Republic of the Philippines

Pinatubo Hazard Urgent Mitigation Project[1]

External Evaluators: Yasuhiro Kawabata and Yuriko Sakairi
Sanshu Engineering Consultant
Field Survey: November 2007- June 2008

1. Project Profile and Japan's ODA Loan

Location of Project Site


Maskup Dam

1.1 Background

Mt. Pinatubo, situated in the center of Luzon Island 90km north of Metro Manila, erupted in June 1991, after lying dormant for 460 years. One of the largest eruptions of the last century, it produced a remarkable volume of pyroclastic flow and ash fall deposits. Lahar generated by the combination of heavy rain and unstable pyroclastic flow deposits pose continuing grave danger to human life and property in the low-lying areas and has displaced about 20,000 households. The areas were isolated after the Mabalacat-Bamban section of Route 3, the major trunk road connecting Central to Northern Luzon, was buried in lahar with a thickness of more than 10 meters, which had regional and national impacts on economic activities. Therefore restoring the roads and other infrastructure was urgently needed to prevent further damage to human life and property.

1.2 Objective

The objectives of the project were to reconstruct roads and construct/reinforce sabo and flood control facilities such as sandpockets[2] in the lahar disaster areas of Tarlac and Pampanga Province located around the Sacobia-Bamban River middle-basin originating from Mt. Pinatubo, to secure the arterial highway transportation network, and to prevent expansion of the mudflow area. In addition, the project aimed to prevent further disaster

[1] The ex-post evaluation for this project was jointly conducted with the Philippine National Economic and Development Authority（NEDA）.
[2] A large sabo system. It is located in the Sacobia-Bamban River with an area of 21km^2.

through river improvement so that it could contribute to economic growth in the affected area. The project site is shown in Figure 1.

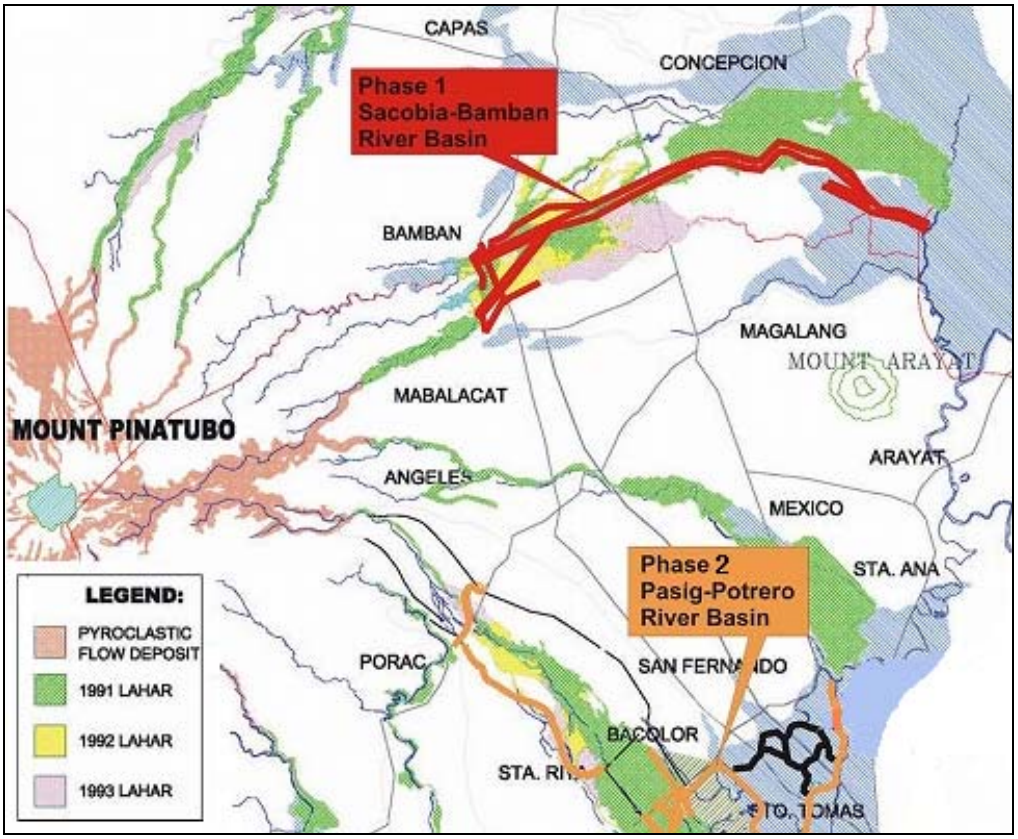


Figure 1: Project Site（in red）

1.3 Borrower/Executing Agency

Government of the Republic of the Philippines/Department of Public Works and Highways（DPWH）

