Indonesia

Mount Kelud Urgent Volcanic Disaster Mitigation Project

Report Date: March 2001
Field Survey: September 2000

1. Project Profile and Japan's ODA Loan

Location Map of Project Area

Debris Blocking Facilities within the Project Area

(1) Background

The project area is located at the base of the Kelud Volcano in Indonesia's East Java Province, roughly 90km southwest of the provincial capital of Surabaya. This region is in the basin of the Brantas River stretching over the three East Java districts of Kediri, Blitar and Tulungagung. Eruptions from this volcano can cause direct damage to an area of 1,736km^2 covering these three districts along the south and west slopes of the volcano. The population for this region stood at 3,194,000 at the end of 1988 (before implementing this project) with a population density of 1,840 people/ km^2.

All of the rivers on the western and southern slopes of this volcano flow into the Brantas River. Therefore, whenever there is an eruption, heavy amounts of earth and sand flow into this river, raising the level of the riverbed and causing flooding in the middle reaches of the Brantas River.

Following the major eruption in 1966, the Kelud Volcano Erosion Control Works Office was established and the Master Plan to prevent volcanic disaster was prepared in 1969. In February 1990 Kelud Volcano erupted again after a dormancy of 24 years and this caused a serious danger of secondary volcanic mudflows resulting from the large amounts of volcanic ash and lava. This is not only an economic problem involving the possible loss of social assets, but also threatens the lives of the local residents. Therefore, the execution of countermeasure project was needed as immediately as possible to stabilize the livelihood.

(2) Objectives

The objective of the project is to control secondary volcanic mudflows caused by the eruption in February 1990 through erosion control facilities. This project was to achieve the following objectives: (1) mitigate direct damage of earth and sand in fan delta of the volcano, (2) mitigate the damage from secondary mudslides caused by soil and earth flowing into the Brantas River, and (3) promote erosion control project within the framework of the master plan and raise the level of mid- and long-term security.

(3) Project Scope

1) Construction and rehabilitation of erosion control facilities are as follows.

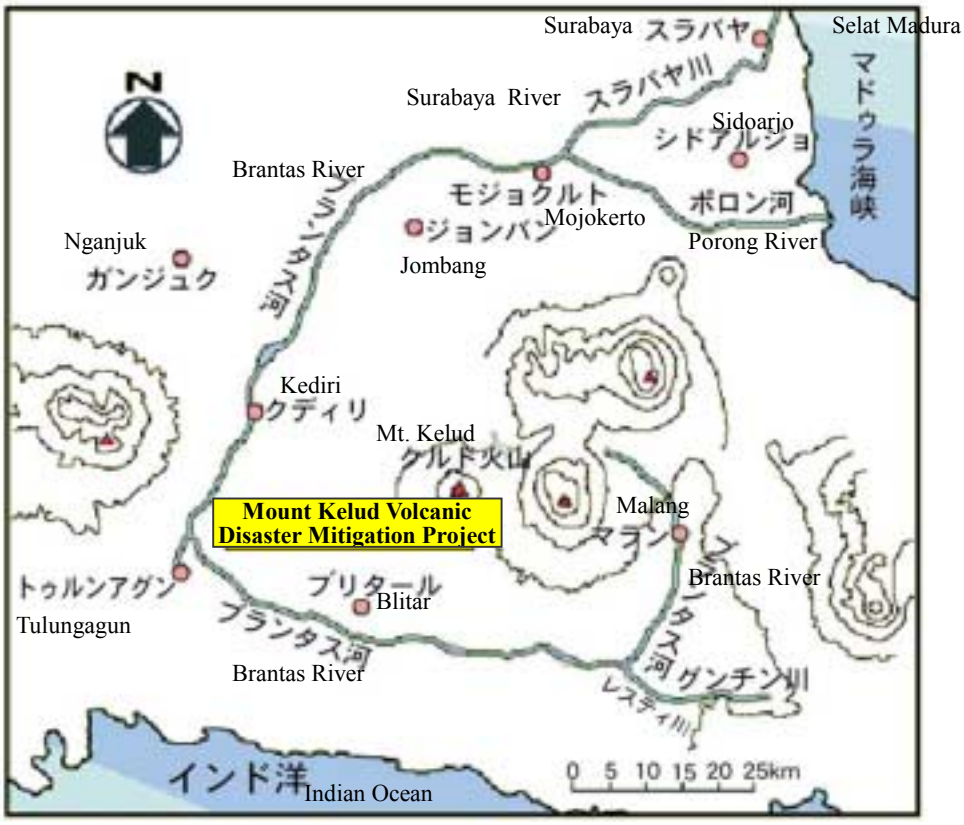
Region	Overview
Badak River	Erosion control dams, embankments, sand pockets
Putih River	Erosion control dams, small sand pockets, embankments, gabions (note), rehabilitation to drainage tunnels
Semut River	Erosion control dams, sand pockets, gabions
Jari River	Erosion control dams, (including a small hydraulic power system)
Konto River	Rehabilitation to dams for irrigation and drainage tunnels
Termas River	Rehabilitation to dams for irrigation
Puncu River	Erosion control dams

