Appendix 3.2.4

Effects of the constructed countermeasure works (evaluations)

Effects of the constructed countermeasure works (evaluations)

Existing slope countermeasures were found only in two sites of the total 18, and it was judged that those countermeasures were insufficient by MPI and JET.

<Management No.2016-010, Maconde>

This slope is located at the cape of Maconde on the south coast of the island. Most of the rock falls were from the basalt part of the cliff. In July and August 2014, RDA carried out removal works of rocks which were unstable and close to the road, and a new road (shift of alignment) was built to reduce the damage from rock falls. In addition, a retaining wall with a rockfall protection fence has been installed in one part of the site. However, it was judged that those countermeasures were insufficient. Rock falls and small rock failures are also a frequent occurrence along the new road because the rocks are weathered, and there is a high possibility of rock fall in future.

Photo 1 Maconde (Management No.2016-010), 5 August 2016 (Source: JET)

<Management No. 2016-018, Hermitage>

This site is situated in the vicinity of Grand River North West. As an existing countermeasure, a boundary wall was constructed by the land developer, but it had been already collapsed in 2012. In the future, a retaining wall should be installed there as a permanent countermeasure for the slope.

Existing retaining wall after the collapse, 2012

The existing retaining wall which collapsed was already removed, 2016

Photo 2 Hermitage (Management No.2016-018), 2012 and 2016 (source: JET)

Appendix 3.2.5

Procedure for elaborating a slope map in QGIS

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF PUBLIC INFRASTRUCTURE AND LAND TRANSPORT (MPI)

TECHNICAL COOPERATION PROJECT:LANDSLIDE ADVISER FOR MAURITIUS

Procedure for elaborating a slope map in QGIS

September 2017

KOKUSAI KOGYO CO., LTD.

Contents

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1. What is GIS

A GIS (geographic information system) is a computer system for capturing, storing, checking, and displaying data related to positions on the Earth's surface. A GIS can show many different kinds of data on one map. This enables people to more easily see, analyze, and understand patterns and relationships. (National Geographic)

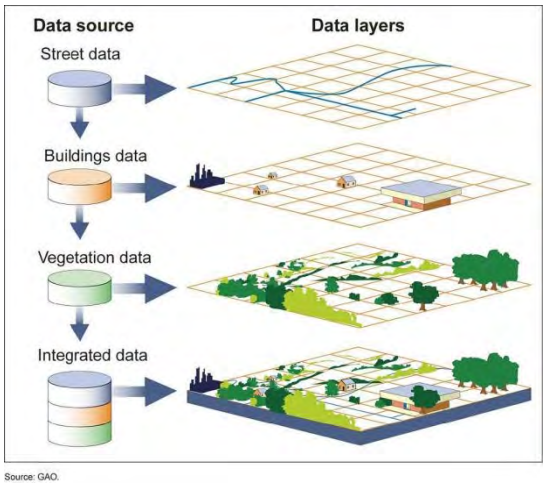


Illustration of GIS (Source: USGAO)

A GIS basically uses 2 kinds of data, vector data and raster data. They are described as follows:

a) Vector data:

Vector data is comprised by vertices and paths. There are three basic symbol types for vector data, points, lines and polygons. Vector points are simply XY coordinates (latitude and longitude), that are used when features are too small to be represented as polygons. Vector lines connect vertices (vector points) with paths and represent features that are linear in nature. Vector polygons are formed when a set of vertices are joined in a particular order and closed, and represent features with a two-dimensional area.

Vector point Vector line Vector polygon

b) Raster data:

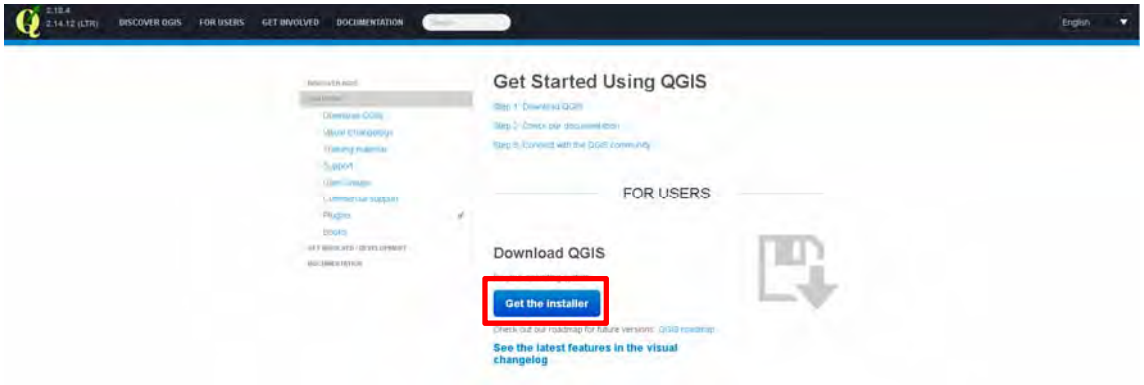
Raster data is made up of pixels (also referred to as grid cells), which are usually regularly-spaced and square. Rasters often have a value or class associated to each pixel. They are useful for storing data that varies continuously as in an aerial photograph, an elevation surface or a satellite image.

There are several types of GIS software, both proprietary and open source. In this manual we will use QGIS, previously known as Quantum GIS.

QGIS is a free open source geographic information system software. It runs on Linux, Unix, Mac OSX, Windows and Android and supports numerous vector, raster, and database formats and functionalities. In this manual, you will learn how to install QGIS, create a slope map from a digital elevation model (hereinafter, DEM), establish the ranks of the slope gradient intervals, save a project and export a map.

2. How to install QGIS

Search for the word QGIS in google and press the button download, or access the following link:
http://qgis.org/en/site/forusers/index.html
Once there, select the button “Get the installer”



Now, select the installer for your operating system in the category “latest release”. As for the 22nd of March 2017, the latest version is 2.18 (Las Palmas). The download may take a few minutes as the installer weighs around 385MB.
Launch the startup installer and press “next”, “agree”, and “install” in order to follow to the

next stage. It is not necessary to install the North Carolina Data Set, South Dakota Data Set, and Alaska Data Set.

Once the installation is complete, the following icons must appear in your desktop

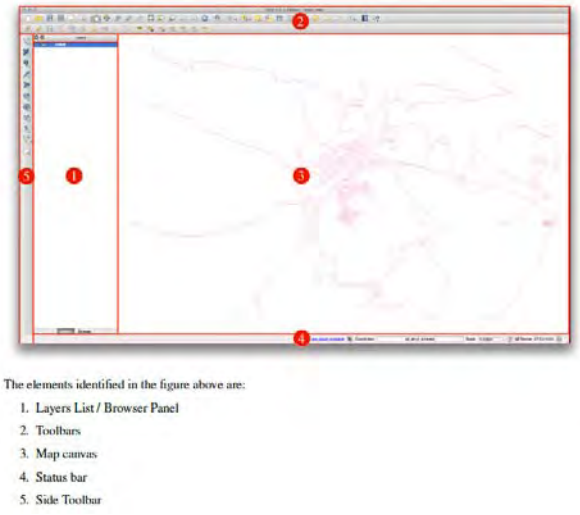
Some of the icons may be hidden inside a folder named “QGIS 2.X.Y”.

