Pinatubo Hazard Urgent Mitigation Project - Phase II

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1. Project Description

Implementation site of the project

Southwest Mega Dike renovated by the project

1.1 Background

The eruption of Mt. Pinatubo, located in the Luzon Central Plain, in June 1991 has been one of the largest eruptions of the century. After the eruption, typhoons and heavy rain falls caused the outflow of the pyroclastic sediments (mudflow (lahar) in downstream) every year, posing enormous mudflow damage in surrounding areas of Mt. Pinatubo and major rivers, such as Sacobia-Bamban River, the Abacan River and the Pasig-Potrero River. In particular, a big landslide due to the massive secondary eruption in October 1993 caused upstream of the Sacobia River captured by the Pasig River. Since then, heavy rain falls in the area of the Pasig-Potrero River have often produced the secondary damages by mudflow and floods from the rise in riverbed or blockage of stream channel in the downstream site.

Under such conditions, repairs of the Sacobia-Bamban River basin was implemented in "the Pinatubo Hazard Urgent Mitigation Project" (LA No. PH-P166; signed in March 1996; loan amount 6,911 million yen), and the study on "the Mudflow and Flood Control Planning for Pasig-Potrero River" was implemented in the consulting service as part of the project and completed in March 1998. Also, with the Philippines' own fund, a new Megadike was built in the Pasig-Potrero River basin as a mudflow control measure.

In addition to the urgent project such as a renovation of Megadike, early implementation

of construction of comprehensive defense facilities for mudflow in the Pasig-Potrero River basin was eagerly awaited for the rehabilitation and reconstruction of the disaster areas, based on the above projects including short-/mid-/long-term measures. Thus the project was designed and conducted to implement those urgent and/or construction projects.

1.2 Project Outline

The objective of the project is to prevent the frequent mudflow/flood disasters in the Pasig-Potrero River basin in the Luzon Central Plain by implementing the civil engineering work, thereby contributing to the improvement of the living conditions, stabilization of the quality of life of local residents, and development of the local economy.

Approved Amount/ Disbursed Amount	9,013million yen / 7,633million yen
Exchange of Notes Date/ Loan Agreement Signing Date	September 1999 / December 1999
Terms and Conditions	・Interest Rate: 1.3％ Repayment Period: 30 years (Grace Period: 10 years) (For Consulting Service: Interest Rate: 0.75%, Repayment Period: 40 years (Grace Period: 10 years)) ・Conditions for Procurement: ・General Untied (For Consulting Service: Bilateral-Tied)
Borrower / Executing Agency	The Republic of the Philippines / Department of Public Works and Highways (DPWH)
Final Disbursement Date	March 2006
Main Contractor (Over 1 billion yen)	China State Construction Engineering Corporation (China) China International Water and Electric Corporation (China) R-II Builders, Inc (Philippines)
Main Consultant (Over 100 million yen)	Nippon Koei Co., Ltd. (Japan) PHILKOEI International, Inc. (Philippines)

Feasibility Studies, etc.	Technical cooperation M/P and F/S by "the Study on Flood and Mudflow Control Planning for Sacobia-Bamban River Basin" implemented in 1993-1996 Japanese ODA loan project "the Pinatubo Hazard Urgent Mitigation Project - Phase I (PHUMP I)" (December 1996－May 2001[8])
Related Projects (if any)	The same as above

2. Outline of the Evaluation Study

2.1 External Evaluator

Shinichi Mizuta, Senior Policy Analyst, Mitsubishi Research Institute, Inc.

2.2 Duration of Evaluation Study

Duration of the Study: May 2010 – February 2011

Duration of the Field Study: August 2 – August 18, 2010; November 17 – November 26, 2010

2.3 Constraints during the Evaluation Study

The degree or form of benefits for the eleven local governments along the Pasig-Potrero River varies from one municipality to another. Due to the above differences, it would be preferable to conduct evaluation surveys to all the relevant parties of local governments and residents. However, in light of time constraints or financial reasons, it was only possible to collect information through the interviews with relevant parties and the beneficiary surveys at three contrasting areas.

