activity.		
3-1 Identify necessary items for O&M and asset management of sewage treatment facilities. 3-2 Draft a TOR proposal for the next O&M contract for the JDWWTP plant (Module 1 and 2) to support UCP's supervision. The next contract will be initiated after the completion of the current contract in 2017.		

3-3 Draft a mid- and long-term O&M plan for sewerage facilities (JDWWTP and the rest) based on the data of sewerage facility management (e.g. plans for O&M cost, content of O&M contract, asset management, renovation planning, risk management, contingency measure, etc.).			
4-1 Conduct public awareness surveys about sewerage management. 4-2 Diagnose UCP's capacity as a baseline and define actions for strengthening UCP. 4-3 Conduct pilot activities to promote pubic awareness about sewerage management.			

Annex 1

Project Design Matrix

Project Title: Panama Metropolitan Area Wastewater Management Improvement Project

Implementing Agency: UCP, MINSA

Target Group: UCP, MINSA

Period of Project: June 2015 to November 2018 (3.5 years)

Project Site: Panama Metropolitan Area and Panama West Province

Model Site:

Version 2

Dated 16 Oct 2015

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Mitigation measures for Panama Bay's pollution are conducted sustainably in Panama Metropolitan Area.	The situation of wastewater management is periodically reported.	Periodical reports			
Project Purpose					
UCP's capacity of administration and O&M management for the facilities implemented by "the Panama City and Panama Bay Sanitation Project" is improved.	Organizational structure, duties and necessary staffing of UCP are drafted. Monitoring of wastewater quality is conducted regularly. The sewerage facilities are managed based on the plans developed in the Project (i.e., the monitoring plan, O&M plan, etc.).	Draft organizational structure, duties and necessary staffing of UCP Monitoring and management records Hearing from staff members	The policies relating to wastewater management are not changed drastically.		
Outputs					
1.Roles of organizations related to sanitation of Panama Bay are determined and a procedure to improve the institutional structure of implementation is proposed.	Improvement of the organization, personnel to implement the tasks in UCP is proposed. Human resource development plan (draft) of UCP is created.	Proposal for improvement The human resource development plan (draft) of UCP	The institutional setups for the Project implementation are not changed drastically.		
2. Periodical water quality monitoring for wastewater pollution sources discharged into Juan Diaz Wastewater Treatment Plant (JDWWTP) is started.	A database on large-scale wastewater sources is created. A draft guideline for water quality monitoring of large-scale wastewater sources is created. Water quality monitoring plan for large-scale wastewater sources is created.	A database on large-scale wastewater sources A draft guideline for water quality monitoring of large-scale wastewater sources The draft plan for water quality monitoring of large-scale wastewater sources			

	The pilot project for wastewater treatment of large-scale wastewater sources is planned and implemented.	The record for pilot project of waste water treatment of large-scale wastewater sources.			
	Mitigation measures on large-scale wastewater sources based on the pilot activity are formulated.	Study report for mitigation measures on large-scale wastewater sources based on the pilot activity			
	Water quality monitoring for large-scale wastewater sources is implemented.	Water quality monitoring reports of large-scale wastewater sources			
3. UCP's ability to manage the sewerage facilities (JDWWTP and the rest, i.e. sewerage networks, collectors, pumping stations and interceptors) is improved.	Items of sewerage facility management are identified.				
	Terms of Reference (TOR) are drafted for the next O&M contract for sewerage facilities.	A draft Terms of Reference (TOR) for the next O&M contract for sewerage facilities			
	A mid- and long-term O&M plan (incl. renovation plan and financial plan) for sewerage facilities is drafted.	A mid- and long-term draft O&M plan for sewerage facilities			
	OJT on the survey and diagnosis method for existing sewers is implemented.	OJT report for the survey and diagnosis method for existing sewers			
	O&M plan (draft) of existing sewer pipe network is created.	O&M plan (draft) of existing sewer pipe network			
	The recycle system of treated wastewater and sludge is studied.	Study report for the recycle system of treated wastewater and sludge			
4. UCP's capacity of education and beneficiaries awareness of water saving and proper use of sewerage facilities is improved.	UCP's activities of education and public awareness are continuously carried out.	Activity plan of UCP			
	Public understanding about water saving and sewerage management is improved.	Public awareness survey report			

NB) Wastewater includes sewage and effluent water generated from industrial and commercial activities.
Sewerage facilities include the sewage treatment plant, sewers, pumping stations, and any other facilities relating to wastewater management.