Note: A gabion is a long round cage filled with earth and rock, and used for the river embankment and water control.

2) Consulting Service

Assistance for bidding procedures, detailed design and construction supervision

Project Map



4) Borrower/Executing Agency

The Republic of Indonesia / Directorate General of Water Resources Development, Ministry of Housing and Infrastructure Development (former Directorate General of Water Resources Development, Ministry of Public Works)

(5) Outline of Loan Agreement

Loan Amount/Loan Disbursed Amount	¥3,246 million / ¥3,235 million
Exchange of Notes/Loan Agreement	September 1991 / September 1991
Terms and Conditions	Interest rate: 2.6%, Repayment period: 30 years (10 years for grace period), General Untied (Partially untied for consulting services)
Final Disbursement Date	October 1997

2. Results and Evaluation

(1) Relevance

The objectives of this project were to enhance the reliability of safety protecting life and property from volcanic disasters, improve the sense of security for local residents and prepare a base for economic development. These goals are deemed to be relevant even at the time of evaluation.

(2) Efficiency

As for implementation schedule, the project was initially to be completed in two and a half years, but it actually took close to four years due to the delays of land acquisition. Specifically, the delays were brought about by the problem of obtaining the required land for the planned bypass channel between Glondong River and Brantas River (one of the bypass channels between the Putih River and Brantas River flowing down the south side of Mount Kelud) needed to control soil erosion flows into the Lodoyo Dam. This bypass channel has still not been completed, but the Indonesian government is currently negotiating with target residents for their resettlement to acquire the land for completing this project.

(3) Effectiveness

The executing agency does not have any appropriate and reliable indicators for the effects and operating conditions of the facilities. Therefore, the questionnaire survey results of beneficiaries below serve as an assessment for effectiveness of the project objective.

1) Evaluation by Local Residents

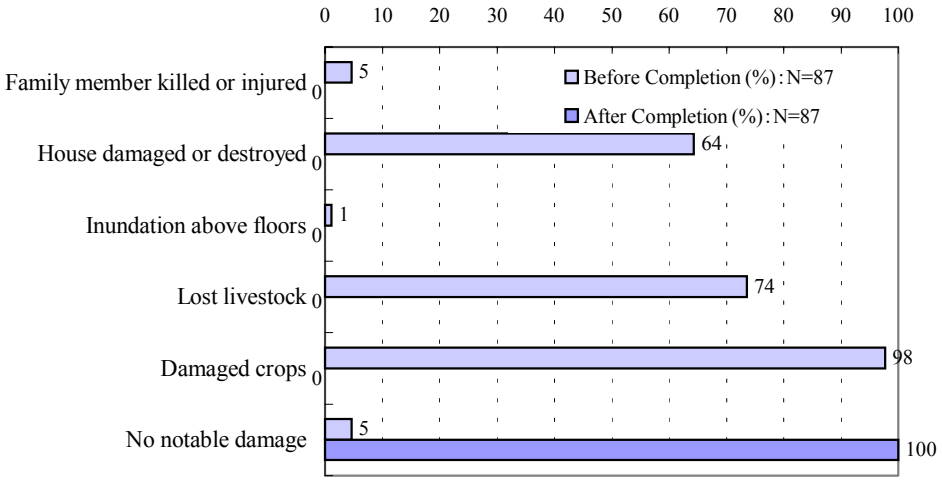
This survey was conducted with cooperation of the executing agency's local office (MKSP: Mount Kelud, Mount Semeru Evasion Control Office). 100 general households in the project region were surveyed (mainly from the Blitar District where many constructions of facilities were carried out). The contents of questions were "damage conditions suffered before and after completion of the project", "changes in the level of safety for the region", and "overall evaluation and additional requests". The outline of the survey results are as followed.