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

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Plan of the Philippines

The Government of the Philippines set a goal for "sustainable development and growth with the societal fairness" in the Mid-Term Philippine Development Plan (MTPDP) 1999-2004. As the means to reach the goal, acceleration of local development focusing on

[8] This project was implemented based on the above mentioned M/P and F/S. Then, the study on "the Mudflow and Flood Control Planning for Pasig-Potrero River" was implemented in the consulting service as part of the yen loan project "PHUMP I" and completed in March 1998, which set the F/S for this project.

agricultural modernization, provision of basic social services for the weak, such as education, health, welfare, housing, etc., development of sustainable infrastructure, promotion of global competition policy, securing of macroeconomic stability, and improving the governance were addressed as the central issues. Among the water projects for infrastructure development, flood control measures were mentioned in addition to the waterworks, sewerage, and irrigation. The measures included the promotion of architectural projects (construction of dikes and canals) and non-architectural project (flood forecasting and development of warning system, etc.

The MTPDP 2004-2010 specifies the goal of flood control of the Clark-Subic area, under the Part 1: Economic Growth and Job Creation, Chapter 6: Infrastructure. The section also states the Pasig-Potrero River basin as the targeted area of this yen loan project, as well as the yen-loan project (PHUMP II) and Phase 1 of the project (PHUMPI) as the currently-implemented / completed project.

Thus, flood control measures have been consistently placed as major issues in the development plans of the Philippines, and especially the areas surrounding Mt. Pinatubo is positioned as a priority area.

3.1.2 Relevance with the Development Needs of the Philippines

The mudflow (lahar) produced in the 1991 eruption of Mt. Pinatubo caused Bacolor City in the center of the Pasig-Potrero River basin to be buried and left tremendous damages to the surrounding areas. From this background, for the economic recovery and restoration of lives of local residents of these areas, it is continuously necessary to reduce the threats of lahar and floods from the both physical and spiritual aspects.

This Project controls the outflow of lahar and prevent surrounding areas from further lahar damages through the reinforcement of the Megadikes. Also, canal improvement and dredge work through this Project has contributed to reducing the flood damage in the downstream areas. However, because the extent of the project has not been sufficient enough to prevent flood damages, further civil engineering work is still necessary, especially for the downstream areas. Thus, PHUMP as the third phase is currently under implementation.

Today, there are continuously strong local needs for the implementation of flood control measures for the surrounding areas of Mt. Pinatubo as the foundation of quality-of-life improvement and economic development of the areas, though more than 10 years have

past since the planning phase.

3.1.3 Relevance with Japan's ODA Policy

At time of appraisal, the Japanese government was to provide assistance to the Philippines on the basis that the country still requires the assistance in restoring economic growth and that the poverty reduction is one of the priority government policies. Especially, the Japanese government's concept regarding the aid to the Philippines was mainly the environmental protection and disaster prevention, focusing on areas of reinforcement of administrative capabilities, measures against general industrial waste and industrial pollution, conservation of natural environment, and assistance in disaster prevention.

In terms of improving the living environments fundamental to the economic development, as well as saving lives of people and preventing direct economic loss from the danger arise from natural disasters, the project was consistent with the Japanese government's assistance policy for the Philippines.

Thus, the project has been highly relevant with the Philippines' development plan, development needs, as well as Japan's ODA policies; therefore its relevance is high.

3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

Civil engineering works, the outputs of the project, consisted of seven contract packages (CP). Although the project was made up from CP1 through CP6 in the initial plan, CP7 was added during the implementation period of the project, in order to conduct required civil engineering work to accomplish the objectives of the project within the budget. The contents of civil work at the initial plan of each CP and major changes are as shown in Table 1. Also, the implementation sites from CP1 through CP7 are shown in Figure 1.