Activities	Inputs		Pre-Conditions
	The Japanese Side	The Panamanian Side	
1-1 Study current laws and policies about aquatic environment, wastewater discharge, wastewater treatment and industrial wastewater in Panama. 1-2 Review the current master plan and ongoing projects regarding Panama Bay purification. 1-3 Study the current status, and future plans of the sewerage facilities (including pumping stations) and industrial wastewater treatment plants (if any) in Panama Metropolitan Area. 1-4 Review the current roles and duties of UCP and IDAAN regarding wastewater management. 1-5 Identify necessary duties for wastewater management and support clarifying the division of the roles of present and future responsible organizations. 1-6 Review the duties, institutional setups and personnel of UCP. 1-7 Create human resource development plan (draft) of UCP.	1. Experts Consultants - Chief advisor / Institutional management - Assistant Chief Advisor / Environmental education - Wastewater quality control - O&M of sewerage facilities / Asset management / Financial management - Wastewater treatment Advisors - Advisors from the City of Yokohama 2. Training - Training in Japan - Training in Panama - Training in a third country 3. Equipment Necessary equipment to be determined	1. Counterpart staffs - Counterpart staffs for each member of Japanese expert - Management staffs for the wastewater quality monitoring system - Management staffs for the pilot activities 2. Facilities - A project office with necessary furniture, air conditioners, internet facility, etc. 3. Counter budget - Salaries and allowances for the Panamanian counterpart staffs - Costs for O&M of equipment provided by the Japanese side	The inputs from the Panamanian side are secured. ⇒
2-1 Survey the situation of large-scale sources, whose effluent is discharged into JDWWTP. 2-2 Train UCP/MINSA staff members how to inspect and control effluent quality from large-scale wastewater sources. 2-3 Create a database on large-scale wastewater sources. 2-4 Create a guideline for water quality monitoring of large-scale wastewater sources.			<Issues and countermeasures>

2-5 Create the water quality monitoring plan for large-scale wastewater sources.

2-6 Plan and implement the pilot project of wastewater treatment for large-scale wastewater sources. (e.g. installation of an advanced treatment unit (JOHKASOU) for a hospital)

2-7 Study mitigation measures on large-scale wastewater pollutant sources (industrial, commercial and institutional sources flow into the JDWWTP), based on the pilot activity.

2-8 Implement water quality monitoring for large-scale wastewater sources.

3-1 Identify necessary items for O&M and asset management of sewerage facilities.

3-2 Draft a TOR proposal for the next O&M contract for sewerage facilities to support UCP's supervision.

3-3 Draft a mid- and long-term renovation plan (draft), financial plan (draft) and O&M plan (draft) for sewerage facilities (JDWWTP and the rest) based on the data of sewerage facility management (e.g. plans for O&M cost, content of O&M contract, asset management, renovation planning, risk management, contingency measure, etc.).

3-4 Implement OJT on the survey and diagnosis method for existing sewers.

3-5 Create O&M plan (draft) of existing sewer pipe network.

3-6 Study the recycle system of treated wastewater and sludge.

4-1 Conduct public awareness surveys about water saving and sewerage management. 4-2 Diagnose UCP's capacity as a baseline and define actions for strengthening UCP. 4-3 Conduct pilot activities to promote pubic awareness about water saving and sewerage management. 4-4 Create and implement PR activities plan.			

Attachment 6　Other related materials

6-1 MINSA/IDAAN Agreement

6-2 Executive Decree No.18 3rd March, 2016

6-3 Law for EPSP