

**THE REPUBLIC OF MAURITIUS
MINISTRY OF PUBLIC INFRASTRUCTURE AND LAND
TRANSPORT (MPI)**

**THE PROJECT OF LANDSLIDE
MANAGEMENT IN THE REPUBLIC OF
MAURITIUS**

FINAL REPORT

SUPPORTING REPORT

VOLUME 1

March 2015

JAPAN INTERNATIONAL COOPERATION AGENCY

KOKUSAI KOGYO CO., LTD.

NIPPON KOEI CO., LTD.

CENTRAL CONSULTANT INC.

FUTABA INC.

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1. Minutes of Meeting on the Detailed Planning Survey for the Project

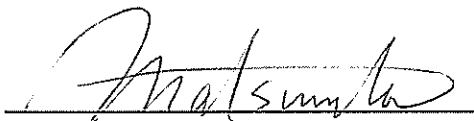
**MINUTES OF MEETINGS
BETWEEN
THE JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE MINISTRY OF PUBLIC INFRASTRUCTURE, NATIONAL DEVELOPMENT
UNIT, LAND TRANSPORT AND SHIPPING
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR LANDSLIDE MANAGEMENT
IN
THE REPUBLIC OF MAURITIUS**

The Japan International Cooperation Agency (hereinafter referred to as "JICA") has dispatched the Detailed Planning Survey Team (hereinafter referred to as "the Team") to the Republic of Mauritius from October 29 to December 4, 2011 for the purpose of preparation of the technical cooperation project concerning the Project for Landslide Management (hereinafter referred to as "the Project").

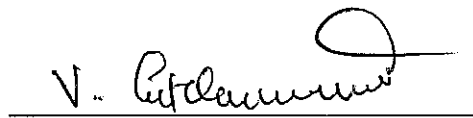
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As a result of discussions, both sides came to understanding concerning the matters referred to in the document attached hereto.

Port-Louis, November 24, 2011



Mr. Shigeyuki Matsumoto
Leader,
Detailed Planning Survey Team,
Japan International Cooperation Agency
Japan



Mr. Vidianand Lutchmeeparsad
Permanent Secretary,
Ministry of Public Infrastructure,
National Development Unit, Land
Transport and Shipping
The Republic of Mauritius

ATTACHED DOCUMENT

1. Draft of Record of Discussions

As a result of the discussions, both sides agreed on the draft of Record of Discussions (hereinafter referred to as "R/D") shown in Appendix I. After the approval of JICA headquarters, JICA and MPI will prepare the final R/D to be signed by both sides before the commencement of the Project.

2. Responsible Agency and Implementing Agency

Both sides agreed that MPI is the responsible agency, and the Engineering Division of MPI is the implementing agency for the Project.

3. Duration and Schedule of the Project

The duration of the Project would be about 30 months from the date when the JICA expert team (JICA mission) arrives.

The Schedule of the Project has been tentatively formulated according to the draft of R/D and is shown as annex to the draft of R/D.

The activities are subject to change within the scope of the R/D, if necessity arises, in the course of the Project implementation.

4. Input by MPI

(1) Allocation of Budget

Both sides confirmed that the following would be allocated by MPI to ensure effective implementation of the Project.

- a. Expenses for utility such as electricity and water supply for the project office
- b. Operational expenses for customs clearance, storage and domestic transportation for the equipment provided by the Japanese side
- c. Expenses for maintenance of equipment provided by the Japanese side
- d. Operation cost for landslide management

JICA will not pay the salaries and other allowances for the training and other project activities in Mauritius for the Mauritian counterpart personnel. Salaries to the Mauritian counterpart personnel would be provided by the Mauritian side.

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Both sides confirmed that MPI would assign suitable number of capable counterpart



personnel (at least 2 civil / geotechnical engineers on a full-time basis) in order to ensure the effective implementation of the Project.

Necessary number and qualification of the staff for any eventual Landslide Management Unit under the aegis of MPI will be elaborated in the course of the Project.

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Both sides confirmed that MPI would provide furnished and air-conditioned office space, which could accommodate around 10 persons including the JICA experts and supporting staff, with office furniture (desk, chair, and shelf), one telephone line and the Internet connection, necessary for the implementation of the Project. MPI will also secure enough storage space for equipment to be procured in the Project, and a meeting room or a seminar room for trainings.

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Both sides confirmed that MPI would provide necessary information for implementation of the Project.

5. Disclosure or explanation on the study findings

(1) JICA explained its information disclosure policy that the all study findings should be open to any organization and to the general public at the right time for the sake of accountability and better utilization of outcomes. On the other hand, JICA respects the Mauritian policy to disclose the study findings because the Project is under the bilateral cooperation scheme.

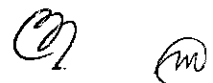
(2) Both sides agreed the result of the Project would be open to the public in order to achieve maximum use of the Project results.

6. Other relevant issues

(1) Both sides agreed that the Project title would be changed to “the Project for Landslide Management in the Republic of Mauritius.”

(2) Both sides agreed that due consideration will be given to other similar programmes such as the Africa Adaptation Programme (AAP) and the Indian Ocean Commission (IOC) so as to avoid duplication of works and ensure good coordination and effective use of resources in order to generate a synergy effect and mutual sharing of information.

(3) Following consultation between the Team, UNDP and MPI, it was agreed to consider



making use of the component of disaster risk reduction of AAP: "Consultancy Services for the Development of an Inundation, Flooding and Landslide National Risk Profile, Maps, Strategy Framework and Action Plans for Disaster Risk Management for the Republic of Mauritius," which includes the risk analysis of landslide, in order to collect more accurate data and analysis for the basic survey in the Project.

- (4) Ministry of Housing and Lands (MHL) has a mandate to control land use and development through the "Planning Policy Guidance (PPG)." Both sides agreed that landslide management needed to be integrated into the land use and development control, and close coordination between MHL and MPI would be inevitable in the course of the Project. The Project will include recommendation for revision of PPG.
- (5) One of the serious issues to enhance landslide management in Mauritius is lack of human resources who have expertise in geological engineering. In this regard, involvement of universities such as the University of Mauritius will be considered, in order to mobilize outside expertise and contribute to education in the field of geotechnical engineering.
- (6) In the meeting with relevant stakeholders on November 17, following needs were expressed from relevant organizations: (a) basic knowledge on landslide and other slope disasters, (b) technical basis for judgment to issue building and land use permit, (c) technical guide for initial inspection in response to reports from residents, (d) risk assessment and hazard map to identify risk areas, (e) methodology to control development in high risk areas, (f) technical report for Chitrakoot and La Butte, and (g) planning of monitoring system and interpretation method of obtained data. These needs will be taken into account for the project activities.
- (7) The IOC has started the Regional Project for Prevention and Management of Natural Risks and Disasters, covering its member countries. Both sides agreed that the Project outputs could be shared with the IOC's project for knowledge sharing with other countries in the region.



RECORD OF DISCUSSIONS

ON

THE PROJECT FOR LANDSLIDE MANAGEMENT

IN

THE REPUBLIC OF MAURITIUS

AGREED UPON BETWEEN

**THE MINISTRY OF PUBLIC INFRASTRUCTURE, NATIONAL
DEVELOPMENT UNIT, LAND TRANSPORT AND SHIPPING**

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

Port-Louis, (Month) (Date), 2012

Mr. Koichi Sasadate
Chief Representative
Madagascar Office
Japan International Cooperation
Agency
Japan

Mr. Vidianand Lutchmeeparsad
Permanent Secretary,
Ministry of Public Infrastructure,
National Development Unit, Land
Transport and Shipping
The Republic of Mauritius



Based on the minutes of meetings on the Detailed Planning Survey on the Project for Landslide Management (hereinafter referred to as "the Project") signed on November 24, 2011 between Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (hereinafter referred to as "MPI") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with MPI and relevant organizations to develop a detailed plan of the Project.

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that MPI, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of Mauritius.

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on January 12th, 2005 (hereinafter referred to as "the Agreement") between the Government of Japan (hereinafter referred to as "GOJ") and the Government of the Republic of Mauritius (hereinafter referred to as "GOM") .

Appendix 1: Project Description

Appendix 2: Main Points Discussed

Appendix 3: Minutes of Meetings on the Detailed Planning Survey



PROJECT DESCRIPTION

Both parties confirmed that there is no change in the Project Description agreed on in the minutes of meetings on the concerning Detailed Planning Survey on the Project signed on November 24, 2011 (Appendix 3).

I. BACKGROUND

Due to its geographical conditions, there exist a number of sites all over Mauritius with high risk of landslides and other slope disasters. In particular, some areas such as Chitrakoot, just on the outskirts of the city of Port-Louis, are diagnosed as potential high risk sites, which needed to be monitored and stabilized by countermeasures to protect the residents and public infrastructures.

In 2005, a large scale landslide occurred at Chitrakoot, and 54 households were damaged. GOM took measures to promote relocation of residents and a school, and prohibited construction in the area with high landslide risk. However, many residents have refused relocation and still in the danger of landslide. Furthermore, under the pressure of the urban development, houses have been constructed in steep slope areas, which have added risk of slope disasters. In addition, it is said that the increasing natural hazards such as heavy rainfall coupled with climate change have posed risks and been assumed to raise the risk of landslide and other slope disasters.