<Damage Conditions>

87 of the households out of 100, or close to 90% of all respondents, said that they had suffered some damage from sliding rocks and earth. The damage conditions before and after completion of the project are as shown in Figure 1. Before the completion of the project there was serious damage caused by the volcano

including “family member killed or injured”, “house damaged or destroyed”, and “lost livestock”. However, such major damages were eliminated after completion of the project.

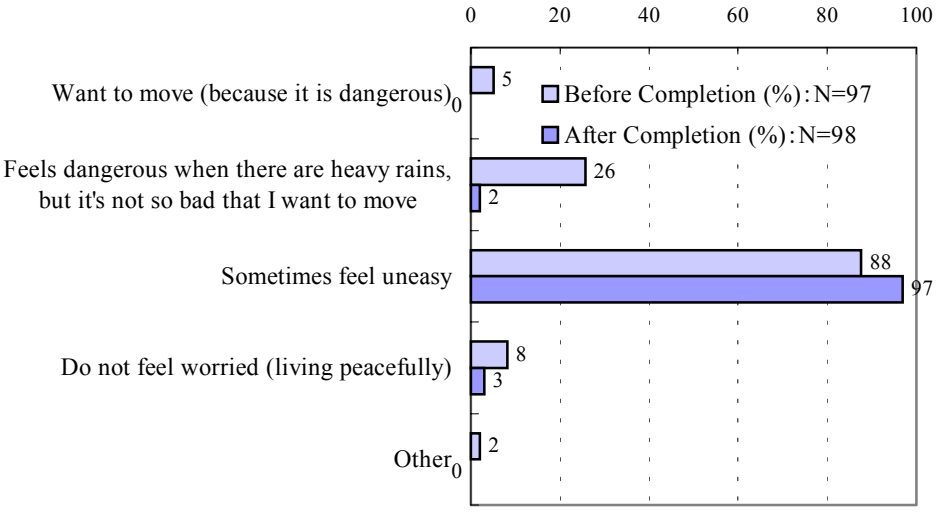
Figure 1 Damage Before and After Completion of the Project (multiple answers allowed)



<Regional Safety>

Figure 2 shows changes in the sense of security felt by the local residents before and after completion of the project. Before completion of the project roughly 30% answered “Want to move (because it is dangerous)” or “Feels dangerous when there are heavy rains”. However, such a sense of fear was almost completely eliminated upon completion of the project. However, roughly 100% of the households said “Sometimes feel uneasy”.

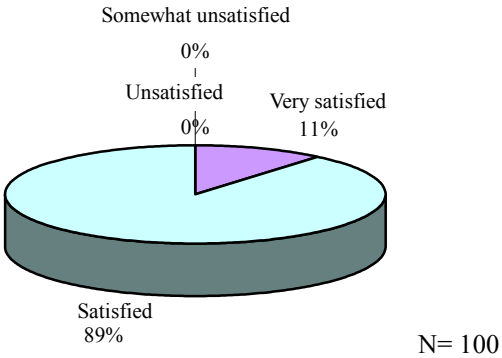
Figure 2 Awareness of Regional Safety (multiple answers allowed)



<Overall Evaluation and Additional Requests>

Figure 3 shows the results for the question that asked residents to rate their overall satisfaction with four ranks for the project. All respondents said that they were "very satisfied" or "satisfied" with the project. On the other hand, when asked about additional requests, the common responses were to strengthen the operation and maintenance systems (more people and money) and expand more facilities to further raise the level of safety for the region. This was consistent with the fact that almost all of the residents said that they sometimes still feel uneasy.