3. Creating a slope map in QGIS

During this manual, we will only use one of the applications of QGIS. Open “QGIS Desktop 2.X.Y” (depending on the version you downloaded) by double clicking its icon in your desktop or selecting it in all your programs.

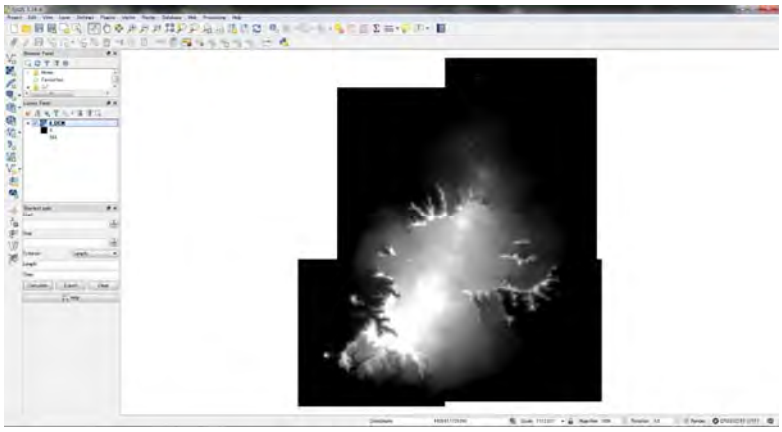
First of all, in order to help the software locate and access easily the data we are going to use and produce, create a file named QGIS in your local disk “C:”, and copy the folder “Manual for Mauritius” into it; inside this folder there is a DEM file named “6_DEM.tif”. This DEM is a raster data digital model of Mauritius’s terrain’s surface and its mesh area is 10mx10m.

The following figure shows the basic elements of the QGIS interface.

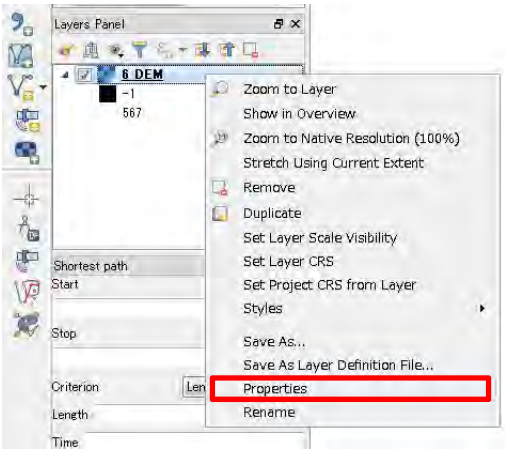


Basic elements of the QGIS interface

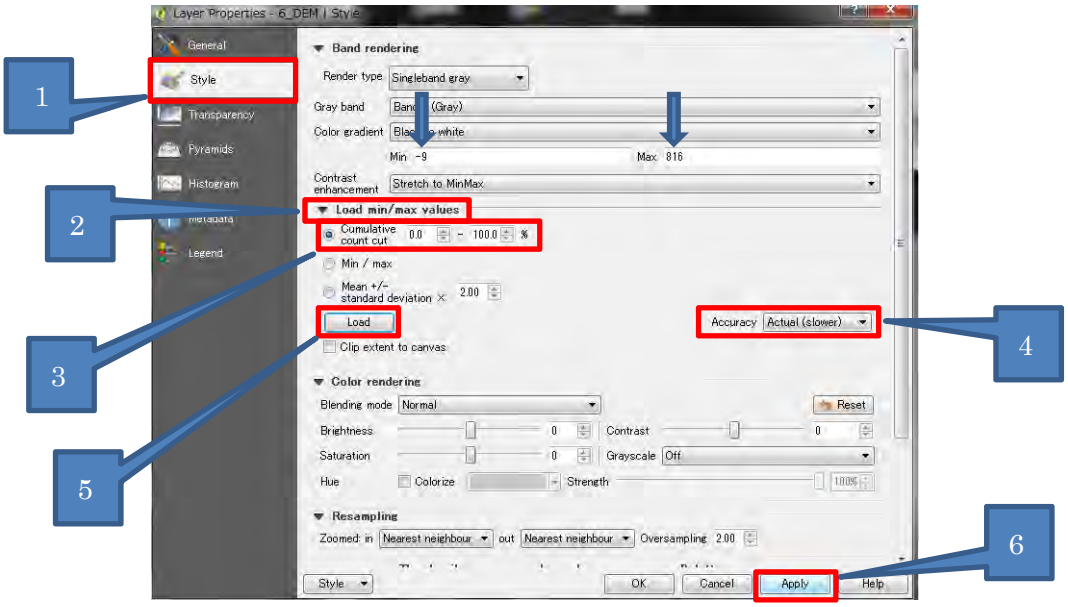
a. To add data into the software, drag the folder and drop it into the “Map canvas” window. You can also add data from the “Side Toolbar”, although you would have to know what type of GIS data (vector or raster) you are going to add. In this case we are going to add a DEM raster, so we have to click on  “Add Raster Layer”, browse the folder where we have saved the target data; select the data we want to add and press “Open”. Once added the file “6_DEM.tif”, our current interface should look as below. If you want to see the hole layer in the exact space of the “Map canvas”, right click on the DEM layer in the “Layers list” and press 



b. We can see the silhouette of the island of Mauritius in monochromatic colors from black to white, where black is 0m AMSL, and white is 567 m AMSL. Here you might ask yourself: Why is the maximum value 567 m if Mauritius’s highest peak, Piton de la Petite Rivière Noire, has 828 m height? The reason is that QGIS automatically omits the highest and lowest height values (the 2% of the data of each end) and rounds out with the next value. Therefore, it is necessary to manually set the software so we can browse all the real height values. For this, right click the DEM file in the “Layer List” and select properties.



Select the tab “Style” in the left, and click the triangle Load min/max values. The option selected by default should be “Cumulative count cut” and its values are established as 2 – 98 %. Change the values to 0 – 100 % and set the “Accuracy” as “Actual (slower)”. Then press “Load”. You should have noticed the minimum and maximum values have changed to -9 and 816 respectively. Once confirmed the minimum and maximum values have changed, press the button “Apply”, in the lower right side of the window.

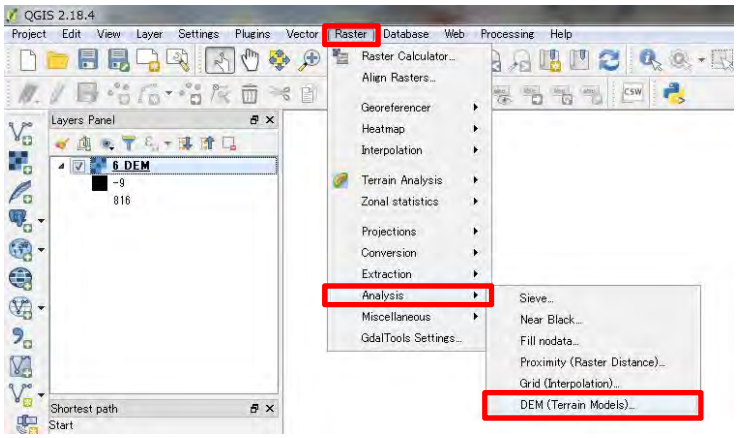


Layer property window

The reason why the maximum value is 816 m, is that the data mesh area is 10mx10m, so the maximum altitude does not have to be the maximum value in the raster data. On the other hand, there are negative values (up to -9 m) which might mean part of the

surface of the added data is beneath sea level, but this fact does not influence in the creation of the slope map.