Given this serious issue, MPI has established the Repair and Rehabilitation Unit & Landslide Management Unit (hereinafter referred to as "RRU/LMU") under the MPI to enhance the slope disaster monitoring and countermeasures. However, the capacity to handle problems related to slope disaster monitoring and countermeasures is needed to be strengthened to manage landslide and other slope disasters.

GOJ and JICA have been supporting the disaster risk management sector in Mauritius, as one of the priority areas of cooperation. Based on the request from GOM, GOJ has decided to implement the Project and entrusted it to JICA.

II. OUTLINE OF THE PROJECT

1. Title of the Project
The Project for Landslide Management in the Republic of Mauritius
2. Expected Goals which will be attained after the Project Completion
 - (1) Goal of the Proposed Plan
A landslide management plan and Feasibility Study are approved by the GOM and implemented by the responsible organizations.

(2) Goal which will be attained by utilizing the Proposed Plan
The risk of landslide and other slope disasters is mitigated, and residents who live in landslide-prone areas are secured.

3. Outputs

- (1) A landslide management plan is formulated.
- (2) Feasibility Study (F/S) and pilot project are conducted.
- (3) Technical capacity on landslide management of the staff in RRU/LMU and other administrations is enhanced.

4. Activities

Component 1: Basic survey

- 1-1 Collection of existing data
- 1-2 Inventory survey
- 1-3 Actual condition survey on the structural and non-structural measures (non-structural measures includes early warning, monitoring, evacuation, land use planning and relocation, etc.)
- 1-4 Social survey
- 1-5 Organizational and institutional survey for landslide management
- 1-6 Economic base survey

Component 2: Formulation of a landslide management plan

- 2-1 Selection of high hazardous sites based on the landslide inventory
- 2-2 Monitoring and analysis of land slide activity level
- 2-3 Slope stability analysis
- 2-4 Safety assessment
- 2-5 Formulation of a landslide mitigation plan
- 2-6 Formulation of a monitoring plan
- 2-7 Review the existing early warning system and evacuation protocol to make recommendations
- 2-8 Formulation of a technical guide for initial inspection
- 2-9 Review of the "Planning Policy Guidance (PPG)" and formulation of recommendation
- 2-10 Formulation of a standard operating procedure (SOP) including technical guidelines
- 2-11 Formulation of a capacity development plan of RRU/LMU
- 2-12 Formulation of an implementation plan
- 2-13 Stakeholder meeting
- 2-14 Seminar for technical transfer

Component 3: Feasibility Study (F/S)

- 3-1 Site selection
- 3-2 Feasibility study (disaster management plan, facility plan and outline design, organization and management, monitoring, stakeholder meeting, etc.)
- 3-3 Project evaluation (technical, economic and social aspects)
- 3-4 Environmental Impact Assessment (EIA)
- 3-5 Seminar for technical transfer
- 3-6 Facilitation for financial resources mobilization

Component 4: Pilot project

4-1 Selection and design of pilot project

4-2 Stakeholder meetings for pilot project

4-3 Implementation of pilot project

4-4 Feedback to the landslide management plan and F/S

Component 5: Technical transfer

5. Input

(1) Input by JICA

(a) Dispatch of Mission (a team of JICA experts)

Following is the expertise of members of the JICA missions;

Landslide Management

Landslide Survey and Analysis

Landslide Monitoring

Institution / Capacity Development

Policy and Planning of Urban Development and Land Use

GIS / Topographic Survey

Geophysical Prospecting

Information, Education and Communication

Design / Cost estimation

Environmental and Social Consideration

(b) Training

Counterpart training in Japan

(c) Machinery and Equipment

Necessary equipment for the Project

Input other than indicated above will be determined through mutual consultations between JICA and MPI, during the implementation of the Project, as necessary.

(2) Input by MPI

MPI will take necessary measures to provide at its own expense:

(a) Services of MPI's counterpart personnel and administrative personnel as referred to in II-6;

(b) Suitable office space with necessary equipment;

(c) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA;

(d) Information as well as support in obtaining medical service;

(e) Credentials or identification cards;

(f) Available data (including maps and photographs) and information related to the Project;

(g) Running expenses necessary for the implementation of the Project;

(h) Expenses necessary for transportation within Mauritius of the equipment

referred to in II-5 (1) as well as for the installation, operation and maintenance thereof; and

- (i) Necessary facilities to the members of the JICA missions for the remittance as well as utilization of the funds introduced into Mauritius from Japan in connection with the implementation of the Project

6. Implementation Structure

The Project organization chart is given in the Annex I. The roles and assignments of relevant organizations are as follows:

(1) MPI

(a) Project Director will be the Permanent Secretary of MPI, and responsible for overall administration and implementation of the Project.

(b) Project Manager will be the Director of Engineering Division, and responsible for implementation of the Project.

(2) JICA Experts (members of the JICA mission)

The JICA experts will give necessary technical guidance, advice and recommendations to MPI on any matters pertaining to the implementation of the Project.

(3) Steering Committee

Steering Committee (hereinafter referred to as "SC") will be established in order to facilitate inter-organizational coordination. SC will be held whenever deems it necessary. A list of proposed members of SC is shown in the Annex II.

7. Project Site(s) and Beneficiaries

The project will cover the main island of Mauritius. A candidate site for F/S is Chittrakoot in Port-Louis city.

Direct beneficiaries are staff who directly involved in landside management and other participants of on the job trainings provided in the Project. Target of technical transfer includes engineers of Local Authorities.

Indirect beneficiaries are engineers who receive technical service from RRU/LMU, such as other administrative members for landside management and local contractors, and residents living nearby landslide-prone areas.

8. Duration

The Project will be carried out in accordance with the tentative schedule as attached in the Annex III. The schedule is tentative and subject to be modified based on the agreement of both sides.

9. Reports

JICA will prepare and submit the following reports to the MPI in English.

- (1) 20 copies and 20 CD-ROMs of Inception Report at the commencement of

- the first work period in Mauritius
- (2) 20 copies and 20 CD-ROMs of Progress Report at the time about 6 months after the commencement of the first work period in Mauritius
 - (3) 20 copies and 20 CD-ROMs of Interim Report at the time about 15 months after the commencement of the first work period in Mauritius
 - (4) 20 copies and 20 CD-ROMs of Draft Final Report at the end of the last work period in Mauritius
 - (5) 20 copies and 20 CD-ROMs of Final Report within one (1) month after the receipt of the comments on the Draft Final Report

10. Environmental and Social Considerations

MPI agreed to abide by 'JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF MPI AND GOM

MPI and GOM will take necessary measures to:

- (1) ensure that the technologies and knowledge acquired by the Mauritius nationals as a result of Japanese technical cooperation contributes to the economic and social development of Mauritius and that the knowledge and experience acquired by the personnel of Mauritius from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and
- (2) grant privileges, exemptions and benefits to the JICA members of the JICA missions referred to in II-5 (1) above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Mauritius.

IV. EVALUATION

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. The MPI is required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, MPI will take appropriate measures to make the Project widely known to the people of Mauritius.

VI. MUTUAL CONSULTATION

JICA and MPI will consult each other whenever any major issues arise in the course of Project implementation.

VII. AMENDMENTS

The record of discussions may be amended by the minutes of meetings between JICA and MPI.