Figure 3 Overall Evaluation for the Project



N= 100

2) Recalculation of Economic Internal Rate of Return

The recalculated EIRR (Economic Internal Rate of Return) for this project came to 16.2%, which was a little lower than the 18.4% obtained at the time of appraisal. Actual expenses for project costs written in the records obtained from the executing agency were used when recalculating EIRR. The maintenance cost value at the time of the appraisal was used to avoid overestimating these figures (actual expenses were less than these values). Data for "benefit" was not available and thus the initial expected value was changed to the standard annual price. Further, the recalculations were also made taking into consideration the population change between at the time of appraisal and at the starting point for common use (the savings from the reduction in damages increases in line with the larger population). Accordingly, the "benefit" used in this recalculation is based on the same disaster occurrence probability and scale used during the appraisal and the value reflects the state of development for the surrounding area.

(4) Impact

1) Impact on Environment

There were no negative impacts on the environment.

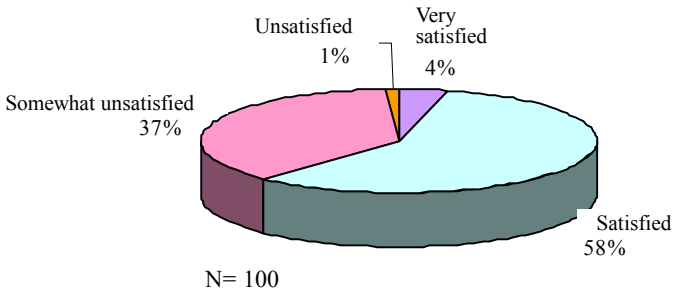
2) Impact on Society

The main objective of this project was to build erosion control facilities, but some other items were included into the project scope such as the building of crossways over rivers and the installation of small hydroelectric equipment. These developments helped to improve the level of convenience for the local residents.

a) River Crossways

A community crossway (between 1~1.5km) over the Badak River running down the southwestern side of Mount Kelud was built and used as a substructure of the silt basin facilities built for this river. According to the questionnaire survey of beneficiaries, 60% of the respondents said that they were "satisfied" or "very satisfied" with the new river crossway (see Fig. 4). This crossway made traveling easier and helped bring the regions on each side of the river together.

Figure 4 Satisfaction with River Crossway



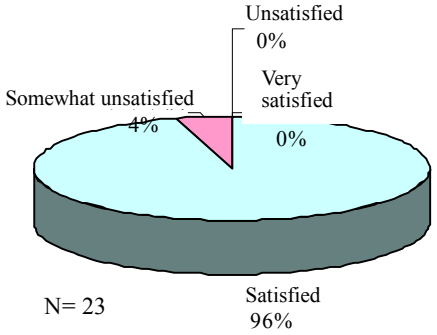
b) Small Hydroelectric Systems

Hydroelectric systems using the current flowing through multi-purpose dams built along the Jari River at the southern base of Mount Kelud were also improved. Small hydroelectric turbines being turned by 210 liters of water per second provide electrical power (12kW) to 61 nearby households. Management of this equipment has been already turned over to Blitar District and a rural electrification research and development team from Bravijaya University in Malang has been helping to operate and maintain this equipment. The equipment was installed three years ago and is still in good working order. The introduction of these systems has had the following impacts on the local communities.

- **Provision of sufficient power at a low price**
- **Provision of power to public facilities such as street lights, mosques and guard posts**
- **Provision of an environment where children can study at night**
- **Stimulated plans for building schools and technical training centers in the surrounding region**
- **Provide water to the surrounding region by using the daytime excess energy**

The questionnaire survey asked the residents about their degree of satisfaction with the hydroelectric systems. 22 of the 23 surveyed households (96%) said that they were "satisfied" (see Fig. 5). This shows that these systems have had a positive impact on this region.