1.4 Outline of Loan Agreement

Loan Amount/Disbursed Amount	6,911 million yen/6,910.78 million yen
Exchange of Notes/Loan Agreement	February 1996/March 1996
Terms and Conditions -Interest Rate -Repayment Period (Grace Period) -Procurement	 2.5%; Consultant: 2.1%; 30 years (10 years); General untied
Date of (Disbursement) Completion	July 2001
Main Contractors	China International Water & Electric Corporation（China）・Grace Const.（Philippines）—JV Daewoo Corporation（Korea）・Dimson (MLA.)（Philippines）—JV J.H.Pajara Construction Corporation（Philippines）・R.D. Policaprio & Co., Inc.（Philippines）・Mitsubishi Heavy Industries (Japan)—JV
Consultant Services	Nippon Koei・PKII Engineers（Philippines）—JV
Feasibility Study	JICA（1995）

2. Evaluation Result (Rating: B)

2.1 Relevance (Rating: a)

2.1.1 Relevance at the time of appraisal

When Mt. Pinatubo erupted in 1991, a lot of ash from the volcano fell over the surrounding area, and a lahar disaster caused by the sedimented ash and rains affected about 4.6 million people over the years. Casualties reached about 2,000 people in total, and about 20,000 families were forced to evacuate their homes. The lahar covered vast areas of farmlands such that the damaged amount of agriculture increased to about 1.7 billion pesos. The Philippine government planned to relocate all affected families by 1996. However, the relocation plan had to be revised as the conditions of the new refugees affected by the lahar from Pinatubo progressively worsened due to heavy rains caused by typhoons. The arterial highway connecting Metro Manila to the center of Northern Luzon was unusable and thus a recovery project had to be implemented to secure transport through the arterial highway as soon as possible. Preventing the expansion of floods and lahar had become pressing problems, and therefore, there was a necessity to reduce and prevent floods and overflowing lahars in the downstream area. Thus the project was given top priority.

2.1.2 Relevance at the time of evaluation

Lahar damage frequently occurred in the affected areas caused by heavy rains during the rainy season and typhoons. To prevent additional damage, there was a necessity to renovate the Sacobia-Bamban River Basin area damaged by the Mt. Pinatubo eruption. Also, the Medium-Term Philippines Development Plan 2004-2010 (MTPDP), followings are given top priority: (1) Secure transport without delay; (2) Strengthen the communication network inside the area; and (3) Renovate main roads between Pampanga and Tarlac in order to support agriculture, industry, fishery, commerce and tourism in Central Luzon. In addition, there was a necessity to renovate vast farmlands covered by lahar to assist farmers in resuming their economic activities. Thus, the project was highly relevant at the time of ex-post evaluation.

In addition, in the same Plan (MTPDP2004-2010) indicates developments of the Subic-Clark region as one of the priorities of the infrastructure sector. It also discussed the need to urgently implement flood control in the lahar-affected Pinatubo area. In the environment and natural resource sector, in order to mitigate the effects of natural disasters and to prevent the loss of life and property, provision of adequate flood control in the flood/sediment disaster prone areas is a priority issue. Furthermore, implementation of Phases II and III of the Pinatubo project are among the priorities and Phases III and IV are scheduled to be completed by 2010. Thus, Phase I of the project was an emergency project as an initial phase of the phased project and relevant to the

MTPDP priority to save human life and property from the effects of natural disaster.

The Philippine Disaster Preparedness and Prevention Act of 2007 has been submitted to the Congress to improve/streamline mobilization of rescue teams, in the event of typhoons and earthquakes, and reconstruction support.

Thus it can be concluded that the project was highly relevant to the National Development Plan and was also greatly important as an emergency mitigation project.