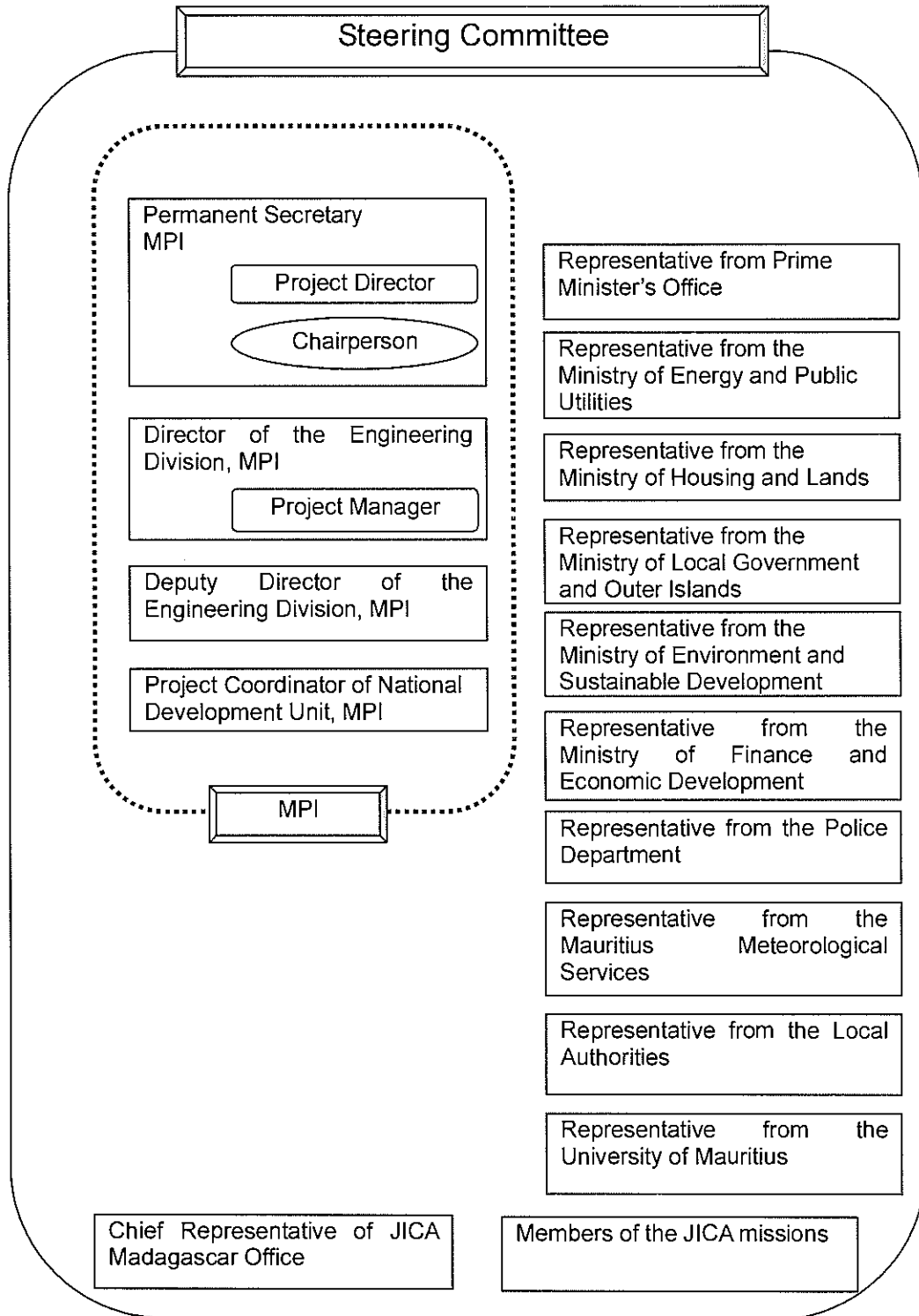
The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex I Project Organization Chart

Annex II A List of Proposed Members of Steering Committee

Annex III Schedule of the Project

Annex I Project Organization Chart



(Handwritten marks)

Annex II A List of Proposed Members of Steering Committee

Chairperson:

Permanent Secretary, Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping
(Project Director)

Member:

(Mauritius side)

- Director of the Engineering Division, MPI
- Deputy Director of the Engineering Division, MPI
- Project Coordinator of National Development Unit, MPI
- Representative from the Prime Minister's Office
- Representative from the Ministry of Energy and Public Utilities
- Representative from the Ministry of Housing and Lands
- Representative from the Ministry of Local Government and Outer Islands
- Representative from the Ministry of Environment and Sustainable Development
- Representative from the Ministry of Finance and Economic Development
- Representative from the Police Department
- Representative from the Mauritius Meteorological Services
- Representative from the Local Authorities
- Representative from the University of Mauritius
- Other organizations assigned by the Project Director, if necessary

(Japanese side)

- Chief Representative of JICA Madagascar Office
- Members of the JICA missions
- Other personnel concerned, to be assigned by JICA, if necessary

Note:

Official(s) of the Embassy of Japan may attend as observer(s).

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MAIN POINTS DISCUSSED

1. In the Project, landslide management covers slope disasters such as slope instability and erosion problems as well.
2. Based on the roles and responsibilities of relevant organizations defined in the "Cyclone and Other Natural Disasters Scheme," the Project will mainly deal with the mandate of MPI, such as monitoring, surveillance, risk assessment, planning and design of preventive measures, policy and strategy making for landslide management, and institutional strengthening of RRU/LMU. However, recommendations for warning, evacuation and emergency stages may be included.
3. The pilot project in the Project aims at (1) capacity development through on-the-job trainings and (2) feedback of lessons learned to the landslide management plan and F/S by small-scale trial of measures to be proposed. Although contents of the pilot project will be discussed and decided in the course of the Project, tentative examples of component are: (1) expanding monitoring coverage by installing measurement equipment and organizing monitoring system in landslide-prone areas, (2) strengthening local monitoring system in Chitrakoot, (3) planning, design, construction supervision and maintenance of countermeasures, and (4) public awareness raising and stakeholder meetings at landslide-prone areas. Stakeholder meetings will be held during the pilot project in order to ensure involvement of key stakeholders and reflect their opinions on planning. The number of expected pilot project would be 3 or 4 components, depending on the availability of the budget and counterpart personnel.
4. The final report of the Project will be open to the public in order to achieve maximum use of the Project results.
5. The Project is expected to contribute to adaptation to climate change. Increasing natural hazards such as torrential rain and stronger cyclone coupled with climate change are assumed to raise the risk of landslide and other slope disasters.
6. MPI will make all efforts to implement the formulated plans once approved.



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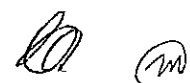
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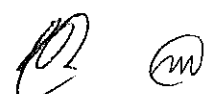
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- (4) Ministry of Housing and Lands (MHL) has a mandate to control land use and development through the "Planning Policy Guidance (PPG)." Both sides agreed that landslide management needed to be integrated into the land use and development control, and close coordination between MHL and MPI would be inevitable in the course of the Project. The Project will include recommendation for revision of PPG.
- (5) One of the serious issues to enhance landslide management in Mauritius is lack of human resources who have expertise in geological engineering. In this regard, involvement of universities such as the University of Mauritius will be considered, in order to mobilize outside expertise and contribute to education in the field of geotechnical engineering.
- (6) In the meeting with relevant stakeholders on November 17, following needs were expressed from relevant organizations: (a) basic knowledge on landslide and other slope disasters, (b) technical basis for judgment to issue building and land use permit, (c) technical guide for initial inspection in response to reports from residents, (d) risk assessment and hazard map to identify risk areas, (e) methodology to control development in high risk areas, (f) technical report for Chittrakoot and La Butte, and (g) planning of monitoring system and interpretation method of obtained data. These needs will be taken into account for the project activities.
- (7) The IOC has started the Regional Project for Prevention and Management of Natural Risks and Disasters, covering its member countries. Both sides agreed that the Project outputs could be shared with the IOC's project for knowledge sharing with other countries in the region.



2. Minutes of Meeting on 1st Steering Committee

**MINUTES OF MEETING
ON INCEPTION REPORT FOR
THE PROJECT OF LANDSLIDE MANAGEMENT
IN THE REPUBLIC OF MAURITIUS
AGREED UPON BETWEEN**

**MINISTRY OF PUBLIC INFRASTRUCTURE, NATIONAL DEVELOPMENT UNIT,
LAND TRANSPORT AND SHIPPING (PUBLIC INFRASTRUCTURE DIVISION)
AND THE JAPAN INTERNATIONAL COOPERATION AGENCY**

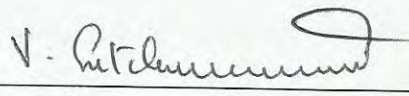
The Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the JICA Expert Team (hereinafter referred to as "JET") to the Republic of Mauritius on the Project of Landslide Management in the Republic of Mauritius (hereinafter referred to as "the Project") in order to explain and consult with the Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (hereinafter referred to as "MPI") on the contents of the inception report of the Project (hereinafter referred to as "the Inception Report") from May 24 to 30, 2012.

As a result of discussions, both sides agreed to the matters described on the attached sheets.

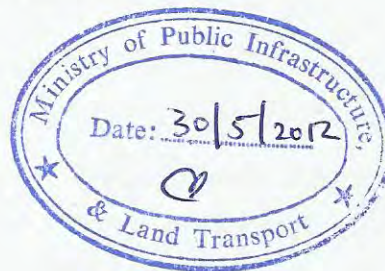
Port-Louis, May 30, 2012



Mr. Kensuke Ichikawa
Chief adviser,
The Expert Team
Japan International Cooperation Agency



Mr. Lutchmeeparsad Vidianand
Permanent Secretary,
Ministry of Public Infrastructure, National
Development Unit, Land Transport and
Shipping (Public Infrastructure Division)
The Republic of Mauritius



Attachment

I. Acceptance of the Inception Report

MPI agreed and accepted in principle the contents of the Inception Report and the undertakings by MPI for the execution of the Project explained by the JET.

Detailed methods will be adjusted in the course of the Project with mutual cooperation.