Table 1: Major Changes in Outputs

CP	Contents of the planned civil engineering work	Major changes
1	(1) Repair of Southwest Megadike	(1) Raising of Southwest Megadike was partially modified Also, as an additional work, improvement was extended to the unarmored portion of the Megadike, which was not included in the original plan.
2	(1) Construction of Closure Dike	(1) The original plan was deleted, and the following alternative works with the similar functions were conducted: - Gugu Bridge on northwest (100.16m) - Widening of the Gapan - San Fernand- Olongapo

		(GSO) Road (2.557 km), - Construction of west bank dike of Gugu River (2.557 km), ・ Upgrading of Culverts
3	(1) Reinforcement of Baluyot Channel Bank / excavation of the Baluyot Channel (2) Raising of Sta. Barbara Bridge Approaches (3) Restructuring of the Sapang Labuan – Baluyot Canal	(1) Reduction in length of civil work area, reduction in areas to be dredged (2) Deleted (because civil work had already been done by DPWH) (3) As a supplementary civil works, the installation work of RCBC (precast concrete box culvert) was conducted
4	(1) Rehabilitation of San Fernand – Sto. Tomas – Minalin Tail Dike (2) Repair of Bacolor Tail Dike	(1) Content of the civil engineering work was partially modified (2) The original plan was deleted, and the following alternative works were conducted: ・ Evaluation road 4 roads ・ Canalization of Gugu River 1,600 m ・ Gugu Bridge 100.8 m
5	(1) Dredging in the Delta Areas (2) Pilot Channel Dredging and Third River	(1) Extention in length and expansion in areas for dredging (2) Reduction in areas for excavation/dredging
6	(1) San Francisco to Sasmuan Cannal	(1) Breadth and depth were nearly unchanged. Reduction in areas for dredging
7	(Added during the implementation period)	(1) Repair of a portion of the Angeles-Porac Road which was swept away ➢ Construction of Mancatian Bridge ➢ Construction of approaches ➢ Renovation of river channel dike (shore protection work) , etc. (2) Other supplementary civil workss (Supplemental Agreement I, II) ・ River channel renovation of upstream of the Mancatian Bridge ・ Construction of Deflection Dike ・ Construction of Maliualu Bridge ・ Repair of the damaged part of Tail Dike (San Fernand – Sto. Tomas - Minalin) ・ Asphalting of the East Mega Dike, etc.

Figure1 Implementation sites of civil engineering works

Source: Mount Pinatubo Emergency Project Management Office (MPE-PMO)

The changes made in all CPs were mainly because of the fact that changes/modifications of contents and areas of civil engineering works became necessary in order to respond to the geographical changes at the implementation site during the passage of time, such as the Pasig-Potrero River's route change due to the accumulation of lahar in the traditional river basin. Additionally, because some of the works initially planned in the project were urgent, the government of the Philippines implemented with its own funds before the project started. Sometimes, alternative, much-needed works at that point were carried out instead in the context of purposes of the project. Overall, these changes in outputs were appropriate in terms of being discussed and determined as necessary at that point by DPWH and JICA.

3.2.2 Project Inputs

3.2.2.1 Project Period

The project implementation period at the time of initial planning was 46 months, from December 1999 (signed date of LA) through September 2003 (completion of civil engineering work of CP6), but the actual period was extended to 75 months (163% longer than planned), from December 1999 (signed date of LA) through February 2006 (completion of civil engineering work of CP7). Therefore, the actual project period was significantly longer than planned.

The delay was mainly as a result of the necessary modifications to the contents of each CP and addition of CP7 made due to the geographical changes and urgent works implemented independently by DPWH, as same as previously mentioned reason for the changes in outputs. All of these modifications and additions were necessary in order to accomplish the goals of the project, such as reduction of flood/lahar damages and improvement of quality of life, and they were implemented with mutual agreement reached between DPWH and JICA. Therefore, the extension of the project implementation period was reasonable and necessary.