2.2 Efficiency（Rating: b）

2.2.1 Outputs

Table 1 shows the project plan and outputs. There were some changes in outputs, however, the changes are minor and deviation from the project plan is minimal. Output was adequately adjusted to the needs according to the actual damage and effects of typhoons. For example, after the Pinatubo eruption, the remarkable volume of lahar deposit changed the upstream stretch of the Sacobia-Bamban River which was annexed to the Pasig-Potrero River, therefore the work required was reduced and adjusted accordingly. Additional work was required to improve the right bank of the Sapang Cauayan River which was damaged by a typhoon in 1991 (the total length of the slope protection was reduced according to D/D). Additional slope protection and spur dikes were provided at Bamban River due to the effects of a flood which occurred in 1999. Cemented lahar and gravel (CLG) embankment was adopted instead of planned double-wall steel sheet piles, because CLG is economical and provides similar protection strength.

Under the consultant services, Flood Control Planning in Sacobia-Bamban River Basin, Agriculture Development of Sand Pocket Area (2,090ha)[3], and Monitoring and Planning of Flood and Mudflow Control Works in Pasig-Potrero River Basin Feasibility Report[4] were conducted. Based on the results of the Feasibility Report, Phase II of the Pinatubo project was designed and successfully implemented with loans from JBIC.

[3] Completed in 1998.
[4] March 1997-April 1998.

Bamban Bridge Bamban River Slope Protection

Table 1: Planned and Actual Project Output

Item	Planned	Actual	Reason for Changes
1. Sand Pocket			
Road dike on Route 329	1,650m	Cancelled	Deemed no longer necessary when Sacobia-Bamban River and other river training works were completed, as the lahar/flood risk was much reduced.
Lateral dike (3 rows)	5,960m	Cancelled	
Raising/closing of open dike	1,050m	Cancelled	
Reinforcement of Parua River Dike	9,000m	20,000m	To take into account the topographic conditions during the D/D.
2. Maskup Consolidation Dam			
	Double-wall type with steel sheet pile	Steel sheet pile with CLG embankment	In order to reduce construction cost as the material can be procured near the construction site and shorten construction period.
Length	490m	496m	Almost as planned.
Steel sheet piles	36,915m	11,068m	An adoption of CLG reduced the total length of sheet piles to one-third of the planned length.
3. Sacobia River Training Work			
Channel width	150m wide	110m wide	River piracy of upper catchments (24km^2) of Sacobia River which was annexed to the Pasig-Potrero River resulted in a reduction in lahar.
Groundsills No. 1-6	Steel sheet piles	Steel sheet piles/CLG	In order to reduce construction cost and shorten construction period.
Channel excavation	2,800,000m^3	3,246,000 m^3	Siltation in Sacobia pilot channel during 1998 rainy season caused additional quantity of channel excavation in Sacobia channel.
Slope protection	10,356m	10,700m	Almost as planned.
CLG	–	92,348m	Due to siltation in the 1997 and 1998 rainy seasons additional work had to be urgently conducted.
4. Bamban River Improvement			
Channel excavation Upper stretch	1,410,000m^3	38,980,000m^3	Due to siltation in the 1997 and 1998 rainy seasons, excavation was required in a wider section of river channel.
Lower stretch	2,000,000m^3	3,040,000 m^3	
Slope protection	20,900m	46,007m	Due to the effect of the lahar which occurred in early August 1999 additional slope protection and spurdikes in lower stretch were needed.
Spur dike	12 sets	45 sets	
5. Sapang Cauayan Training Work			
Slope protection	3,600m	2,400m	To take into account the topographic conditions during the D/D.
6. Restoration of Highway Route 3			
Total length	3,400m	3,220m	Almost as planned.
Bamban Bridge	175m	174m	Almost as planned.
Mabalacat Bridge	198m	156.2m	Due to reinforced slope protection in the

Item	Planned	Actual	Reason for Changes
			upper stretch, the length of the bridge was reduced.
Concrete Pavement	3,203m	2,887m	To take into account the topographic conditions during the D/D.
7. Consultant Services			
International	203 M/M	242 M/M	Due to additional work including investigation of CLG adoption, monitoring and planning of sabo/flood control in Pasac Delta.
Local	189M/M	315 M/M	Due to additional work to conduct D/D for Phase II.