II. The Structure of the Project Execution

The JET explained about the structure of the Project which is a component of the JICA's Cooperation Program for Environment, Climate Change and Disaster Management. The issues discussed are as follows;

1. It is understood that the program is composed of two independent projects namely :
 - (a) Landslide Management implemented by MPI
 - (b) Capacity Development on Coastal Protection and Rehabilitation implemented by Ministry of Environment and Sustainable Development (MoESD)
2. The JET and MPI iterated the importance of coordination and collaboration between donors and stakeholders to ensure sharing of information and avoid any duplication of activities.
3. It was also noted that various projects relevant to the JICA program are being implemented internally by the MPI. Therefore, it was proposed to set up a JICA Coordination Group instead of the Climate Change Adaptation and Disaster Management Committee = CADMAC as referred in the Inception Report. The JICA Coordination Group will be responsible for coordinating with other related projects so as to avoid duplication in the works.
4. In accordance with the Record of Discussions agreed upon by MPI and JICA on 1st March 2012, MPI agreed to set up the Steering Committee (SC) chaired by the Permanent Secretary, MPI in order to facilitate inter-organization coordination. The members are shown in **Annex-1**.
5. The MPI also agreed to set up Sub-Committee consisting of technical staff from the SC to discuss technical matters for particular issues.

Both sides agreed that the SC Meetings would be conducted on a quarterly basis or at the end of each phase of the Project, as scheduled and shown in **Annex-2**, and the Sub-Committee Meetings would be held upon the request of MPI and JET.

6. The JET explained that the sharing of technical skills and hands-on experiences would be an important component of the Project and will be conducted throughout the Project period. MPI agreed that the Civil Engineering Division would assign the counterpart personnel (at least 6 officers). In case assistance would be required from other organizations MPI would carry out the necessary liaison.
7. The JET mentioned that the Project is focused on planning and technical transfer. Therefore, the actual countermeasures shall be made after the formulation of the plan. The necessary budget to conduct the formulated countermeasures shall be reported to the relevant government organizations and other necessary action shall be taken to realize the plan.
8. The JET also mentioned that future management and ownership of the Project by the counterpart organization is vital for the sustainability of the activities. This was understood by the counterpart organization.
9. The JET emphasized that the flexibility of the Project shall be secured during the study in response to the results of basic survey and data review.

III. Discussion on the significant issues

1. Operational Policy of the Project

- The SC members agreed to cooperate with the Project, especially provisions of data/information such as topography and meteorology requested by MPI.
- The MPI agreed that engineers/researchers in other Ministries/Government Departments/university should participate in capacity development to support the limited technical personnel in MPI.
- The JET suggested that the impact of natural disasters such as extremely heavy rainfall or earthquakes should be considered.

2. Formulation of landslide management plan

- The target landslides in the Project shall be i) large landslide (1km-500m), ii) middle landslide (100-50m), and iii) small landslide (10-5m) near residential areas. "Chitrakoot" is a re-activated landslide not a new one. The concept of the categorization shall be taken into account in the Project.
- The MPI and JET shall establish a system in which monitoring devices are protected against theft in the site by cooperating with the local people. Not only electronic but simple monitoring devices such as wooden piles are useful for landslide monitoring in the Project.

- The MPI and JET shall propose measures for the effectiveness of “the Cyclone and Other Natural Disasters Scheme”, especially on the flow of disaster information, and shall propose improvement plans and strategies.

3. Implementation of the Pilot Project

- The MPI and JET confirmed that budget should be allocated for the construction of countermeasures in accordance with the results of the Feasibility Study

4. Technical Transfer

- The joint seminar will be organized under the Project and will be financed by Indian Ocean Commission, in order to disseminate the technical knowledge to Mauritius and the other countries in the Indian Ocean region

Annex-1 Members of the Steering Committee

Annex-2 Schedule and Contents of the Steering Committee Meetings

Annex-3 List of members who attended 1st Steering Committee

Members of the Steering Committee

| Position | Organization |
|------------------|----------------------------------------------------------------------------------------------------------------------|
| Chairperson | Permanent Secretary, Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (MPI) |
| Members | Director, Engineering Division, MPI |
| | Deputy Director, Engineering Division, MPI |
| | National Development Unit, MPI |
| | Prime Minister's Office (PMO) |
| | Ministry of Energy and Public Utilities (MoEPU) |
| | Ministry of Housing and Lands (MoHL) |
| | Ministry of Local Government and Outer Islands (MoLG) |
| | Ministry of Environment and Sustainable Development (MoESD) |
| | Ministry of Finance and Economic Development (MoFED) |
| | Police Department (PD) |
| | Mauritius Meteorological Services (MMS) |
| | Local Authorities (LA) |
| | University of Mauritius |
| | JICA Madagascar Office |
| JICA Expert Team | |
| Observers | Embassy of Japan in Madagascar |
| | Indian Ocean Commission (IOC) |
| | United Nations Development Program (UNDP) in Mauritius |

Proposed Schedule and Contents of the Steering Committee Meetings

| No. | Proposed Date | Contents / Objectives |
|-----|---------------|-----------------------|
| 1 | 29 May 2012 | Inception Report |
| 2 | October 2012 | Progress Report |
| 3 | July 2013 | Interim Report |
| 4 | July 2014 | Draft Final Report |

Steering Committee will be held whenever deems it necessary.

List of members who attended 1st Steering Committee

<MAURITIUS SIDE>

Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (MPI)

- Mr. Lutchmeeparsad Vidianand (Permanent Secretary)
- Ms. Bahadoor Savitree (Assistant Secretary)
- Mr. Jewon Reshad (Deputy Director, Civil Engineering Division)
- Mr. D. Chinasamy (Principal Engineer, Civil Engineering Division)
- Mr. S. P. Anadachee (Engineering officer, Civil Engineering Division)
- Mr. Dookhony (Chief Regional and Development Officer)
- Ms. N. Subrun (Secretary)

Other Ministries/Organizations

- Mr. S. Ghunowa (Government Land Surveyor, Ministry of Housing and Lands)
- Mr. R. Dhurmea (Meteorologist, Mauritius Meteorological Service)
- Mr. R. Beedassy (Deputy Environment Officer, Ministry of Environment and Sustainable Development)
- Mr. J. E. Merle (Higher Executive Officer, Ministry of Local Government and Outer Islands)
- Ms. B. Trilok (Second Secretary, Ministry of Foreign Affairs, Regional Integration and International Trade)
- Mr. B. Bijloll (Assistant Commissioner, Ministry of Social Security, National Solidarity, and Reform Institutions)
- Mr. S. Kaleeah (Head, Planning and Research Unit, Ministry of Gender Equality, Child Development and Family Welfare)
- Mr. K. Nobin (Deputy Commissioner of Police, Natural Disaster and Operations Coordination Centre)
- Mr. M. Muneesamy (Director Finance and Administration, Mauritius Revenue Authority)
- Mr. S. Zeadally (Senior Hydrological Officer, Water Resources Unit)
- Mr. K. Khothandaraman (Assistant Chief Fire Officer, Fire Services Department)
- Mr. D. Seesahye (Deputy Chief Fire Officer, Fire Services Department)
- Mr. S. Ramdin (Head of Works Department, Municipal Council of Port Louis)
- Mr. S. Permala (Head of Works Department, Grand Port/Savanne District Council)
- Ms. Lacroix (Coordinator, Commission De L'Ocean Indien (COI))

<JAPANESE SIDE>

JICA

Ms. Megumi Tsukizoe (Deputy Assistant Director, Global Environment Department, JICA HQ)

Mr. Junichi Kawase (Project Formation Advisor, JICA Madagascar Office)

Ms. Razafimahefa Manoela (Programme Officer, JICA Madagascar Office)

JICA Expert Team

Mr. Kensuke Ichikawa (Chief Advisor)

Dr. Takeshi Kuwano (Vice Chief Advisor / Landslide Management)

Mr. Tomoharu Iwasaki (Landslide Survey and Analysis)

Dr. Hiroshi Hashimoto (Vice Chief Advisor / Coastal Conservation)

Ms. Martine Citon (Project Assistant of JICA Expert Team)

3. Minutes of Meeting on 2nd Steering Committee

**MINUTES OF MEETING
ON SECOND STEERING COMMITTEE FOR
THE PROJECT OF LANDSLIDE MANAGEMENT
IN THE REPUBLIC OF MAURITIUS
AGREED UPON BETWEEN
MINISTRY OF PUBLIC INFRASTRUCTURE, NATIONAL DEVELOPMENT UNIT,
LAND TRANSPORT AND SHIPPING (PUBLIC INFRASTRUCTURE DIVISION)
AND THE JAPAN INTERNATIONAL COOPERATION AGENCY**

The Japan International Cooperation Agency (hereinafter referred to as “JICA”) dispatched the JICA Expert Team (hereinafter referred to as “JET”) to the Republic of Mauritius on the Project of Landslide Management in the Republic of Mauritius (hereinafter referred to as "the Project") in order to conduct with the Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (hereinafter referred to as “MPI”).

As a result of discussions on this steering committee, both sides agreed to the matters described on the attached sheets.

Port Louis, November 1, 2012

Mr. Kensuke Ichikawa

Chief adviser,

The Expert Team

Japan International Cooperation Agency

Mr. Lutchmeeparsad Vidianand

Permanent Secretary,

Ministry of Public Infrastructure, National

Development Unit, Land Transport and

Shipping (Public Infrastructure Division)

The Republic of Mauritius

ATTACHMENT

I. Acceptance of the Progress Report

MPI agreed the contents of the Progress Report and accepted the undertakings by MPI for the progress of the Project explained by JET.

Detailed methods will be adjusted in the course of the Project with mutual cooperation.