Figure 5 Satisfaction with Hydroelectric Systems



c) Land Acquisition

21 farming households are in need of resettlement in order to build the bypass channel connecting the Glondong River with the Brantas River. The executing agency is currently negotiating with these families to obtain this land.

d) Other impacts

The aforementioned questionnaire survey of beneficiaries asked about other impacts brought about by this project. In addition to the direct impact of protecting lives and property by controlling soil erosion, there are expected to be various indirect impacts such as stabilization of public welfare and the regional economy. In fact, all of the respondents answered in the affirmative when asked, “Do you think this project has supported economic activities?” Specific examples included increased employment opportunities in agriculture and the excavation of sand for use in construction materials. This would also suggest increased incomes for the local residents.

(5) Sustainability

1) Operation and Maintenance

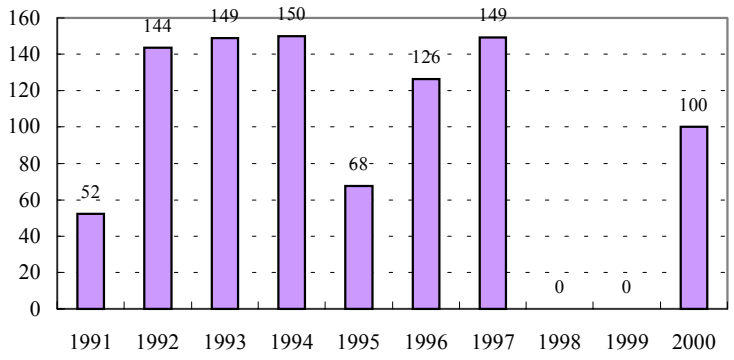
The erosion control facilities developed by this project were to be overseen by PJT (Perum Jasa Tirta), water management public corporation for the Brantas River region (government regulation PP No. 5) after project completion. However, even though the completed facilities have already transferred to this public corporation, actual maintenance operations have been shouldered by the Mount Kelud / Mount Semeru Erosion Control Office (MKSP: Mount Kelud Semeru Project; 60 employees) under the jurisdiction of the Directorate General of Regional Development, Ministry of Housing and Regional Development. For example, when accumulated soil from Kelud Volcano needs to be removed from the Brantas River, PJT will make informal request of the Erosion Control Office to inspect the relevant locations and then ask the central government for the needed budget. Later PJT will initiate the formal procedures for asking this office to conduct the soil removal project. Fortunately, there is a good cooperative relationship between PJT and the Mount Kelud / Mount Semeru Erosion Control Office.

2) Operation and Maintenance Status

The budget for the maintenance of the facilities falls within the framework of the national budget (APBN) and budget allotments are made within the framework of the annual action plan (DIP) for the project. The amount needed for the operations of the maintenance body, the acquisition of land, facility maintenance (including subcontracted work) is indicated in the annual action plan. However, according to the executing agency it is hard to cover all maintenance-related costs with the actual amount that is provided.

The amount provided by the central government for the maintenance of this project is as shown in Figure 6. Every year the project office requests 2 billion rupiahs to be applied to equipment rehabilitations, but only around one-tenth of this amount is actually provided. This is also smaller than the percentage for the assumed construction costs (project costs) at the time of the appraisal. In fact, no budget was allotted in 1998 and 1999 due to the Southeast Asian currency crisis of 1997. During those two years it was very difficult to conduct maintenance operations and erosion control facilities became damaged and their performance deteriorated. Farmers and other local residents were asked to cooperate in maintenance operations in order to overcome these budget shortfalls, but these activities alone are not expected to completely repair the facilities.

Figure 6 Operational and Maintenance Budget for this Project (million rupiahs)



* Based on data from the project office.

The person in charge of maintaining the various facilities makes inspections about once a week to check on the conditions of the erosion control equipment. The technical staffs at the Erosion Control Office all receive regular training from central government education agency (DIKRAT) and therefore they have adequate skills.

Evacuation warnings are also issued to the local residents as part of the disaster prevention activities and the local governments are responsible for issuing such warnings, but in this case the Erosion Control Office supports the local governments in assessing the situation and provides technical support for the evacuation efforts. The following is an outline of the procedures followed from recognizing a potential disaster to ordering an evacuation.

(i) The initial abnormal readings from the seismographs located around the volcano are sent to the Directorate Volcanology in Bandung (DVB), East Java Province. This directorate is a subsidiary organization of Ministry of Mineral and Energy.