2.2.2 Project period

The planned project period at the time of appraisal was from March 1996 to December 1999 (46 months). The actual period was from March 1996 to May 2001 (at civil work completion, in total of 63 months); at 137% compared with the planned period. While the construction period was planned from June 1997 to December 1999 (31 months), the actual period was from July 1999 to May 2001 (47 months). The construction delay affected the project period of the consultant services. While the project period for the consultant services was planned from May 1996 to May 1999 (44 months), the actual period was from December 1996 to May 2001 (54 months). The project period of each component is shown in Table 2[5]. As the upstream morphology of the Sacobia-Bamban River became stable, the urgency of work was lessened. The rehabilitation of Route 3 Highway was found to have greater social and economic impact, hence rehabilitation of the highway was given priority and completed ahead of original schedule.

Project delay was due to additional construction works caused by natural disaster[6]. Work was suspended because of the flood caused by the heavy rain in 1998 after the start of the renovation of the Sacobia-Bamban River; there was a further two-year delay due to the additional work to eliminate sedimentary soil. Although works related to the project were completed in mid-October 2000, works had to be carried out again due to lahar damages and damaged bank protection in the Sacobia-Bamban River caused by Typhoon Reming that occurred at the end of the month. (The entire stretch of the Sacobia Channel was completely filled-up with sediments as well as 2km of the Bamban Channel downstream of its confluence with Sacobia. Restoring works of damaged structures and excavation of pilot channel capable of discharging 20-year flood magnitude through the buried stretches took about six months.) The adoption of CLG and the increased manpower helped shorten the project period resulting in a slight delay despite frequent

[5] Table 2 indicates that the last package was completed in April 2001. The official completion date was set one month later at the satisfactory inspection.

[6] Damages were caused by the heavy rains during the rainy seasons in 1997, 1998 and 1999, and by Typhoons Reming and Seniang in October and November 2000, respectively.

suspension of work caused by repeated natural disasters.

Table 2: Project Plan of Packaged Activities

	Planned	Actual
Package 1: Bamban River Improvement, Sand Pocket	June 1997 – December 1997	July 1998 – February 2001
Package 2: Sacobia-Bamban River Training Work, Maskup Dam	January 1998 – May 1999	November 1997 – April 2001
Package 3: Rehabilitation of Route 3, Bamban-Mabalacat Bridge Rehabilitation	January 1999 – December 1999	July 1997 – August 1998

The consultant services are summarized in Table 3.

Table 3: Activities and Project Period of Consultant Services

Activities	Period（Actual）
D/D	December 1996 – March 1998
Construction Supervision	July 1997 – April 2001
Agricultural Development Plan	March 1997 – March 1998
Monitoring and Planning of Flood and Mudflow Control Works in Pasig-Potrero River Basin Feasibility Report	March 1997 – March 1998
Monitoring and Planning of Sabo/Flood Control in Pasac Delta	June 1999 – May 2001

2.2.3 Project cost

The total project cost was estimated at 9,215 million yen and the total loan amount at 6,911 million yen at the time of appraisal. (The remaining 2,304 million yen was to be financed by the Government.) The actual total project cost was 9,894 million yen and the amount of the ODA loan disbursed was 6,910 million yen. The total project cost was at 107.4% of the estimates.

The reasons for cost over-run were additional work due to damages caused by the natural disasters resulting in cost increases. (The lower stretch of the Bamban Channel was filled with sediment due to heavy rains which required excavation work.) Consultant service cost was slightly increased by 2% due to additional investigations and prolonged construction supervision caused by delays in project implementation. The number of banks increased per D/D which added to cost, however changes in construction method by using CLG and competitive bidding contributed to a reduction in the project cost.

The project efficiency is rated as moderate because output of the project was almost as planned, however, the project cost and Project period exceeded planned.