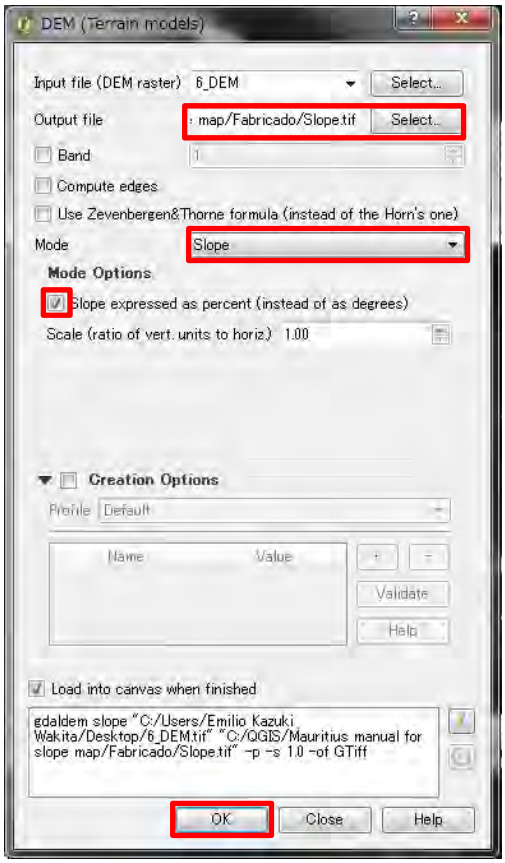
c. Once we have calibrated our raster data, we will proceed to make the slope map. Search for the tab “Raster” in your “Toolbar”, put your mouse on top of “Analysis” and select “DEM (Terrain Models)…”.



In the “DEM (Terrain models)” window:

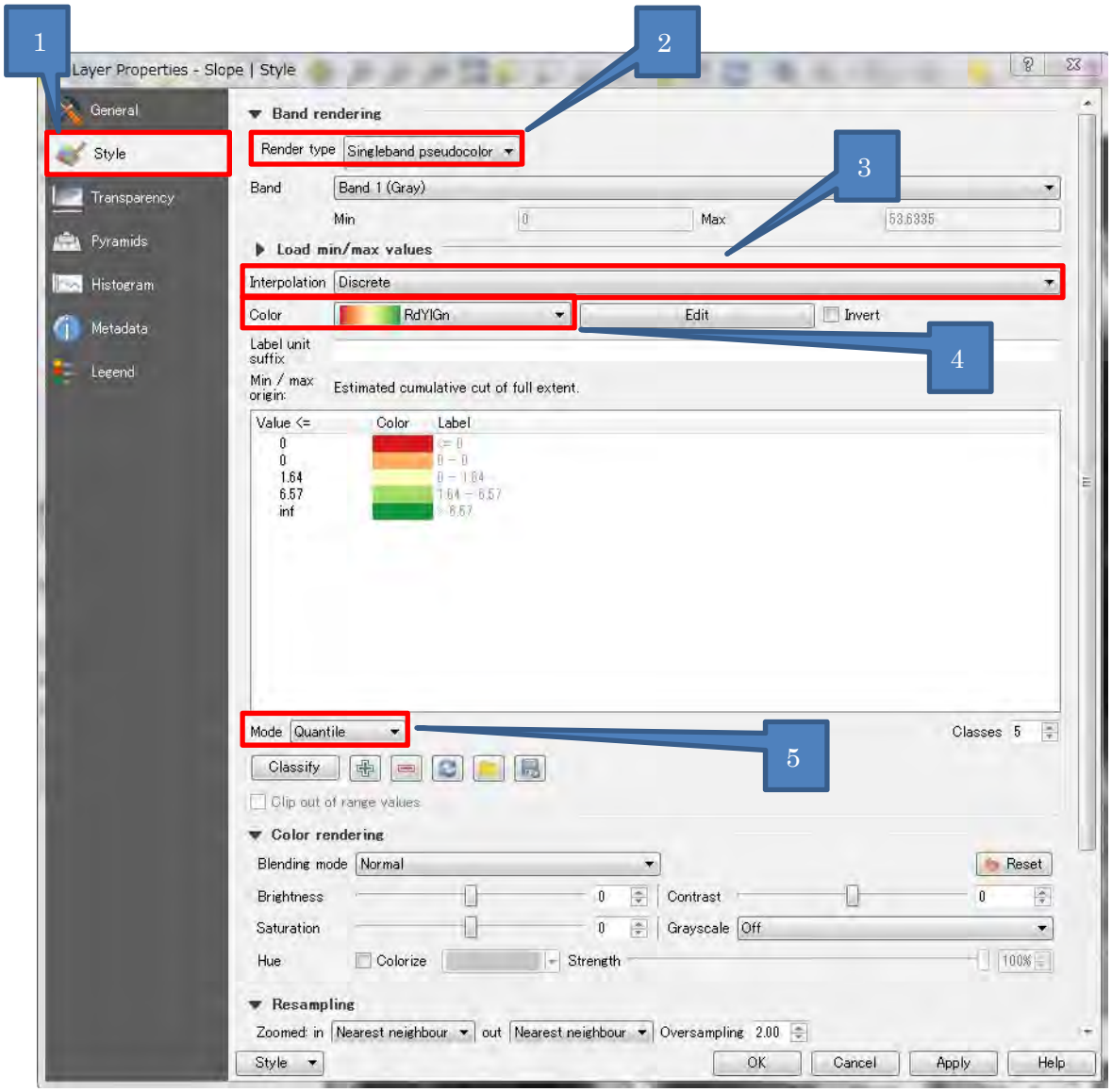
Select where you want to save and how you want to name (in this case we will name the file as “slope” the file we are about to create. It is recommended to create a new folder where you will save the files generated during this manual. In mode, select “Slope”. Check the box for “Slope expressed as percent (instead of as degrees), and press OK. Close the windows that notify the completion of the task by pressing OK and close the “DEM (Terrain models)” window.

The new file generated will also have a “.tif” extension. This means it is also a raster file, which contains slope value data instead of height.