Even if we assume that CP7 had not existed, we could say that the actual period was 58 months (126% longer than planned), from December 1999 (signed date of LA) through September 2004 (completion of civil engineering work of CP5, which was the most delayed package), and that the actual project period was longer than planned.

3.2.2.2 Project Cost

The total cost of the project planned at time of appraisal was 10,604 million yen, including yen loan portion of 9,013 million yen, but the cost actually spent was 10,616

million yen, including yen loan portion of 7,633 million yen, mostly as planned (100.11%). As previously mentioned, contents of every CP of the project had to be changed. The implementation cost of every CP increased/decreased in accordance with these changes, and the peso-based total cost of civil engineering work and consulting services slightly increased as a whole. Also, changes in the scope of civil engineering work resulted in a large increase in the cost related to the Right of Way (ROW) required for land acquisition etc., leading the peso-based total cost of the project to be significantly higher than that of the previous evaluation. However, compared with the time of appraisal, the yen-based total cost of the project during the project implementation period eventually became mostly as planned, due to the exchange rate of the peso against the yen.

Although the project period was significantly longer than planned, the project cost was mostly as planned; therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

(1) Reduction in flood frequencies and damages and prevention of further damage by lahar

In the interviews with representatives of LGUs, they pointed out that, in addition to the reduction in flood frequencies, average days of flood reduced from a few month before to a few days to a few weeks in recent days. Table 2, which summarizes the flood data collected from LGUs surrounding the project site, certainly shows the decrease in average days of flood and reduction of average inundation height in most of the LGUs.

Table 2: Changes in days of flood / maximum inundation height in the project implementation area

	Average days of flood		Average inundation height	
	2000-2002 (Before completion)	2008-2010 (After completion)	2000-2002 (Before completion)	2008-2010 (After completion)
Guagua	25.0days	9.7days	143.0cm	85.0cm
Bacolor	12.5 days	3.0 days	45.7cm	35.5cm
Santo Tomas	90.0 days	14.0 days	120.0cm	30.0cm
Sasmuan	60.0 days	7.0 days	100.0cm	30.0cm
Minalin	59.6 days	57.0 days	40.0cm	48.6cm

Source: MPE-PMO

In addition, the evaluation confirmed through interviews and site visits that civil works including repair of the Megadike contributed to prevention of further damage by lahar. However, because it is very difficult quantify effects of civil works for preventing further lahar damage by setting indicators, such indicators were not set from the beginning. Therefore, we did not evaluate this effect by using operational indicators.

(2) Effect of widening of Gapan - San Fernand – Olongapo (GSO) Road (CP2)

For the purpose of improving the lives of local residents, CP2 of the project included the widening of the GSO Road which crosses the center of Bacolor (the largest affected areas of flood and lahar) and functions as the evacuation road to the outside of dike. As shown in Table 3, it was assumed that the GSO Road would serve the better road access of 19,000 cars per day, which was the traffic flow as of 1998. However, after the completion of CP2, the actual daily traffic on the GSO road increased to 89,708 cars per day in 2006, and it remains as high as 73,727 cars per day in 2010. The daily traffic on the GSO road slightly decreased from 2006 to 2010 because an alternative road was newly developed and opened in 2009 in parallel with the GSO road.

Table 3: Changes in annual average volume of traffic on GSO Road

Indicator (unit)	1998	2006	2010
Average daily traffic on the GSO Road (cars)	19,000	89,078	73,727

Source: MPE-PMO

(3) Effect of improving (Asphalting) of East Mega Dike (CP7)

CP7 (completed in May 2005), which was implemented as an additional package, included the asphalting of the East Megadike. Asphalting the Megadike and other dikes were requested by local residents for the betterment of their lives, improvement of economic activities, and provision of better evacuation routes, and this civil work was implemented upon such requests from residents. Asphalting the East Megadike improved the access from the GSO Road to the Angeles-Porac Road by reducing its travel time from 45 minutes in 1998 to 16 minutes today.