2.3 Effectiveness（Rating: a）

2.3.1 Beneficiaries

Table 4 shows the number of beneficiaries[7], which exceeded the estimates at the time of the appraisal by about 20%. The repeated floods and lahar disasters may have increased the number of affected persons, however, the executing agency effectively identified the disaster victims and the damaged areas and sites and swiftly carried out reconstruction assistance to rebuild the local infrastructure, which also may have contributed to the increased number of beneficiaries. According to the census as shown in Table 5, the population in the Sacobia-Bamban River has increased. It is difficult to prove any connection to the project, however, the lahar mitigation measures may have restored confidence in the people and encouraged them to return as they felt it was safe to live in the area. The project restored the lahar-affected areas[8] and improved the agricultural activities.

Table 4: Number of Beneficiaries (1,000 people)

Area	Planned	Actual (2006)	Against Planned (%)
Pampanga	4,043	4,833	+19.5
Tarlac	2,362	2,823	+19.5
Total	6,405	7,656	+19.5

Table 5: Population in the Sacobia-Bamban River Area (1,000 people)

Area	1990	1995	2000
Pampanga	1,532,615	1,401,756	1,882,730
Tarlac	859,708	945,810	1,068,783
Region III	6,199,017	6,962,570	8,030,945

Source: National Statistic Bureau Census

2.3.2 Traffic volume

The route from Manila to Central Luzon is through the North Luzon Expressway (Mabalacat Exit) to Route 3. Route 3 was entirely swept away by the lahar caused by the typhoon in 1993 and rendered impassable. According to the Appraisal Report, it was estimated that 60% of the total number of vehicles at the Manila exit travel towards Central and Northern Luzon, thus about 6,000 vehicles (1995) were estimated to travel to Central/Northern Luzon through Mabalacat. Therefore at Mabalacat, the traffic volume increased by 33% from 6,000 to 8,500 in 1999 and subsequently it increased further.

[7] Persons who live in the areas and the municipalities damaged by the Pinatubo eruption.
[8] The lahar-affected area was 11,753ha.

Route 3 was largely improved through the reconstruction work under the project and was opened in 1999, accommodating traffic of 16,000 vehicles/day[9]. Thus the project contributed to improvement of the regional traffic. (Refer to Tables 6 and 7).

Table 6: Traffic volume of North Luzon Expressway (Manila exit) (ADT)

1991.5	1991.6*	1991.10	1992	1993	1994	1995
2,715	2,398	824	3,312	3,110	9,411	10,227

*Mt. Pinatubo erupted in June 1991. According to the Appraisal Report, 60% of the total number of vehicles travel towards Central and Northern Luzon, while the remaining 40% travel to Anhelse and San Fernando.

Table 7: Traffic volume of North Luzon Expressway (Mabalacat) (ADT)

1999	2000	2001	2002	2003	2004
8,498	8,833	9,690	10,476	10,373	9,890

Source: DPWH

Cars had to take a detour to Route 329 running parallel 10km east of Route 3, when Route 3 was impassable, which substantially increased the travel time to Northern Luzon and Manila. The San Francisco Bridge over Route 329[10] was rebuilt in order to maintain the travel route and to prevent proliferation of lahar. Therefore the traffic on this route (Route 329) was also interrupted during the construction. Thus rehabilitation of Route 3 was given top priority and contributed substantially to the local community. (Refer to the environmental and social impact section.)

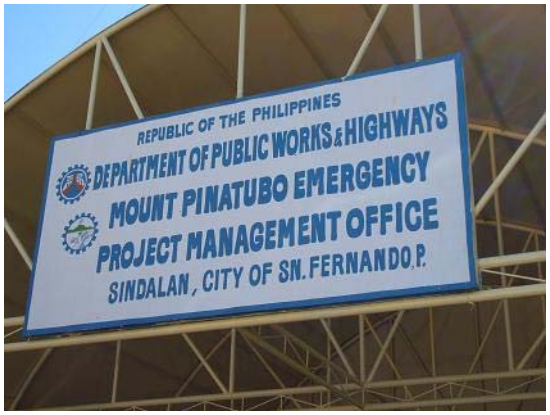
2.3.3 Internal rate of return

The Internal Economic Rate of Return at Appraisal（EIRR）, with project investment cost and increased administrative and maintenance costs as costs, and for the implementation of this project and a reduction of damage costs caused by floods less than the 20-year probability flood as benefits with a project life of 30 years, was estimated at 18.9%. At the ex-post evaluation, EIRR was recalculated at 17.2% based on similar assumptions. The main reason of the lower EIRR was the delayed benefit which occurred because of the project completion delay. However, as the project contributed to the revitalization of the local economy by improving the transport network, increasing number of farmers who returned to the affected area, and locating firms to the area, the investments were adequate and the objectives at the time of appraisal were fully achieved.