II. The progress of the Project

JET explained about the progress of the Project to MPI and the members at the Steering Committee. The issues discussed are as follows;

1. JET conducted the landslide inventory survey for landslide hazard areas selected in the "Cyclone and Other Natural Disasters Scheme 2011-2012" and re-designated 37 hazard areas in the re-classified 9 disasters.
 - (a) Landslide: 6 areas
 - (b) Slope failure: 7 areas
 - (c) Rock fall: 1 area
 - (d) Debris flow: 1 area
 - (e) Stream erosion: 10 areas
 - (f) Damage of Embankment: 4 areas
 - (g) Damage of wall: 5 areas
 - (h) Damage of house: 1 areas
 - (i) Cavern: 2 areas

2. JET evaluated the 6 landslide areas by a scoring method based on site reconnaissance and selected 3 high score sites for the Project.
 - (a) Chitrakoot in the Municipality of Port Louis
 - (b) Vallee Pitot in the Municipality of Port Louis
 - (c) Quatre Soeurs in the Grand Port/Savanne District Council

3. Landslide movement and the relevant activity are monitored by inclinometers, pipe strain gauges, automatic piezometers, extensometers and rain gauges in the Project. Plan of the geological survey and the monitoring is indicated in the table below. However, the quantity and type of survey/monitoring can be adjusted according to site condition.

| Landslide | Drilling | Inclinometer | Pipe strain gauge | Piezometer | Extensometer | Rain gauge |
|--------------|--------------------|--------------|-------------------|------------|--------------|------------|
| Chitrakoot | 50m * 4 30m * 2 | 2 | 2 | 2 | 4 | 1 |
| Vallee Pitot | - | - | - | - | 2 | - |
| Quatre Soeur | 20m * 2 | - | 2 | - | - | 1 |

III. Activity plan and policy

JET, MPI and the members at the Steering Committee agreed about the activity plan and policy to be conducted from now on as follows;

1. Hazard evaluation on the targeted landslides

- (1) Implement site reconnaissance, drilling survey, monitoring etc. for 3 targeted landslides
- (2) Analyze the stability based on volume, mechanism, affected area of landslide
- (3) Evaluate the hazard on landslide as basic data for countermeasure plan

<Methodology>

- Prepare plain drawing and cross section by topographic survey
- Plot surface anomalies on plain drawing by site reconnaissance
- Confirm geological feature by drilling survey
- Grasp soil hardness by Standard Penetration Test (SPT)
- Grasp geophysical feature in the ground by geophysical exploration
- Monitor movement in/on the ground by pipe strain gauge, inclinometer, extensometer
- Monitor rainfall by rain gauge and groundwater level by piezometer
- Grasp area, blocks, moving direction, mass volume, slip surface based on the above mentioned data
- Prepare geological cross sections
- Discuss soil parameters and inducing factors/triggers
- Conduct stability analysis and evaluate the current safety factor
- Evaluate hazard based on the safety factor and monitoring results

2. Design/implementation of landslide countermeasure

- (1) Implement preventive measures, emergency measures, and permanent measures
- (2) Establish the cooperative system by relevant organizations for countermeasures
- (3) Establish the cooperative system by relevant organizations for preparedness

<Methodology>

- (1) Implement preventive measures, emergency measures, and permanent measures

Countermeasure of landslides is composed of 2 types; “Hard” measures (emergency measure works and permanent measure works) and “Soft” measures (monitoring/early warning/

evacuation, resident relocation/compensation). Countermeasure plans are as follows;

(i) Emergency countermeasures

Local authority who receives reports of landslide activity from local residents shall contact LMU. LMU shall order emergency countermeasures to contractors.

(ii) Permanent countermeasures

LMU shall order permanent countermeasures to contractors after detailed investigation/analysis/monitoring. LMU, MHL and local authorities shall conduct consensus building of local residents.

(iii) Monitoring/early warning/evacuation

Refer to “3 Proposal of early warning/evacuation”.

(iv) Resident relocation/compensation

Refer to “4 Proposal of revision of the PPG”.

(2) Establish the cooperative system by relevant organizations for countermeasures

Refer to “5 Formulation of organizational reinforcement of LMU”.

- Clarify role and effectiveness of each countermeasure
- Define the responsibility of each relevant organization for various work stages
- Establish cooperative framework and flow (draft)

(3) Establish the cooperative system by relevant organizations for preparedness

(i) Inspection of landslide disaster prevention

Regular inspection shall be conducted based on “37 recording sheets” which have been prepared in the Project. The inspection shall be implemented by LMU and local authorities after rainy season.

(ii) Regulation of new development/construction

Refer to “4 Proposal of revision of the PPG”.

3. Proposal of early warning/evacuation

(1) Reinforcement of landslide monitoring system

(2) Clarification of roles and responsibilities of relevant organizations

(3) Establishment of devices and system of data transmission

(4) Proposal for the Disaster Scheme

<Methodology>

(1) Reinforcement of landslide monitoring system

- Extensometer, inclinometer, pipe strain gauge, piezometer, rainfall gauge are installed in the targeted 3 landslides (Chitrakoot, Quatre Soeurs, Vallee Pitot)
- Monitoring system for landslide disaster is reinforced by MPI as well as local authorities understanding the method of data collection/analysis. Possibility of data collection by local residents is discussed in future.

- Thresholds of warning/evacuation for each landslide are set because landslides have different characteristic features. Consensus building with local residents for setting of thresholds of warning/evacuation is necessary after the discussion.

(2) Clarification of roles and responsibilities of relevant organizations

- Current roles, responsibilities, tasks, ability and status are summarized for each organization such as LMU, PMO, local authorities, police, para-military, MHL.
- Desired roles, responsibilities, tasks, ability and status are proposed for each organization.
- At local authority which has a targeted landslide, “Landslide Management Unit” is organized, and they deal with emergency response and regular tasks.
- Action plan, which consists of 3-5 stages, for emergency landslide movement by heavy rainfall is set, and initial action and correspondence procedure are prepared.
- LMU conducts monitoring management, countermeasure maintenance and consensus building for residents in ordinary times.

(3) Establishment of devices and system of data transmission

- Device and system of data transmission are discussed based on examples of ones in Japan and/or other countries.
- Data information center for landslide disaster is set at the local authorities and MPI. Monitoring data will, in future, be transmitted to the center using an inexpensive method such as mobile networking system capable of real-time transmission. In case that rainfall data or displacement data surpass a set threshold, the information is sent to mobile of persons in LMU.
- LMU member list including mobile numbers and contact procedure is prepared and distributed to relevant members.
- MPI will formulate an action plan, consisting of 3-5 emergency levels, upon being contacted by the local authorities, and prepare a contact list, initial action and correspondence procedures.
- Correspondence procedure from MPI to police/fire department/para-military is clarified, and main liaisons and the deputy are appointed.
- For local residents, evacuation instructions and evacuation order are emitted from local authorities through loudspeaker car/broadcast/phone communication etc. in case of landslide emergency.

(4) Proposal for the Disaster Scheme

- Protocols of additional description for the Disaster Scheme are discussed with PMO.
- Contents and schedule of revision of the Disaster Scheme are discussed among MPI and relevant organization.

4. Proposal of revision of the Planning Policy Guidance (PPG)

(1) Designation of the Caution Zone on landslide in the PPG and each municipality’s Outline

Planning Schemes (OPS)

- (2) Recommendation on and support for relocation from existing buildings in the Special Caution Zone
- (3) Development of warning/evacuation system in the Caution Zone
- (4) Dissemination and education to public and administrative officer regarding the legal systems/schemes of Landslide Disaster Risk Management (LDRM)

<Methodology>

[Active and clear landslide]: Based on the current process; (i) reporting from municipalities to LMU, (ii) investigation by LMU, “1. Hazard evaluation on the targeted landslides” is implemented for the landslide. If the assessment result judges that the landslide has high risk, the area is designated as the Caution Zone by PPG.

[Unclear landslide]: Based on topographic and land use condition, the area considered to be affected by landslide disaster is designated as the Caution Zone by PPG.

(i) The region which is more than the “Medium level” of the AAP hazard map is designated as the Marked Region. There are landslide areas and steep slope areas in the Marked Region.

(ii) For the landslide area, landslide topographic forms are identified in the Marked Region by aerial photograph interpretation. The identified landslide area is designated as the Landslide Caution Zone.

(iii) For the steep slope area, the slope angle of a certain degrees or more is designated as the Special Steep Slope Caution Zone in the Marked Region. The surrounding area of the Special Steep Slope Caution Zone is designated as the Steep Slope Caution Zone which has the extent of double the distance of slope height (specific standards should be discussed). If the new development is implemented in the Marked Region, the officers of MPI or related ministries/agencies check the presence of these Caution Zones.