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

(1) Financial Internal Rate of Return (FIRR)

The civil works implemented in the project do not produce financial returns, but bring about economic returns such as economic benefits deriving from reduction in flood damages and increase in income of local residents. Due to such nature of the project, a quantitative analysis of FIRR was not possible; therefore no attempt was made for the

calculation of the FIRR either at the time of appraisal or ex-post evaluation.

(2) Economic Internal Rate of Return (EIRR)
At the time of appraisal, the EIRR was calculated to be 21.8%. On the other hand, it was calculated to be 23.7% at the time of this ex-post evaluation.

In the calculation of the EIRR at the time of this ex-post evaluation, the following figures were used for the project life, costs and benefits: The project life- 30 years; Costs- costs in the construction period including civil works construction and ROW, and costs in the operation and management period including labor, electricity, communication, dredging, etc.; Benefits- regional GDP, values of buildings, roads, agricultural lands, houses and other properties protected through flood prevention.

3.3.2 Qualitative Effects

The eruption of Mt. Pinatubo and its following lahar damages negatively affected 114,300 residents (27,000 households, as of 1990) and the lands of 267 k ㎡, including 4,360 ha agricultural lands. The implementation of the project contributed to preventing further serious damages to those residents and lands.

This Project aimed at protecting major residential and economic areas outside the Megadikes, such as San Fernando City (Capital City of Pampanga Province), and Guagua City, which is located in the downstream basin of the Pasig-Potrero River, from further lahar and flood damages.

Based on such a background, we conducted a beneficiary survey in the following areas: Guagua City, where direct benefit was expected by construction and repair of the Megadikes; Bacolor City, most of which is located inside the Megadikes; and the Bulaon community, where displaced people from Bacolor City is now living.

Residents in the three areas were asked if they felt safer (residents in Bacor and Guagua were asked about the safety of the area where they were living and residents in Bulaon were asked about the safety of the area where they used to live) compared with ten years ago (before the implementation of civil works). 96% of respondents in Guagua City, 74% of respondents in Bacolor City and 84% of respondents in the Bulaon community answered that they felt safer than before.

In addition, the residents were asked how much the civil works contributed to prevention

of flood and the improvement of the living condition. 76% - 96% of respondents (Guagua City 96%, Bacolor City 80% and Bulaon area 76%) answered that the civil works contributed to flood prevention and the improvement of the living condition.

Although awareness for safety improvement after the implementation of the project and the contribution of the construction varies in each area, many respondents in all areas answered positively.

Thus, this Project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended Impacts

As shown in Table 4, after the implementation of the project, GDP and population of the targeted areas increased and the unemployment rate of the areas decreased. In fact, it is very difficult to quantify the degree of contribution of the project to the economic development and the decrease of the unemployment rate. As stated above, however, residents in the area highly evaluated the contribution of the project to flood prevention and the improvement of living environment. Thus, it can be said that the project gave a positive impact to the economic development of the areas.

Local government officials and residents pointed out as follows; As the danger of lahar and flood was diminished, the economic activity and ordinary life were being conducted more safely. If a flood happened, with dredging implemented, sludge retention time was shortened and hygienic status was improved. With regard to the impact on San Fernando City, which is located outside the East Megadike and is the capital of Pampanga Province and the economic centre, not only officials of the implementing agency but also the government officials and residents in the surrounding areas shared the same view.

Table 4: Basic statistics in the Central Luzon (Region 3)

	Year （Before the project）	Year （After the completion of the project）
Regional GDP	1998	2008
	206.5 billion pesos	572.0 billion pesos
Regional Population	1995	2007
	7,902,000	9,720,000
Regional Unemployment Rate	2000	2008
	11.4%	9.2%

Source: DPWH/NEDA

Respondents of Guagua City, where flood prevention effect is high, answered that the economic situation improved compared with 10 years ago. This confirms that the project contributed to the economic development of the targeted area. On the other hand, only 55% of respondents in Bacolor City and 44% in the Bulaon community answered so. In Bacolor City, which is located inside the tail dike and has a high possibility of continuous flood damage, it was difficult that the economic activity would recover to the same level of that of before the eruption of Mt.Pinatubo. So, only more than half of respondents in this city answered that economic activity was improved. In the Bulaon community, where displaced people from Bacolor City were living, residents considered their situation as a temporary one.