2.4 Impact

2.4.1 Improved transportation

At the time of appraisal, Route 3, the



Mt. Pinatupo Emergency Project Management

[9] About 13,000 vehicles in 1995.
[10] Supported by ADB.

main arterial road, through the damaged area was completely buried in the lahar. The roads were wiped away by a flood from the Bamban River for a 3.5km stretch. In addition the bridge over Bamban River was heavily damaged and rendered impassable. As a result, the area was completely isolated. The Magalang-Concepcion-Capas bypass was the only accessible route, however, the detour added an extra 16-26km of travel which obstructed economic activities. Because this bypass was narrow and poorly paved and was damaged by flood and lahar, it increased travel time by 1.5 hours compared with Route 3. During the rainy seasons, the Sacobia-Bamban River, where lahar was accumulated, flooded 75% of the bypass increasing travel time by 3-4 hours.

The project has fully restored Route 3 enabling the trip from Mabalacat to Tarlac within one hour. The traffic volume has increased which contributes to the economic development of the area. The roads at the San Francisco Bridge on Route 329 are not submerged thus traffic conditions have substantially improved. Farmland in the affected area is being restored and agricultural production is improving[11]. It was reported that the project generated momentum for the Government's long-term industrial development plan for Central Luzon[12].

2.4.2 Beneficiary assessment

Under the ex-post evaluation, a beneficiary survey was conducted by interview in the project area[13] (September-December 2007). 93% of the respondents said the project motivated them to invest as the investments/properties can be protected; 70% of the respondents said they feel secure thanks to the project because flood and lahar damage can be avoided; and 98% of the interviewees stated their income increased; by approximately 10%（63% of the respondents）, by approximately 20%（15% of the respondents）, or by approximately 30%（10% of the respondents）. Improved road network contributed to better access, especially to markets (over 98%). 70% of the respondents consider the project helped improve access to schools, hospitals, and government offices. The restoration work increased employment opportunities. As restoration continued, women with family-operated farmlands returned to their homes to resume agricultural activities. 25% of women interviewed during the beneficiary survey reported increased income after the project.

Table 8 below summarizes the average income for the country and the affected areas. The income in the affected regions increased over time; the average income in Region III

---

[11] Before the Pinatubo eruption, sugar cane was grown in between Routes 3 and 329 (25km^2), rice was produced in the area of Route 329 (20km^2).

[12] (a) Formation of Metro Manila-Subic-Clark triad, (b) Strengthening production linkages within Northern Luzon, (c) Development of additional industrial lands in Tarlac, and Nueva Ecija to integrate Central Luzon provinces and Northern Luzon.

[13] Sample of 400 people was randomly selected and interviewed: 100 people in Bamban, 175 in Mabalacat, 125 in Magarang/Concepcion. Valid response was 400. 60% of the respondents were male and remaining 40% were female.

and Pampanga exceeded the national average except for that of Pampanga in 2003. The unemployment rate in the affected regions (Table 9) was worse than the national average, however, the rate for Region III has improved since 2004. Thus, the project has contributed to the revitalization of social and economic development and to improvement of opportunities of productive activities for women in the region.

Table 8: Average Family Income（pesos）

Area	1997	2000	2003
Nationwide	123,168	145,121	147,888
Region III	133,130	150,504	158,612
Papanga	153,522	160,827	N.A
Tarlac	115,074	113,087	N.A.