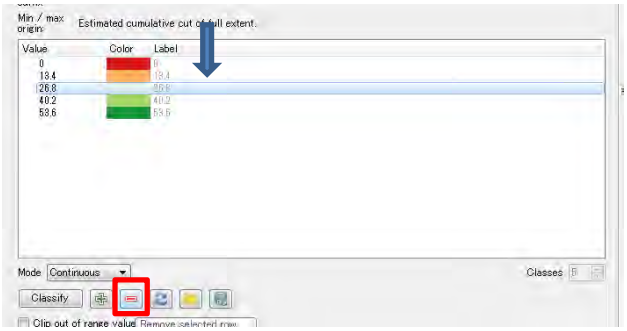


d. A new layer named “slope” has been added in your “Map canvas” and “Layer list”. The new slope map is represented in a continuous percentage range (as we established before) from 0 to 53.6335 in a black to white gradient. In order to classify our slopes for landslides, we will classify all the slopes in 3 classes; 0 – 10 %, 10 – 20 %, > 20 %, differentiated by colors.

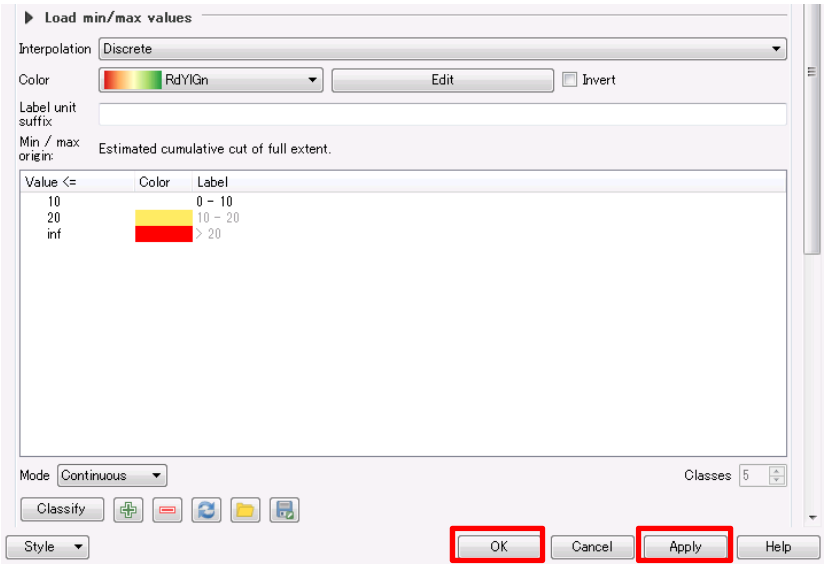
As in step b, select “Properties”, but this time for the new layer “slope”. First, select “Style” in the left tab. Second, select “Singleband pseudocolor” in “Render type”. Third, select “Discrete” for the category “Interpolation”. Fourth, establish a range of colors other than black and white; posteriorly we will change the color for each category manually. Fifth, select “Quantile” in “Mode”; 5 classes with their respective colors will appear in the window beneath. Check the figure below to see the steps we have carried out until this moment.



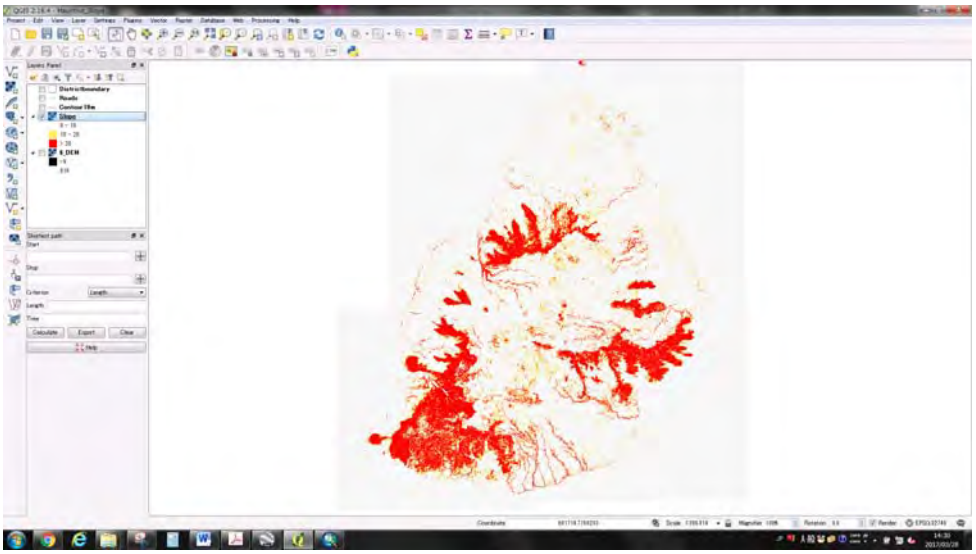
To separate the slope gradients in the categories of the classification criteria we explained beneath (0 – 10 %, 10 – 20 %, > 20 %), we have to erase two of the current categories. Erase two random categories by selecting them and pressing on the red minus button  one by one.



When you have three categories left, set each category's value, by pressing the number in the column value. Set the value of the first category as **10**, and its label column will change to <=10; this means all the places with slope inclination equal or less than 10% are included in this category. Also, set the color of this category as white. The value of the other two categories will be **20** (for the areas with an inclination between 10 – 20 %), and **inf** (for the areas with an inclination beneath 20 %). Establish their colors as yellow and red respectively.



Once you have finished the classification, press the button "Apply" and close the window by pressing "OK". Your current "map canvas" should look like the image below.



The base for our slope map is now complete. Now we will continue creating and inserting other features before exporting the map into a final format, but before we will save the project just in case.
For saving the current project, go to the “Project” tab in the “Toolbars”, and press “Save as”. Name the map as you like, browse the location where you want to save the project and press “Save”. Now the project is saved. The extension of the file saved is “.qgs”

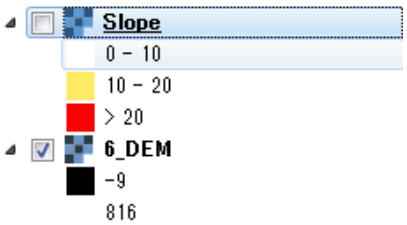
Now, whenever you want or need to close the application you shall press the save icon before. Whenever you want to continue working on the current project, you can open the project you just save by double clicking it, or selecting the project in the “Open” function of the tab “Project” of “Toolbars”. Please note that the current project opens the layers from the same location we saved the initially, so if you move the location of the base layers, the program will not be able to find them and show them on screen.