3.4.2 Other Impacts

(1) Impacts on the natural environment

In the Philippines, according to the decree No.37 stipulated by the Department of Environment and Natural Resources (DENR), Environment Impact Assessment (EIA) must be conducted when public/private projects are implemented. The implementation of EIA is necessary to get an Environment Compliance Certificate (ECC). For the implementation of the project, EIA was conducted and then ECC was issued in July, 1999.

As stated, the environment assessment was properly conducted before the implementation of the project. In addition, the project restrained the spread of lahar of damage and frequencies of flood, and the living condition was improved. DPWH signed memoranda with the Pampanga Province Government and related LGUs, based on which the LGUs monitored the impact of the construction operation and maintenance including environmental and social one. The environmental monitoring includes a site inspection, an interview study on disposal/water pollution/social impact. Environmental damage which requires a special measure had not happened so far.

(2) Land Acquisition and Resettlement

In the project site where lahar damage had happened, residents had evacuated already and resettlement was not needed. However, to acquire lands, negotiation with property rights owners was needed. Furthermore, if residents in a targeted area objected the project, the land in the area was not acquired. As unexpected alternative and additional construction were conducted, the acquired land area reached 374ha and the total expense was 511 million pesos. Although the ROW-related expense had been expected to be 40 million pesos at first, as a result it increased ten times as much as the originally expected. However, as the cost increase was due to necessary alteration and addition works, no

serious problem was observed..

3.5 Sustainability (Rating: b)

3.5.1 Structural Aspects of Operation and Maintenance

After the completion of the project, the operation/maintenance task was transferred to DPWH region 3 (Region 3:the Central Luzon).

The maintenance division, which consisted of 26 staff, carried out the operation/maintenance task. The division consists of Road/bridge/flood/building group and Road/bridge information application/bridge operation group. The former has 19 staffs (6 engineers) and the latter has 5 staffs (4 engineers).

The DPWH closely contacts with local governments in the targeted area. If the structures, which the project developed, were damaged and additional works were needed to increase efficiency of flood prevention, the local government contacts the DPWH Region 3 and has a meeting with it. If possible, the DPWH side may bear the financial burden and implement work. Or the local government will implement the work with its own account.

Once a year, DPWH Region 3 inspects the facilities which are maintained and submits a report to DPWH Central Office.

3.5.2 Technical Aspects of Operation and Maintenance

DPWH Central Office provides various training programs once a year to enhance engineers' skill. Training programs concerning operation/maintenance of flood control facilities cover the following topics; application of hydrology to infrastructure projects, hydraulic design, plan and design of flood control/drainage structure, recovery and maintenance procedures of flood control/drainage structure, hydraulic research/data collection, river/sand protection engineering, value engineering in infrastructure projects, safety measures in construction projects and flood management control.

Ten engineers, deployed at the maintenance division of DPWH, took the trainings provided by DPWH central office. The engineers took five courses on plan/design of sand protection, plan design of flood control/drainage development, maintenance of flood prevention/drainage facility, construction management of flood control project. The engineers, who took these courses, were provided with a certificate without an exam. Furthermore, there was no system to evaluate their learning status; therefore it was

impossible to evaluate the enhancement of skill level quantitatively. DPWH staff, however, recognize that the engineers took the courses earnestly and their skill level was enhanced steadily.

3.5.3 Financial Aspects of Operation and Maintenance

In principle, DPWH is responsible for providing necessary funds for operation/maintenance. Under the agreement between DPWH and LGUs, if DFPW lacks insufficient funding and urgent renovation is needed, the local governments can provide a necessary fund from its budget. Some additional works such as renovation of dale dike and road extension were implemented on the local government fund.