Table 9: Unemployment Rate (%)

Area	2003	2004	2005	2006	2007
Nationwide	11.4	11.8	7.4	N.A.	N.A.
Region III	12.1	12.3	12.0	10.4	7.8
Papanga	4.0	N.A	N.A	N.A	N.A
Tarlac	7.5	N.A	N.A	N.A	N.A

Source: National Statistic Bureau, The World Bank

2.4.3 Environmental and social impact

It is believed that there were no harmful effects on the natural environment because the reconstruction efforts were part of an emergency response in a region already covered with lahar. Maskup consolidation work enabled the storage of unstable lahar deposits of 70 million m^3 as planned and the lahar disaster area has been restored. Nearly 8,700 people in the lahar damaged sand pocket area who had been resettled by the Mt Pinatubo Commission[14] returned to their original homeland. The lahar prone area is now protected from flood and lahar, where people can live safely. Farmland has been fully restored and the road network has been safeguarded against lahar. Thus economic activities are rapidly growing in the region resulting in an improved labor and living environment. The agricultural crops were limited to sugar cane which was widely produced in the area and its cultivation was recently commenced. Life and peace have gradually been restored as before the eruption. Thus the project satisfactorily met the objectives and its contribution was considered high.

In view of the above, the benefits from the project were mostly realized as planned

[14] The Commission was established in the Executive Office of the President under the special legislation in October 1992. The Commission, consisting of 11 members, was tasked to provide assistance and resettle people affected by the Mt. Pinatubo eruption.

therefore the project effectiveness is highly satisfactory.

2.5 Sustainability（Rating: b）

2.5.1 Executing agency（Department of Public Works and Highways: DPWH）

The executing agency was the Department of Public Works and Highways（DPWH）[15], and its Mt. Pinatubo Emergency Project Management Office（MPE-PMO）implemented the project.

2.5.1.1 Operation and Maintenance system

Region III of DPWH is responsible for operation and maintenance (O&M) of the facilities constructed under the project. The Technical Unit of the two offices in Tarlac and Pampanga carries out regular O&M.

2.5.1.2 Technical capacity

Each District Office has a highly skilled maintenance crew which specializes in road, bridge as well as river maintenance, including slope protection and spur dikes. The maintenance crew is regularly updated on new trends and technology pertaining to O&M. Regarding the flood control infrastructure, O&M work is undertaken according to the manuals. Such maintenance aspects include patrol and inspection on bridge abutment, bridge girder, road surface, road and dike embankment, revetment, spur dikes and other structures. Through the inspection, identification of places where maintenance and repair are required are to be reported to the Regional Office of the DPWH which is to formulate a work program and secure the budget. Frequency of the patrol and inspection is set at once a month during the dry season and at once a week during the rainy season. During flooding, inspection is carried out a few times a day.

O&M of the road and superstructures of the bridges include occasional repairs on the asphalt shoulders of the road and asphalt overlay on the bridges, and occasional painting of both bridges and occasional tightening/adjustment of the steel cables of bridges. As DPWH has established an inventory of infrastructure and O&M is regularly conducted according to the O&M benchmark, the technical aspect of the O&M unit is considered as sound.

2.5.1.3 Financial status

The operation and maintenance budget for roads is allocated based on Equivalent Maintenance Kilometer （EMK） of the inventory submitted to the DPWH Headquarters, while the budget for flood control is allocated from the national budget. In 2002, 783

[15] The Headquarters of DPWH is located in Manila under which there are 15 Regional Offices consisting of multiple District Branch Offices. There are 11 PMOs which are responsible for ODA projects. The O&M unit of DPWH is the Bureau of Maintenance (BOM) which prepares O&M budgets and inspects roads and other infrastructure.

million pesos was allocated from the National Budget, out of which 37 million pesos (5%) was allocated to the Pinatubo area. However, the annual budget for flood control allocated during 2003-2006 was only 98 million pesos, and no funds were allocated to the Pinatubo area.

Table 10 shows the O&M budget for flood control in 2007 and 2008. In 2007, the O&M budget was increased to 521 million, out of which 11 million pesos (2%) was spent on O&M in Pinatubo. The river morphology is considered stable and the flood risk is unlikely as the river piracy of upper catchments of Sacobia River annexed to the Pasig-Potrero River; accordingly O&M of the project financed infrastructure has not been implemented. O&M has been carried out for the slope protection and channel rehabilitation of the Pasig-Potrero River (Phase II of the Pinatubo project). Although in 2008 the requested budget for flood control was fully granted, the budget allocation to Pinatubo decreased from the previous year and no O&M program is planned for this Phase I project. However, as previously discussed, DPWH carries out periodic inspection and monitoring. If any damages which require urgent repair work are found, fund can be obtained from the Quick Response Fund which finances urgent requirements outside of the routine O&M budget.