For further information on how the gradient values are calculated check the link below:
http://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/how-slope-works.htm

4. Create contour lines in QGIS

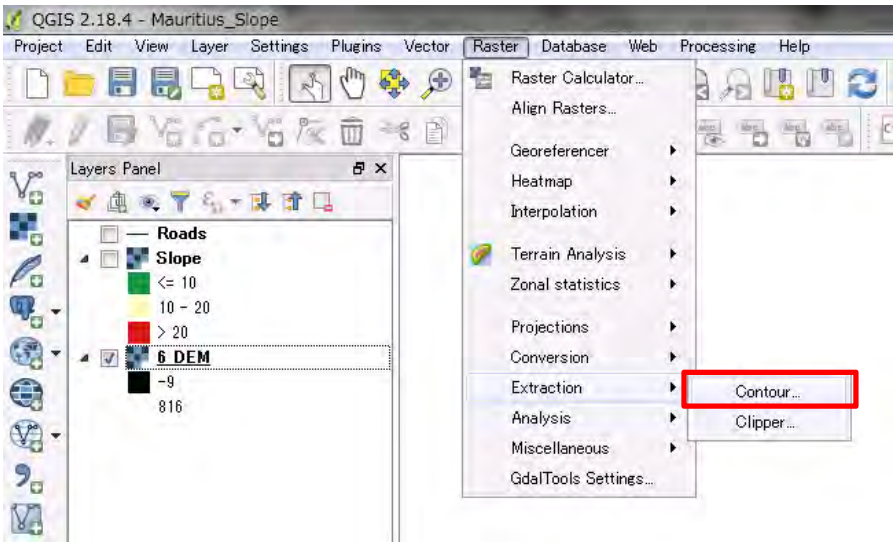
In this chapter we will continue working on the same project as chapter 3. For making the contour line, the base data is also the DEM raster. In this exercise we will create 10 m unit contour lines.

a. As we will not be using the slope map we created before we will deactivate that layer. Layer deactivation is useful in situations where you have to manage many types of layers but at one moment you only need to use some of them. In order to deactivate a layer you should click on the check on the left side of the layer in the “Layers Panel”.

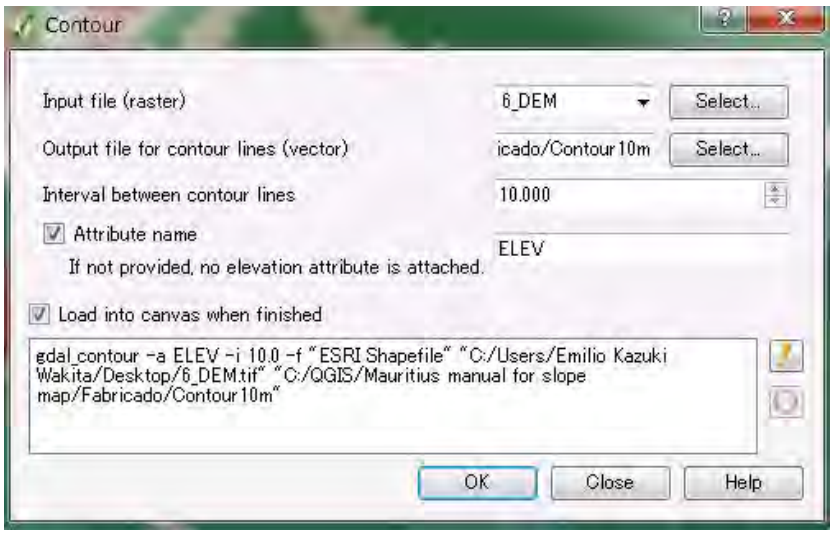


Whenever you want to visualize that layer again, click on the check box. For this exercise make sure the “Slope” layer is inactive and the “6_DEM” is active.

b. Select the tab “Raster” from “Toolbars”. Select “Contour…” inside “Extraction”

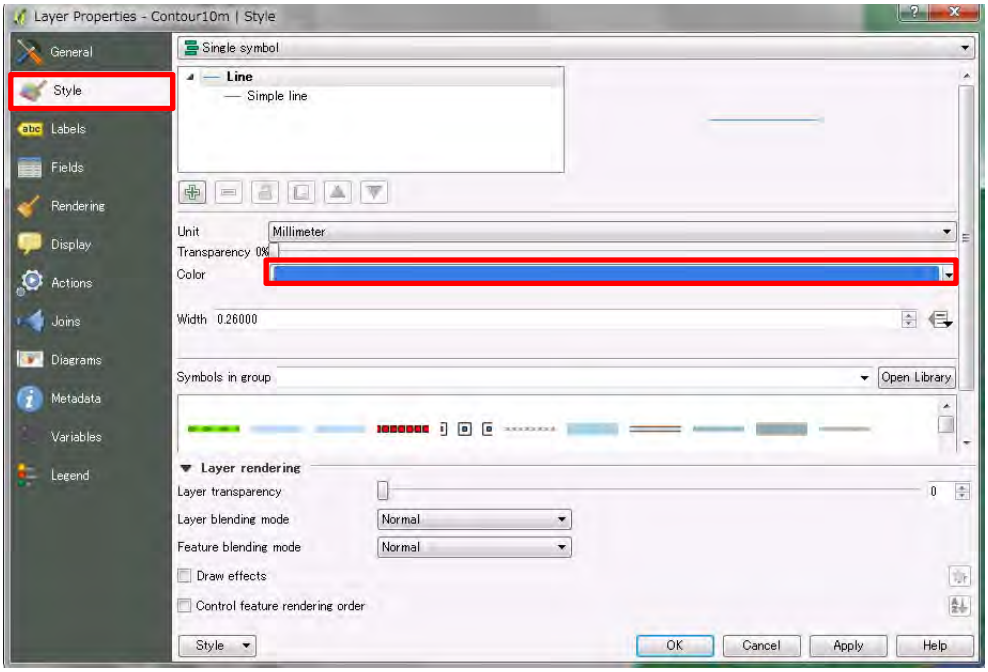


c. Now, the “Contour” window should be open. Select the “6_DEM” layer as the Input file (raster), and press “Select” for the Output file for contour lines (vector). Browse the same folder you saved the Slope layer and establish the name of the file as “Contour10m” for example. The Interval between contour lines should be 10.000 (m) as a default; if not set it as 10. There should also be a check in the boxes of “Attribute name” (the contents is OK as “ELEV”) and “Load into canvas when finished”. Now press “OK” and when the creation process is complete, close the window.

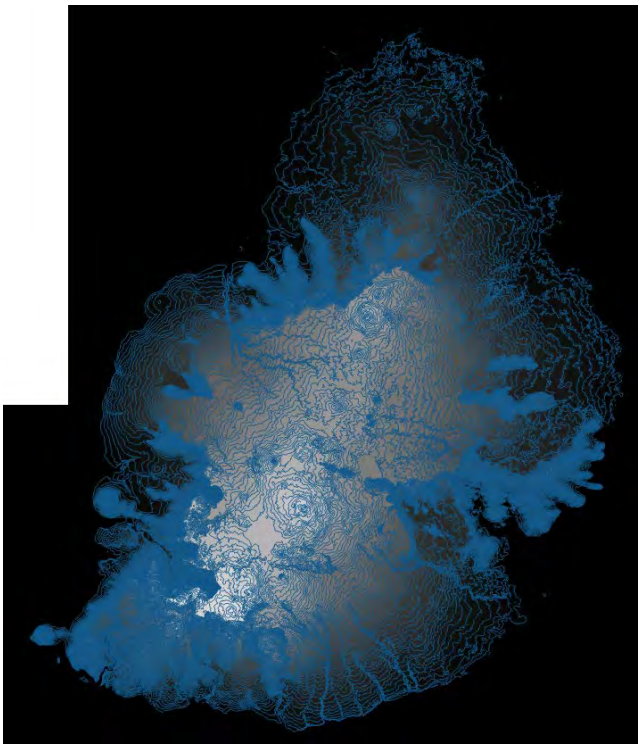


The counter map created will be a shapefile (.shp) as it is composed of lines.