According to DPWH, the annual expenditure for the operation/maintenance for the facility developed by the project was 15.7 million pesos on average and it was provided from the central government (DPWH) budget. The budget for operation/maintenance of buildings/facilities for the project was not appropriated in the total budget. Necessary funds were raised from available budget each time.

DPWH central Office, Mount Pinatubo Emergency Project Management Office and DPWH region3 all pointed out that there was no sufficient central government budget for operation/maintenance of flood control facilities. According to DPHW staff, it was necessary to appropriate 130 million pesos for the operation/maintenance of the facilities. However, such a necessity was not recognized among DPWH senior staff and the Ministry of Finance.

Local government officials in the targeted areas were concerned about the lack of funds. As financial ability of local governments was not sufficient enough, they expected that the central government should keep enough fund in the budget. On the other hand, DPWH staff stated that local governments should bear some part of the cost. In fact, with regard to this project, DPWH and LGUs concluded MoAs to confirm that they both would share maintenance and operation budget.

Nevertheless, it can be said that the fund necessary for the operation/maintenance of the facilities was not secured constantly. Although the fund for urgent renovation works was raised somehow, it is desirable that the budget for operation/maintenance should be constantly secured by DPWH and LGUs, either by sufficient budget secured by DPWH, which has a primary responsibility for operation and maintenance, or by making clearer

the division of responsibilities and the amounts of funding to be shared between DPWH and LGUs.

3.5.4 Current Status of Operation and Maintenance

On the site inspection for all work sites of the 7 contract packages (CP), it was confirmed that the operation/maintenance status was good.

However, a part of the southeast Megadike renovated in the project was damaged, which the study observed on the site although this damage is not thought to be caused by deficiencies on the part of the structure. As of November, 2010, DPWH was implementing a renovation work, leaving the access road unchanged.

Some problems have been observed in terms of financial aspects of operation and maintenance; therefore sustainability of the project is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

To conclude, the relevance of the project is high. The efficiency is fair as the expenditure and the project term exceeded the plan. Although there is a slight financial problem in the sustainability, the effectiveness is high.

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

4.2 Recommendations

4.2.1 Recommendation for implementing agency

None.

4.2.2 Recommendation for JICA

None.

4.3 Lessons Learned

It turned out that the operation/maintenance budget for the facilities of the project was not secured constantly. One of the reasons why operation/maintenance budget is properly secured at this moment is that plans for budget amount and shares to be paid by relevant authorities were not specified and formulated beforehand. When JICA extend cooperation concerning infrastructure facility development like this project in the future, it is

desirable to do the following; first, to formulate a cost plan for an operation/maintenance and its sharing scheme for about 5 to 10 years after completion at the time of appraisal; second, to review budget forecasts in accordance to the changes at detailed designing and implementation phases; and third, to make sure that JICA and the implementation agency reconfirm the plans for maintenance and operation together with specific budget measures and shares of responsibilities at the time of the project completion.

Comparison of the Original and Actual Scope of the project

Item	Original	Actual
1.Project Outputs	CP 1 Repair of Southwest Megadike Length: 4.5 km	CP1 Raising of Southwest Megadike: Partially modified Length: 3.3 km Reinforcement of West Megadike: Extention Length: 7.27 km
	CP2 Construction of Closure Dike Length: 3 km Hights: 8m Lahar dike: 575,210 ㎥	CP2 The original plan was deleted, and the following alternative works were conducted: -Gugu Bridge on northwest (100.16m) -Widening of the Gapan - San Fernand- Olongapo (GSO) Road (2.557 km), -Construction of west bank dike of Gugu River (2.557 km), -Upgrading of Culverts
	CP3 (1)Reinforcement of Baluyot Channel Bank and Excavation of the Baluyot Channel Length: 4 km Estimated Excavation Volume: 2,040,000 ㎥	CP3 (1)Partially modified Length: 3.52 km (Reduction) Estimated Excavation Volume: 504,646 ㎥ (Reduction)
	(2)Raising of Sta. Barbara Bridge Approaches	(2)Deleted (because civil work had already been done by DPWH)
	(3)Restructuring of the Sapang Labuan - Baluyot Canal	(3)Partially modified -Installation work of RCBC (precast concrete box culvert) was conducted as a supplementary civil works
	CP4 (1)Rehabilitation of San Fernand - Sto. Tomas - Minalin Tail Dike	CP4 (1)Content of the civil work was partially modified
	(2)Repair of Bacolor Tail Dike	(2)The original plan was deleted
		(3)The following alternative works were conducted:

		-Evaluation road: 4 roads -Canalization of Gugu River: 1,600 m -Gugu Bridge: 100.8 m
	CP5 (1)Dredging in the Delta Areas Length: 10 km Total Volume: 1,384,000 ㎥ (2)Excavation/Dredging of Pilot Channel (Third River) Total Volume: 4,240,000 ㎥ CP6 (1)Canal Development (from San Francisco to Sasmuan Cannal)	CP5 (1)Partially modified: Extention Length: 16.09 km Total Volume: 1,986,234 ㎥ (2) Partially modified: Reduction Total Volume: 2,519,748 ㎥ CP6 (1)Partially modified: Breadth and depth nearly unchanged. Reduction in areas for dredging (471,305 ㎥) CP7 (Added) (1)Repair of a portion of the Angeles-Porac Road which was swept away -Construction of Mancatian Bridge (270.34 m) -Construction of approaches (3.6 km) -Renovation of river channel dike (200 m), etc. (2)Other supplementary civil works (Supplemental Agreement I, II) -River channel renovation of upstream of the Mancatian Bridge (750 m) -Construction of Deflection Dike (296.83 m) -Construction of Maliualu Bridge (66.86 m) -Repair of the damaged part of Tail Dike (San Fernand - Sto. Tomas - Minalin) (75 m) -Asphalting of the East Mega Dike, etc.
2.Project Period	Dec. 1999 – Sep. 2003 (46 months)	Dec. 1999 – Feb. 2006 (75 months)

3.Project Cost		
Amount paid in Foreign currency	6,199 million yen	7,633 million yen
Amount paid in Local currency	4,405 million yen	2,983 million yen
	(1,468 million pesos)	(1,366 million pesos)
Total	10,604 million yen	10,616 million yen
Japanese ODA loan portion	9,013 million yen	7,633 million yen
Exchange rate	1 peso = 3 yen (As of Dec. 1999)	1 peso = 2.47 yen (Average between Dec. 1999 and Mar. 2003)

Third Party Opinions on

"Pinatubo Hazard Urgent Mitigation Project - Phase II" (PHUMP)

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The Project is relevant not only in terms of the national development goal of mitigating flooding but more importantly in terms of the economic development of the Central Luzon Region (Region 3) as well. In particular, the Project directly impacts on Pampanga province which is the focal point of Region 3 and a significant part of the day-to-day functional orbit of the National Capital Region, or Metro Manila. Rapid urbanization is taking place in the Province with the development of a Metro Angeles that is considered the next hierarchy of urban settlements. Population growth in this area is projected to surpass that of Metro Manila in the medium term. The economic potential of the Region is very high but many lands are unutilized due to flooding and mudflow and unstable lahar environment. The improvement of infrastructure for flood measures is thus critical and highly relevant.

The construction and rehabilitation of infrastructure in the Province has had immediate effects on the lives of the residents as shown by the lower flood frequency and lower inundation. However, the degree of effectiveness differs across municipalities or barangays in the Province. A further probe on the differential effects would be helpful since flooding is still an issue in some areas/barangays while in others the flood condition has remained unstable. At the household level, qualitative measures of "safety" can be supported by indicators on the growing confidence of the business community by examining business registration and activities at the local level. A situational analysis of the condition prior to the Project would help in the effectiveness as well as impact analysis.