- (1) Designation of the Caution Zone on landslide in the PPG and each municipality’s OPS
 - The Caution Zone is designated by using above mentioned methodology.
 - The highly affected area by the active and clear landslide in the Caution Zone is designated as the Special Caution Zone.
 - Development/building restriction zone for landslide prone area in the Caution Zone shall be shown in the Development Management Plan (DMP) of OPS.
 - The Caution Zone designation shall be designated in PPG/OPS, where the development/building should be restricted. The objects to be restricted are different (MHL: residence, MPI: road and infrastructure, MoESD: drainage, Municipalities: development/building permission system etc.).
- (2) Recommendation on and support for relocation from existing buildings in the Special Caution Zone

- Inclusion of contents of the recommendation on and support for relocation in PPG/OPS.
- If a resident's life/building is at high risk of landslide damage in the Special Caution Zone, the local authorities shall recommend relocation or other measure to the resident.
- The discussion and consensus building shall be required regarding to the support for demolition of existing building and new land/house acquisition and with related organizations.

(3) Development of warning/evacuation system in the Caution Zone

Refer to "3 Proposal of early warning/evacuation". Specific contents of recommendation for PPG are shown below;

- Preparation of a regional disaster prevention plan by each local authority, which contains a warning/evacuation system such as landslide information collection/distribution, forecasts, warnings, evacuation, rescue and others.
- Distribution and publication of hazard map and leaflet etc., which contains the landslide information collection/distribution, evacuation site, important things for evacuation and others.

(4) Dissemination and education to public and administrative officer regarding the legal systems/schemes of LDRM

- Holding of seminars/workshops regarding the systems/schemes of LDRM for administrative officer on a periodic basis.
- Improvement of Building and Land Use Permit Guide which is used for development/building permit applications.
- Dissemination of development/building restriction in slope area to public.
- Discussion and consensus building shall be required regarding to the actual/specific contents of the recommendation for PPG through collaboration with related ministries/agencies.

5. Formulation of organizational reinforcement of Landslide Management Unit (LMU)

(1) Definition of roles, tasks, position of LMU

(2) Establishment of system/organization for landslide countermeasure

(3) Establishment of system/organization for monitoring/early warning/evacuation

(4) Establishment of system/organization as an educational institution

<Methodology>

(1) Definition of roles, tasks, position of LMU

- Action policy and road map
- Roles, position, tasks, responsibilities
- Work flow
- Initial action plan for emergency landslide

- Organization chart for emergency contact
 - List of mobile numbers and contact procedures
- (2) Establishment of system/organization for landslide countermeasure
- Clarification of the tasks and responsibilities of, and relationship between National Disaster and Operations Coordination Centre (NDOCC), LMU, MHL, local authority.
 - Proposal of draft of cooperative system and workflow.
 - Revision of the proposed draft based on brainstorming session by representatives of all relevant organizations.
 - Verification of the proposed draft by comparing practical workflow for countermeasure work.
 - Finalization of the cooperative system and workflow.
- (3) Establishment of system/organization for monitoring/early warning/evacuation
- Clarification of the tasks and responsibilities of, and relationship among Cyclone and Other Natural Disasters Committee (CONDC), MPI, local authorities, PMO, police, para-military, MHL.
 - Proposal of draft of cooperative system and workflow.
 - Finalization of the cooperative system and workflow through discussion with CONDC and police etc., for CONDC will become effective policy-making organization.
- (4) Establishment of system/organization as an educational institution
- Clarification of tasks to be implemented by LMU as an educational institution. The demarcation between LMU and university is defined as educational institutions.
 - Decision of methodology of consensus building and enlightenment for local residents on landslides through discussion with LMU. Consideration of education of disaster prevention at schools through discussions with Ministry of Education.
 - For effective technical instruction on landslide to other organizations by MPI, practical check points shall be included in “Technical Guideline for the Initial Survey” and “Landslide management Manual” prepared in the Project.
 - Discussion of collaborative activity with Mauritius Broadcasting Corporation (MBC) and Government information Service (GIS).

6. Technical transfer for the Landslide Management Unit (LMU)

The related technology on “1 Hazard evaluation on the targeted landslides” and “2 Design/implementation of landslide countermeasures” shall be effectively transferred to LMU.

- (1) Utilization of On-the-Job Training (OJT), workshops, technical transfer seminars, special/collaborative seminars
- (2) Preparation of guideline/manual
- (3) Enhancement of the consulting ability of LMU for other organizations

<Methodology>

(1) Utilization of OJT, workshops, technical transfer seminars, special/collaborative seminars

- The objectives of OJT are (i) to grasp the flow of survey, analysis, monitoring, design, countermeasure on landslide, (ii) to propose the institution plan, manual/guideline, actual early warning system.
- The objectives of pilot project are (i) to understand actual method of plan/design/cost estimation/construction/ maintenance of countermeasure, (ii) to understand importance of cooperation of residents and stakeholders for construction of countermeasure.
- The objectives of training in Japan are (i) to understand “what is a landslide?” and “what is disaster management?” for landslide management in Mauritius in future, (ii) to understand actual landslide countermeasures and their significance/ method for landslide countermeasure work in Mauritius in future.

(2) Preparation of guideline/manual

[Technical Guideline for the Initial Survey]

- Introduction (purpose, landslide overview, outline)
- Existing survey materials (distribution map, databases, current countermeasures)
- Initial survey planning (survey areas, geological survey plan, monitoring plan)
- Initial survey implementation (survey/monitoring, analysis, evaluation)
- Early warning/evacuation system (monitoring system, warning threshold, evacuation procedure)
- Post-survey action (detailed survey planning, policy of landslide countermeasures)

[Landslide management Manual]

- Outline (purpose/contents/application/structure of the manual)
- Surveys (preliminary, rough, and detailed surveys, and analysis)
- Planning (prevention plan/targets/safety analysis/warning and evacuation/environmental considerations)
- Emergency measures (field survey/landslide movement prediction/emergency action and countermeasures)
- Designing (outline/control and restraint work designing/environmental and social considerations)
- Construction (construction plan/important points/construction work and management)
- Post-work inspection/observation (inspection/observation/record keeping/reflection in plans/judgment of functional decline of facilities/repairs, etc.)

(3) Enhancement of the consulting ability of LMU for other organizations

Refer to “5 Formulation of organizational reinforcement of LMU”.

7. Collaboration with the Meteorological Radar Project by JICA

In case the predicted rainfall by the Meteorological Radar has reached the threshold in the

early warning system, Mauritius Meteorological Service (MMS) shall make an official announcement to alert local residents.

<Methodology>

- Among “3 Proposal of early warning/evacuation”, threshold (3-5 stages) by rainfall amount shall be set based on the monitoring results.
- In case the predicted rainfall by the Meteorological Radar has reached the threshold, MMS shall make an official announcement to alert local residents, such as “slope disaster is expected” or “slope disaster is tremendously expected”.
- The prediction of rainfall by the Meteorological Radar will be used to make official announcements to alert local residents, as part of the early warning system.
- The above mentioned procedure shall be described in the Disaster Scheme in future.

Annex-1 List of members who attended the Steering Committee

List of members who attended the Steering Committee

<MAURITIUS SIDE>

Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (MPI)

Mr. Putchay (Principal Assistant Secretary)

Ms. Bahadoor Savitree (Assistant Secretary)

Mr. Jewon Reshad (Deputy Director, Civil Engineering Division)

Other Ministries/Organizations

Mr. S. Ghunowa (Government Land Surveyor, Ministry of Housing and Lands)

Mr. R. K. Dhurmea (Meteorologist, Mauritius Meteorological Service)

Mr. R. Luximon (Environment Officer, Ministry of Environment and Sustainable Development)

Mr. O. Sewraj (Second Secretary, Ministry of Foreign Affairs, Regional Integration and International Trade)

Mr. S. Kangloo (Principal Social Security Officer, Social Security)

Mr. J. Kelly (Team Leader, Mauritius Revenue Authority)

Mr. J. Merle (Ministry of local Government and outer Island)

Mr. M. Seebarith (Special Mobile Force)

Mr. S. Zeadally (Senior Hydrological Officer, Water Resources Unit)

Mr. R. Deenoo (Chief Inspector, City Council of Port Louis)

Mr. S. Permala (Head of Works, District Council Grand Port /Savanne)

Mr. C. Dawonauth (Chief Inspector, Police Force)

Mr. K. Khothandaraman (Assistant Chief Fire Officer, Fire Services Department)

Mr. D. Seesahye (Deputy Chief Fire Officer, Fire Services Department)

Ms. Kajima (UNDP)

<JAPANESE SIDE>

JICA

Ms. Kaoru Takahashi (Project Formation Advisor, JICA Madagascar Office)

Ms. Razafimahefa Manoela (Programme Officer, JICA Madagascar Office)

Kyoto University

Dr. Hiroshi Fukuoka

JICA Expert Team

Mr. Kensuke Ichikawa (Chief Advisor)

Dr. Takeshi Kuwano (Vice Chief Advisor / Landslide Management)

Dr. Tomoharu Iwasaki (Landslide Survey and Analysis)

Mr. Fumihiko Yokoo (Landslide Monitoring)

Mr. Yoji Kasahara (Geophysical Prospecting)

Ms. Sophie Bundun (Project Assistant of JICA Expert Team)

4. Minutes of Meeting on 3rd Steering Committee

**MINUTES OF MEETING
ON THIRD STEERING COMMITTEE FOR
THE PROJECT OF LANDSLIDE MANAGEMENT
IN THE REPUBLIC OF MAURITIUS
AGREED UPON BETWEEN
MINISTRY OF PUBLIC INFRASTRUCTURE, NATIONAL DEVELOPMENT UNIT,
LAND TRANSPORT AND SHIPPING (PUBLIC INFRASTRUCTURE DIVISION)
AND THE JAPAN INTERNATIONAL COOPERATION AGENCY**

The Japan International Cooperation Agency (hereinafter referred to as “JICA”) dispatched the JICA Expert Team (hereinafter referred to as “JET”) to the Republic of Mauritius on the Project of Landslide Management in the Republic of Mauritius (hereinafter referred to as "the Project") in order to conduct with the Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (hereinafter referred to as “MPI”).