Your map current “Map canvas” should be similar to the image below. The color of the contour lines has been set randomly by the application, but in order to differentiate from the other layers, establish its color as blue. To change the color of a layer, right click the target layer and press the option “Properties”. Press the tab “Style”, and choose the color you like from the color palette in the tab “Color”.



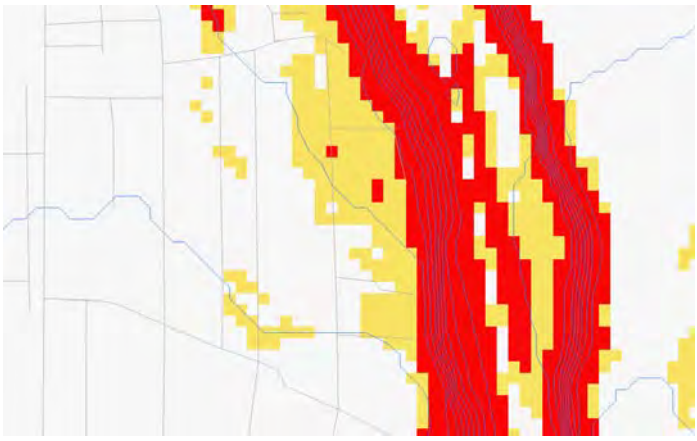
Save the project with the current status.



5. Add vector data in QGIS.

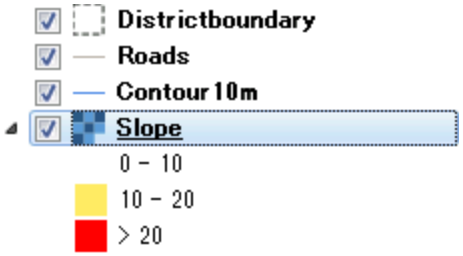
A risk map does not make sense and cannot be created if the natural factors do not affect social factors. In this exercise, as a case of example we will learn to add a vector file of roads in Mauritius. It is common to overlap data of roads and houses with slope inclination layers to evaluate sites in risk of landslides.

a. In this stage, the DEM data is no longer necessary so you can deactivate it as we have done in Chapter 4.
b. Go to the folder “Manual for Mauritius” drag the file “Roads.shp” and drop it into the “Map canvas”. The reason why there are multiple files named road with different terminations is that each file contains different kind of information of the layer; such as georeference, color, etc. Although we only dragged one file into the application all the folders are active, so you should not erase or move any of them and treat them as a package.
c. Change the color of the road layer to grey as you have learnt in the previous chapter.



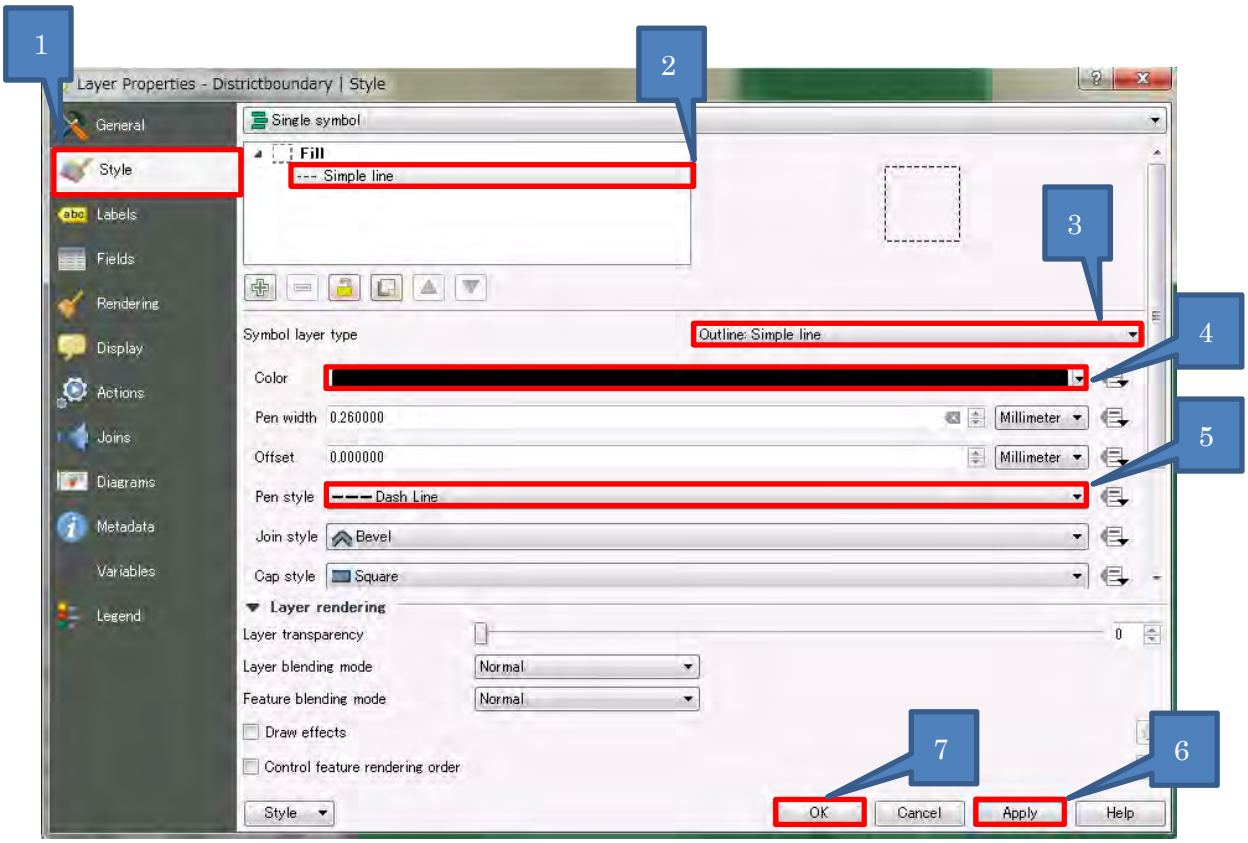
In this zoom up, we can distinguish slope areas with 0 – 10 % (white), 10 – 20 % (yellow), and > 20 % (red) inclination, roads (in grey), and 10 m unit contour lines (blue).

d. We will also add a boundary map of the districts of Mauritius. Add the file "Districtboundary.shp", the same way as step b. This file is a polygon, so you must have noticed that all the data you had has been covered and cannot be seen. Now we will have to transparent the fill of the polygons. Note that the latest files we have added into the application are overlaying the old ones, but this can be changed by dragging the layers in the position you want them to be. Obviously, if we put an opaque layer on top, we won't be able to see the layers below.