(ii) The Directorate Volcanology in Bandung informs the Ministry of Mineral and Energy, the local governments (districts) and the Erosion Control Office of the conditions of the volcanic activity.

(iii) The local governments (districts) issue warnings to its local residents. Then the Erosion Control Office supports the evacuation activities of local governments and their residents.

3) Sustainability

The Erosion Control Office has prepared a plan to sustain and expand the effects of erosion control in the relevant regions by rehabilitating existing facilities and conducting additional erosion control constructions. However, the Indonesian government has not been able to provide the needed budget adequately due to financial difficulties, and as a result, damage to the existing facilities is on the move. This problem will need to be resolved in order to sustain the effects of this project and improve project independence. The following is a list of some of the issues that currently need to be addressed to enhance the sustainability of the project (based on the results of the on-site visits and monitoring by the maintenance organizations).

- **Rehabilitate erosion control facilities that have major damage**
- **Construct additional erosion control facilities**
- **Replace and repair maintenance roads around the crater of the volcano**
- **Enact tougher regulations to prevent unauthorized and unlawful excavation of river sand**

Originally these activities were to be conducted by the self-help efforts of the maintenance body. However, due to the financial difficulties facing Indonesia, the Indonesian government has asked Japan for additional ODA loans to rehabilitate damaged facilities provided by previous ODA loan projects.It was decided that an additional survey (Special Assistance for the Project Sustainability) would be executed to check the technical feasibility of the relevant repair plans and the sustainability of the project .

Comparison of Original and Actual Scope

Item	Plan	Actual
①Project Scope		
I. Construction and improvement of disaster prevention facilities	No. of facilities for each river region	
1. Erosion control dam	Badak River 3	Same as left
a. Construction	Putih River 2	Same as left
	Sumut River 1	Same as left
	Jari River 2	Jari River 1
	Serinjing River 1	Same as left
	Semut River 1	Same as left
b. Reinforcement	Konto River 1	Same as left
c. Rehabilitation		
2. Embankment	Badak River 1	Same as left
a. Construction	Putih River 1	Same as left
	Sumut River 1	Same as left
	Putih River 2	Putih River 1
b. Reinforcement	Sumut River 1	Same as left
3. Silt basin		
a. Construction	Badak River 1	Same as left
	Putih River 1	Same as left
b. Reinforcement	-	Badak River 1
4. Improvement of drainage tunnels	-	Drainage tunnel for the crater section
5. Access road	-	Badak River 1
	-	Putih River 1
6. Improvement of drainage canal	Putih River 1	Same as left
7. Construction of drainage canal (bypass channel)	-	Glondong River - Brantas River 1 (Partly incomplete)
II. Consulting service		
-Assistance for bidding procedures - Detailed design -Construction supervision	Foreign: 105M/M Local: 227M/M	Foreign: 118.53M/M Local: 281.80M/M
②Implementation Schedule		
1. Exchange of Notes	Sep. 1991	Sep. 1991
2. Consulting service		
(1) Selection of consultant	Jul. 1991 ~ Jun. 1992	Jul. 1991 ~ Aug. 1992
(2) Design and procurement	Jul. 1992 ~ Jun. 1993	Sep. 1992 ~ Dec. 1995
(3) Construction supervision	Jan. 1994 ~ Jun. 1996	Jan. 1994 ~ Oct. 1997
3. Land acquisition	Apr. 1993 ~ Mar. 1994	Apr. 1993 ~ Oct. 1998
4. Construction work		
(1) Bidding	Jan. 1993 ~ Dec. 1993	May 1993 ~ Dec. 1995
(2) Construction execution	Jan. 1994 ~ Jun. 1996 [☆]	Sep. 1993 ~ Oct. 1997 [★]
	[☆] To be completed	[★] Completed
③Project Cost		
Foreign currency	¥1,170 million	¥278 million
Local currency	¥2,649 million (38,935 million Rp.)	¥2,957 million (71,426 million Rp.)
Total	¥3,819 million	¥3,235 million
ODA loan portion	¥3,246 million	¥3,235 million
Exchange rate	1Rp.＝¥0.068 (Apr. 1991)	1Rp.＝¥0.041