As a result of discussions on this steering committee, both sides agreed to the matters described on the attached sheets.

Port Louis, November 21, 2013

Mr. Kensuke Ichikawa

Chief adviser,

The Expert Team

Japan International Cooperation Agency

Mr. Lutchmeeparsad Vidianand

Permanent Secretary,

Ministry of Public Infrastructure, National

Development Unit, Land Transport and

Shipping (Public Infrastructure Division)

The Republic of Mauritius

ATTACHMENT

I. Acceptance of the Interim Report

MPI agreed the contents of the Interim Report and accepted the undertakings by MPI for the progress of the Project explained by JET.

Detailed methods will be adjusted in the course of the Project with mutual cooperation.

II. The progress of the Project

JET explained about the progress of the Project to MPI and the members at the Steering Committee. The following contents were discussed and agreed by all related parties.

1. Geological interpretation

Topographic survey, site reconnaissance, drilling survey, geophysical exploration, laboratory test, monitoring have been conducted at the high risk sites, Chitrakoot, Vallee Pitot and Quatre Soeurs. The geological hazard has been assessed for each site.

2. Monitoring

The landslide depth has been confirmed at only one location in Chitrakoot. It is about 6 m deep and is just boundary between soil and rocks. The groundwater level at all locations becomes high with rain fall. The main cause of landslide is high water pressure in the ground. Precipitation monitoring by rain gauge can be used for early warning. Extensometer also can be used for early warning.

3. Recommendation of the Disaster Scheme

1) The concentration of the MPI's responsible area is changed from all of Mauritius to the high risk area, 2) The voluntary evacuation is adopted with rain gauges and extensometers, 3) The warning/evacuation system is simplified from five stage to three, 4) The monitoring of rain gauge, extensometer and anomalies by residents is utilized in the warning/evacuation system.

4. Recommendation of the Planning Policy Guidance

1) The zoning and development restriction is adopted, 2) The contents for slope disaster prevention are applied on roads, 3) The contents for surface water drainage are added, 4)

The permitted area of development shall be reviewed flexibly, 5) The capacity development is conducted for technical officers in the related authorities.

III. Activity plan and policy of Pilot Project

JET, MPI and the members at the Steering Committee agreed about the activity plan and policy of Pilot Project to be conducted as follows;

1. Priority site and Pilot Project site

Chitrakoot is selected as a priority site in consideration of the results of survey, the volume of landslide, the magnitude of disaster, the countermeasure method, the installation of warning system. Chitrakoot is determined as a Pilot Project site in consideration of the results of the Feasibility Study.

2. Structural countermeasures

(a) Policy of the structural countermeasure work:

- The target landslides to be installed countermeasure works are Block-A and -B in Chitrakoot.
- Current Factor of Safety is set as 0.98, and Planned Factor of Safety is set as 1.20.
- The countermeasure work shall be applied in stages. The control work as surface or groundwater drainage work will be installed to achieve 1.10 in the first place. After verification of effectiveness of the works, further control works or restraint works will be installed to achieve 1.20 as needed.
- Countermeasure in Block-B landslide will be decided after further feasibility study.

(b) Layout of the proposed drainages and channel

(c) Schedule of the work

- EIA: until middle December 2013
- Land acquisition and compensation: until February 2014.
- Procurement of the contractor: until April 2014
- Implementation of the work: from May 2014 to middle December 2014

(d) Collaboration between relevant organizations

- Clearance for the work by land owner
- Identification of land owner
- Land acquisition and compensation
- EIA (Evaluation of environmental impact)
- Feasibility Study
- Upgrading of existing water course
- Clearance for discharging water nearby river

- Clearance for felling tree
- Maintenance of early warning system

3. Early warning and evacuation

Rain gauges and extensometers can be used for early warning. Criteria of warning and evacuation can be decided by the past disaster records. Simple rain gauge will be installed at inhabitants' houses in Chitrakoot, Vallee Pitot and Quatre Soeurs. Alarm systems will be installed on two extensometers in Chitrakoot and Vallee Pitot.

4. IEC/Consensus building

Stakeholder meetings for inhabitants who live in three priority areas have been conducted accordingly to share them among attendants.

The stakeholder meetings before/during/after the Pilot Project is held. MPI head office and relevant organizations arrange the stakeholder meetings and the disaster drill for inhabitants in Chitrakoot. The Project Newsletters are issued every six months, and distributed to inhabitants at priority areas and relevant organizations.

5. Activity Plan

The Pilot Project evaluation as the component 3, the construction of countermeasures in Chitrakoot and the operation of the early warning system as the component 4 and the consensus building for the stakeholders shall be conducted in the next phase.

Annex-1 List of members who attended the Steering Committee

List of members who attended the Steering Committee

<MAURITIUS SIDE>

Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping (MPI)

Mr. Lutchmeeparsad Vidianand (Permanent Secretary)
Ms. Bahadoor Savitree (Supervising Officer)
Ms. Subrun (Secretary Officer)
Mr. Jewon Reshad (Deputy Director, Civil Engineering Division)
Mr. Chinasamy (Principal engineer, Civil Engineering Division)
Mr. Bissessur (Senior Engineer, Civil Engineering Division)
Mr. S.Ramdin (Project Manager, National Development Unit)

Other Ministries/Organizations

Mr. A. Sookhareea (ASP, NDRRMC, PMO)
Mr. S. Ghunowa (Government Land Surveyor, Ministry of Housing and Lands)
Mr. R. K. Dhurmea (Divisional Meteorologist, Mauritius Meteorological Service)
Mr. D.S Chamillal AGDEO (Climate Change Division), Ministry of Environment and Sustainable Development)
Ms. Li Pin Yuen Maryse (Second Secretary, Ministry of Foreign Affairs)
Mr. S. Kangloo (Principal Social Security Officer, Ministry of Social Security)
Mr. A. Aubeeluck (Divisional Officer, Mauritius Fire & Rescue Service)
Mr. G. Luchoomun (Project Officer, National Development)
Mr. S. Zeadally (Senior Hydrological Officer, Water Resources Unit)
Mr. Auladin (CIW, Grand Port District Council)

<JAPANESE SIDE>

JICA Expert Team

Mr. Kensuke Ichikawa (Chief Advisor)
Mr. Takeshi Kuwano (Vice Chief Advisor / Landslide Management)
Mr. Fumihiko Yokoo (Landslide Monitoring)
Mr. Takashi Hara (Design/Cost Estimation)
Ms. Yurie Kawabata (Information, Education and Communication)

Mr. Yoshimizu Gonai (Policy and Planning of Urban Development and Land Use)

Ms. Haruka Yoshida (Institution/System Analysis/Capacity Development)

Mr. Makoto Tokuda (Coordinator)

Ms. Sophie Bundun (Project Assistant of JICA Expert Team)

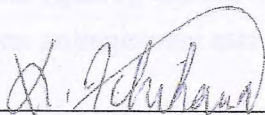
5. Minutes of Meeting on 4th Steering Committee

**MINUTES OF MEETING
ON FOURTH STEERING COMMITTEE FOR
THE PROJECT OF LANDSLIDE MANAGEMENT
IN THE REPUBLIC OF MAURITIUS
AGREED UPON BETWEEN
MINISTRY OF PUBLIC INFRASTRUCTURE AND LAND TRANSPORT
(PUBLIC INFRASTRUCTURE DIVISION)
AND THE JAPAN INTERNATIONAL COOPERATION AGENCY**

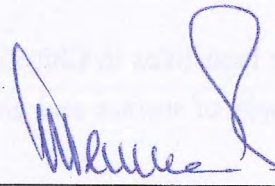
The Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the JICA Expert Team (hereinafter referred to as "JET") to the Republic of Mauritius on the Project of Landslide Management in the Republic of Mauritius (hereinafter referred to as "the Project") in order to conduct with the Ministry of Public Infrastructure and Land Transport (hereinafter referred to as "MPI").

As a result of discussions on this steering committee, both sides agreed to the matters described on the attached sheets.

Port Louis, January 19th, 2015



Mr. Kensuke Ichikawa
Chief adviser,
The Expert Team
Japan International Cooperation Agency



Mr. Reshad Jewon
Director of Civil Engineering Department,
Ministry of Public Infrastructure and Land
Transport (Public Infrastructure Division)
The Republic of Mauritius

ATTACHMENT

I. Acceptance of the Draft Final Report

MPI agreed the contents of the Draft Final Report and accepted the undertakings by MPI for the progress of the Project explained by JET. In order to submit the Final Report on March 2015, MPI will feedback their comments for the Draft Final Report to JET by February 20th, 2015.