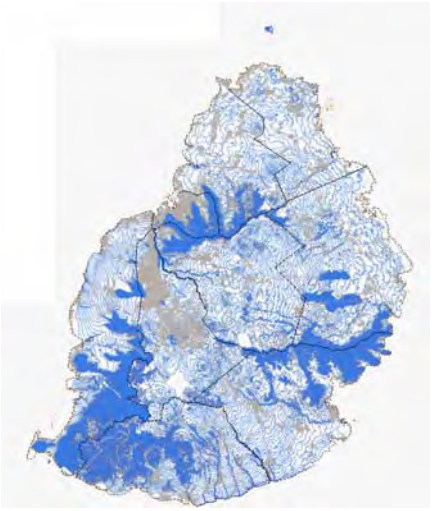


In the case of this image, the slope map is in the base and is overlayed by the contour lines, the roads and the district boundary lines respectively.

e. Go to the "Properties" of the "Districtboundary" layer. Select the tab "Style", press "Simple fill" beneath, and in the tab for "Symbol layer type", select "Outline: Simple line". We will set the color of the outline as black, and for "Pen style" choose "Dash Line". Once you have selected all the items as above, press "Apply", and close the window with "OK".



Your map should look like below once you have zoomed to layer. Because it has a lot of detail in relation with the display size, it is necessary to zoom in to see the different features.

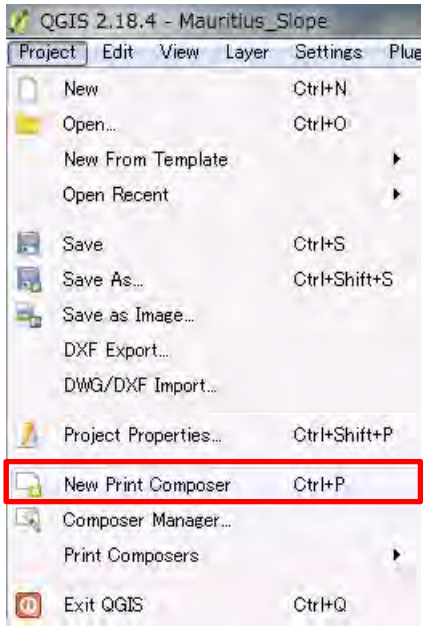


Save the project and follow to the next chapter.

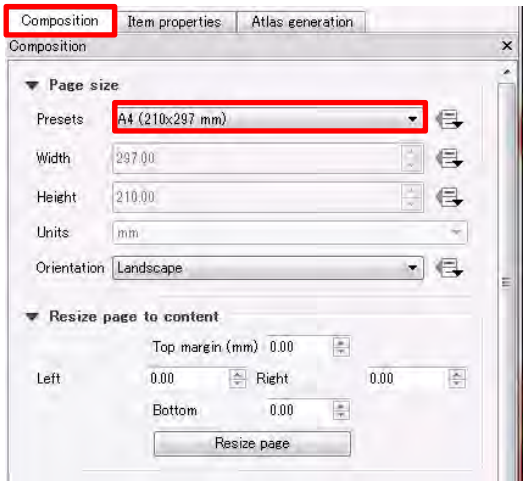
6. Exporting a map in QGIS

In order to print a map we will use the composer tool.

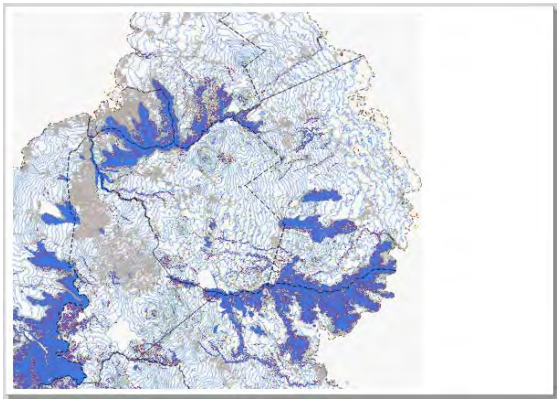
a. The composer tool is opened pressing “Ctrl” + “P”, or “New Print Composer” in the “Project” tab of “Toolbars”. Press “OK” when the “Composer Title” window pops up. A new window named Composer must have popped up. This is the window where we will be working for editing the map we want to export and print.



b. The size of the map we will be exporting is A4 by default, so we will be using this format during the exercise. If you want to check or change the format of the map to be exported, select or edit another format in the tab “Composition”.

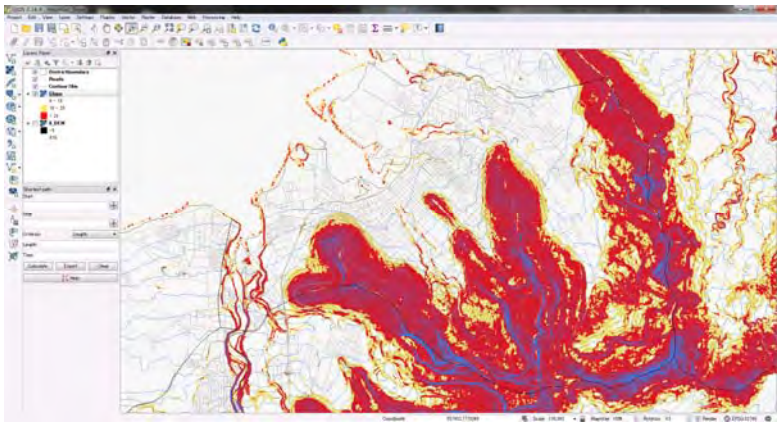


c. Now, we will insert a window where we can see the map we have been working with by pressing the icon “Add new map” ( ) located in the toolbar in the left side of the window. Click and drag the mouse to extend a window (a map viewer) which will reflect the layers we have been working with. You may want to open a window leaving some space in the right side for example, in order to insert the title, the legend, the scale, etc. The image that appears in the map reflects the area that is visualized in the “Map canvas” of the project editor.

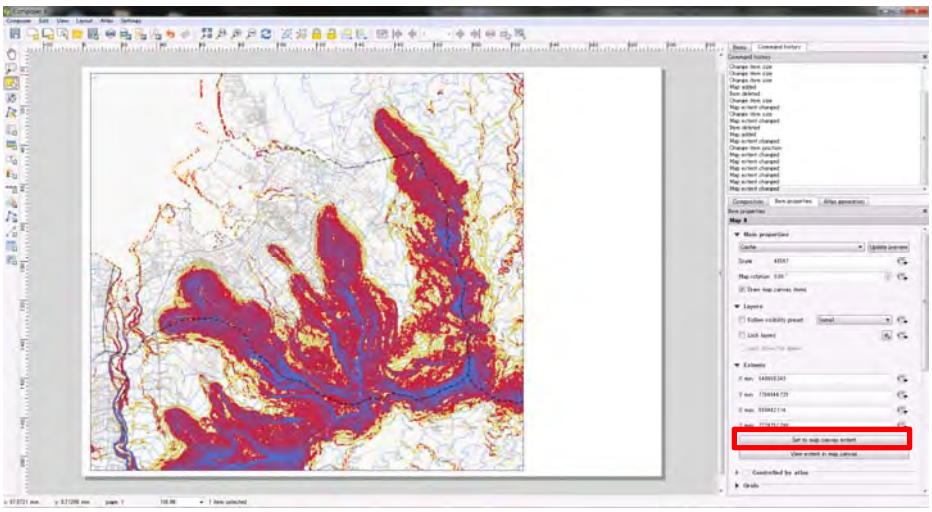


In the example beneath, a random area of the Island of Mauritius is visualized so it is necessary to set the area we want to focus on.

d. In this exercise we will make the slope map for the district of Port Louis, so go back to the project editor window and zoom into the area of Port Louis district so we can see it in full extent.