Table 10: O&M Budget for Flood Control（million pesos）

	2007	2008
Nationwide	521	1,099
Region III	88	218
Pinatubo	11	10

2.5.2 Operation and Maintenance status

Maintenance work for roads and bridges constructed under the project has been regularly implemented (such as rehabilitation of asphalt shoulders and inspection of bridge cable strength), and no problems have been reported. Occasional inspection and monitoring is carried out of the channel bed at the Bamban Bridge site which is expected to degrade at a maximum depth of 10m from the designed bed level in 10 years after construction, and any problems are reported.

Maskup Dam was constructed in the river to store unstable lahar deposits of 73 million m^3 in a spindle-shaped valley upstream of the dam site. In 2001 the Dam was already filled with lahar of 70 million m^3 and during the ex-post evaluation the Dam structure was completely buried with lahar deposits. According to DPWH, the Dam is constantly full of lahar and occasional desiltation of the channel is required to prevent lahar damage caused by heavy rains to the communities and farmlands located outside of the river banks. Private quarrying companies are encouraged to use them as aggregate for

construction material. However, it cannot be said that they will be effective as desiltation to prolong the storage capability of the Dam. DPWH plans the reduction of lahar to restore the storage capacity of the Dam.

The affected sandpocket was restored and cultivated as farmland. It will take time for the topsoil in the lahar-covered fields to develop and accumulate, making farming viable again. In the meantime, farmers attempt to grow crops which are resistant to alkaline soil. Rice cultivation is now the major agricultural activity in the downstream area where it is safe from flood/lahar, and the production rate is expected to increase.

No O&M problems have been noted, therefore the project sustainability is considered satisfactory. However, given that the Maskup Dam is full of soil completely covering the structure, there is concern about insufficient monitoring/O&M program and lack of budget for desiltation of the whole stretch of river channels.

3. Feedback

3.1 Conclusion

In light of the above, the project is rated as satisfactory.

3.2 Lessons learned

N.A.

3.3 Recommendations

In order to sustain sabo capability, it is desirable to conduct periodic desiltation of soil deposit from upstream. DPWH should conduct regular monitoring, formulate a desiltation plan based on the monitoring results, and secure the budget to improve the project sustainability and safety in the region.

Comparison of the Main Issues at Planned/Actual

Activities	Planned	Actual
(1) Output		
1. Sand Pocket		
Road dike on Route 329	1,650m	cancelled
Lateral dike (3 rows)	5,960m	cancelled
Raising/closing of open dike	1,050m	cancelled
Reinforcement of Parua River Dike	9,000m	20,000m
2. Maskup Consolidation Dam		
	Double-wall type with steel sheet piles	CLG
Length	490m	496m
Steel sheet piles	36,915m	11,068m
3. Sacobia River Training Work		
Channel width	150m wide	110 m wide
Groundsills No. 1-6	Steel sheet piles	Steel sheet piles/CLG
Channel excavation	2,800,000m^3	3,246,000m^3
Slope protection	10,356m	10,700m
CLG	_	92,348m
4. Bamban River Improvement		
Channel excavation Upper stretch	1,410,000m^3	3,898,000m^3
Lower stretch	2,000,000m^3	3,040,000m^3
Slope protection	20,900m	46,007m
Spur dike	12 sets	45 sets
5. Sapang Cauayan Training Work		
Slope protection	3,600m	2,400m
6. Restoration of Highway Route 3		
Total length	3,400m	3,220m
Bamban Bridge	175m	174m
Mabalacat Bridge	198m	156.2m
Concrete Pavement	3,203m	2,887m
7. Consultant Services		
International	203M/M	242 M/M
Local	189M/M	315 M/M
(2) Project Period	March 1996－December 1999	March 1996－May 2001
(3) Project Cost（Total Project Cost） Foreign Currency Local Currency Total ODA Loan Portion Exchange Rate	 5,634 million yen 3,581 million yen （895 million pesos） 9,215 million yen 6,911 million yen 1 peso＝4 yen（Nov. 1995）	 6,989 million yen 2,905 million yen （726.43 million pesos） 9,894 million yen 6,910.78 million yen 1 peso＝4 yen（average of 1996-2001）