II. The progress of the Project

JET explained about the progress of the Project to MPI to the members at the Steering Committee. The following contents were discussed and agreed by all related parties.

1. Structural countermeasures

The countermeasure works has been done as the pilot project in the Project. The planned works were divided into two sections due to the time period to obtain the clearance. In the pilot project, the Work Section I has been carried out.

(a) Plan of the countermeasure works

- The target landslides to be installed countermeasure works are Block-A and -B in Chitrakoot.
- Factors of the landslides in Chitrakoot shall be soften and weak ground geology and excessive supply of surface and ground water according to the site investigation and analysis.
- The countermeasure works which has been planned for the landslide in Chitrakoot has been selected based on the following points
 - Technical superiority
 - Feasibility
 - Simplicity of maintenance
 - Environmental impact
 - Relocation
- Countermeasure in Block-B landslide will be considered after installation of the all planned countermeasure works on Block A.

(b) Construction cost

- Work Section I: 14,045,723Rs
- Work Section II: 5,500,000Rs (estimated)

(c) Land acquisition

(d) Work Schedule for the Works on the Section I

- The construction works implemented from July 2014 to December 2014.

- (e) Works on the Section I
 - New channel for Flood (CH-1)
 - Up-grading of the existing water course
 - Horizontal drainage
 - Bridge (Ancillary work)
- (f) Cancellation of the work
 - The planning up-grading water course for 82m stretch has been canceled due to the request from the land owner.
 - The canceled work section shall be carried out with the works on the Section II by MPI.
- (g) Plan of the work on the Section II
 - New Channel for flood (CH-2)
 - Horizontal drainage
 - Surface drainage
 - Open-blind ditch
 - Blind ditch
 - Ancillary facilities (water catch basin, bridge and man-hole for maintenance)
- (h) Further activities for landslide countermeasure after the Pilot Project
 - Conducting the work on the Section II and canceled work on the Section I
 - Evaluation of the stability of the target landslide after completion of the all planned works
 - Confirmation of effectiveness of the works on Section I and II to the Landslide Block- B.
 - Monitoring of groundwater level and extensometer continuously.
- (i) Evaluation of the effectiveness of the installed countermeasure works
 - The following monitoring shall be carried out for evaluation.
 - Groundwater level meter (Piezometer): to check the changing of the ground water level on/around landslide areas
 - Extensometer: to check the movement of the target landslide

2. Early warning and evacuation

The new landslide disaster protocol of which warning stages has been proposed according to the monitoring of the extensometers and the observation of deformation of houses. The new protocol based on about two years landslide monitoring in Chitrakoot, Vallee Pitot and Quatre Soeurs are the following features;

- i) Warning stages are raised according to the monitoring of the extensometer and the observation of deformation of houses in the landslide risk areas.

- ii) In heavy rain, the habitants in the landslide risk area should follow the Torrential Rain Warning or the Cyclone Warning, not the Landslide Warning.
- iii) Once the residents evacuate from their house, they may return to their house subject to the annual protocol.
- iv) The landslide disaster protocol is effective in Chitrakoot, Vallee Pitot and Quatre Soeurs only, however it can be applied to other landslide

3. Organizational reinforcement plan

The organizational structure of the LMU has been established in order to sustain the effects of the Project. Deployment of six full-time engineers/senior engineers, three technical officers and one public relation officer/intern is in the process. The LMU is divided into three sections: survey section, hard countermeasure section and soft countermeasure section.

Technical knowledge has been transferred to the LMU through daily job training, seminars and training in Japan. Technical knowledge is also enhanced as one of the engineers participated in the JICA's short training of 'Disaster management for landslide and sediment-related disasters' in Japan. Moreover, JICA's ABE initiative of master's degree would contribute to strengthen the abilities of the LMU.

The tasks and responsibilities of landslide management for the LMU and the related stakeholders are defined in the different situations such as classified landslide prone areas, emergency situations, new landslide prone areas and early warning. Landslide management in Mauritius can only be achieved by close collaboration of all stakeholders.

The importance of dispatching the JICA's landslide adviser was highlighted. Dispatching the landslide adviser would enhance further technical knowledge of landslide such as slope failure, rockfall and debris flow which have not been covered in the Project.

III. Collaboration with other projects

Overall picture of the JICA Mauritius intervention were presented as four components of "JICA Climate Change Adaptation and Disaster Management". The Landslide Management Project is recognized as one of the above components. The outcome of various international development partners was also explained. The area of concern for the Mauritius frameworks and strategies in regard to the climate change and disaster management were identified through the representative three major projects, and the relation between those activities were shown.

IV. Future Plan after the Project

JICA Madagascar Office explained the future plan on Environment, Climate Change Adaptation and Disaster Management after the Project as follows;

- i) JICA has received an official request from the government of Mauritius for dispatching a Landslide Expert and the screening process has been ongoing in the JICA headquarters and relevant Ministries in Japan. The final result will be informed by way of diplomatic channel by the end of March 2015.
- ii) The Project of Enhancing the Observation, Forecasting and Warning Capabilities of Meteorological Services using a Doppler Radar will be launched in 2015. The project plans to enhance collaboration among different institutions related to early warning system. JICA hopes that a better coordination of it between MPI and Mauritius Meteorological Services will be enhanced.
- iii) JICA received an application for ABE initiative, a two year Master course for African Countries, from MPI / LMU and is still at the selection stage. If the candidate will be successful, he or she will attend a course starting in the middle of 2015.

Annex-1 List of members who attended the Steering Committee

List of members who attended the Steering Committee

<MAURITIUS SIDE>

Ministry of Public Infrastructure and Land Transport (MPI)

Mr. R. Jewon (Director, Civil Engineering Division)
Mr. D. Chinasamy (Principal engineer, Civil Engineering Division)
Mr. S. P. Anadachee (Senior Engineer, Civil Engineering Division)
Mr. Bissessur (Senior Engineer, Civil Engineering Division)
Mr. V. Ramdhan (Senior Engineer, Civil Engineering Division)
Mr. K. Mosaheb (Senior Engineer, Civil Engineering Division)
Mr. B. Dabycharun (Senior Engineer, Civil Engineering Division)
Mr. S.M. Ramdowar (Senior Engineer, Civil Engineering Division)
Mr. V. Ramchurn (Technical Officer)
Mr. H. Bholah (Chief Project Manager, NDU)

Other Ministries/Organizations

Mr. R. Luximon (Environment Officer, NDRRMC)
Mr. G. Rosunee (Principal Planner, Ministry of Housing and Lands)
Mr. V. S. Chuckun (Surveyor, Ministry of Housing and Lands)
Mr. K. Dhoomun (Ministry of Environment, Sustainable Development, Disaster and Beach Management)
Mr. G. Nundlall (Ministry of Local Government)
Mr. P. Dooneeady (Divisional Meteorologist, Mauritius Meteorological Service)
Mr. D. Jokhun (Forestry Service)
Mr. S.A. Zeadally (Senior Hydrological Officer, Water Resources Unit)
Mr. D. Towakel (Police Inspector, SMF)
Mr. I. Kheerdali (Police Sergeant)
Mr. S. Jeetun (Head, Public Infrastructure Department; Riviere Du Rempart District Council)
Mr. P. Balloo (Head, Public Infrastructure Department; District Council of Black River)
Mr. A. Reesaul (Head of Public Infrastructure Department, Municipality of Quatre Bornes)
Mr. M. Ragaver (Civil Engineer, District Council Moka)
Mr. N. Reemul (Chief Inspector of work- Municipality of Vacoas/ Phoenix)
Mr. V. Sookoy (District council of Flacq)
Mr. K. Domah (Head of Public Infrastructure, Pamplemousses District Council)
Mr. A. Sookun (Head of Public Infrastructure Department, Pamplemousses District Council)

Mr. S. K. Seechurn (Civil Engineer, District Council of Savanne)
Mr. D. Seebaluck (Head of Public Infrastructure Municipal of Council of Curepipe)
Mr. S. Sairally (Head of Public Infrastructure Department)
Mr. R. Oodally (Head Public Infrastructure Department)

<JAPANESE SIDE>

JICA Madagascar Office

Mr. Akira Nishimoto (Chief Representative)
Ms. Kaoru Takahashi (Representative)
Ms. Razafimahefa Manoela (Programme Officer)

JICA Expert Team

Mr. Kensuke Ichikawa (Chief Advisor)
Mr. Takeshi Kuwano (Vice Chief Advisor / Landslide Management)
Mr. Fumihiko Yokoo (Landslide Monitoring)
Mr. Takashi Hara (Design/Cost Estimation)
Ms. Haruka Yoshida (Institution/System Analysis/Capacity Development)
Ms. Sophie Bundun (Project Assistant of JICA Expert Team)
Ms. Shalina Mangroo (Project Assistant of JICA Expert Team)

6. Landslide Location Map