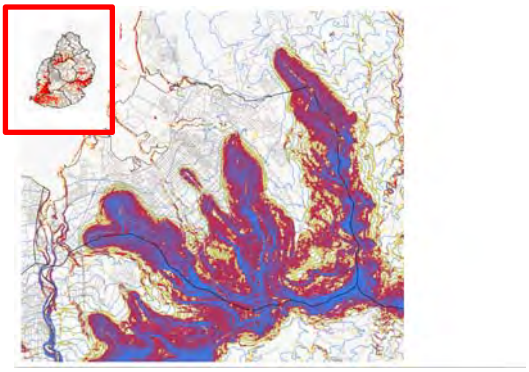


Go back to the composer window and press the tab “Item properties” in the right side, scroll down and press “Set to map canvas extent”. This tool will actualize the content of your map viewer to the current section you are visualizing in the project editor window.



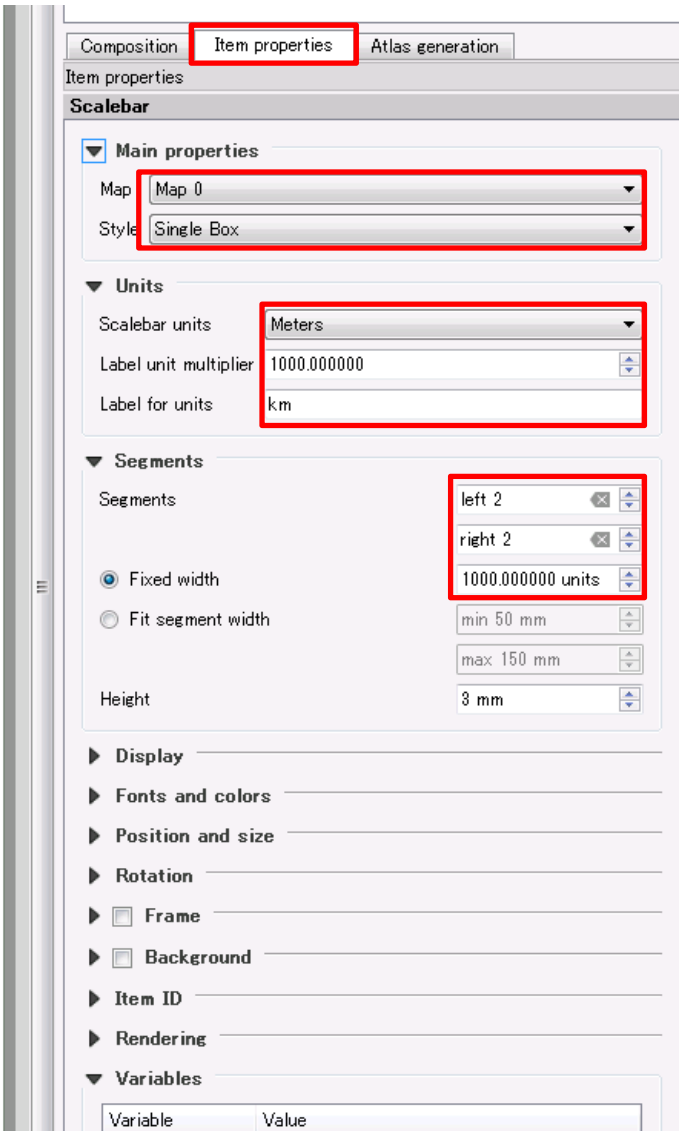
Repeat the process of zooming in to the target area in the project editor window and “Set to map canvas extent” as many times as necessary until you consider your map viewer has an optimal size of Port Louis. Note that for this map all the layers except for the DEM data are activated.

e. The next step, will be adding another map viewer in the same paper, but this time with the whole extent of the Island of Mauritius. You may want to add this map in the upper left side of the paper but this must be a personal decision as it is an esthetic preference. The result of this stage should be like the image below. (The map viewer of Mauritius is in the upper left corner)



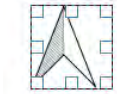
f. To add a scale bar press the icon “Add new scalebar” in the toolbar in the left. Press and drag the scalebar wherever you want. In this example it will be inserted in the

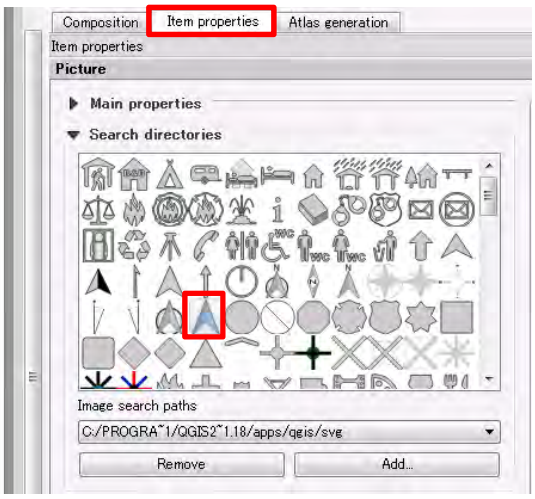
lower right part of the page. Make sure the scalebar you just inserted is selected and active. Now go to the “Item properties” tab of the right side and in the tab for “Main properties” > “Map”, choose “Map 0” which is the first map viewer we inserted, i.e. the zoom up of Port Louis. Leave the “Style” as “Single Box”. In the tab for “Units”, set “Meters” for “Scalebar units”, “1000.000000” in “Label unit multiplier”, and “km” in “Label for units”. In the tab for “Segments”, set “left 2”, “right 2”, and 1000 units in “Fixed width”. The above is only a suggestion, so each person can edit and display the scalebar as they consider better.



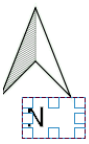
g. To insert a north arrow, press the icon “Add image” in the toolbar in the left side of the composer window. Press and drag wherever you want to set the north arrow. Press

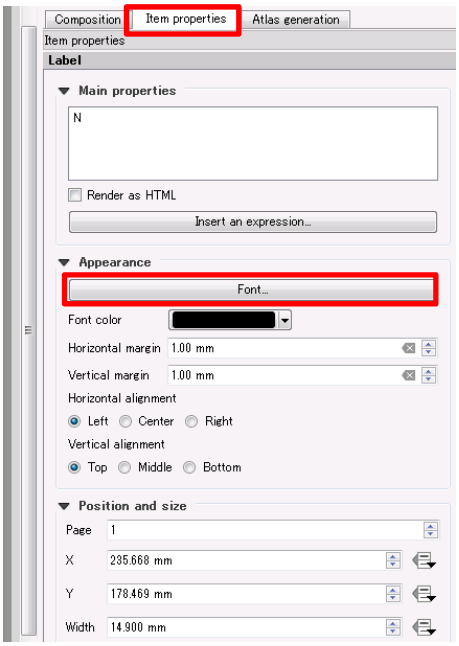
“Item properties” and open the tab “Search directories”. Chose the symbol you most like as a north arrow. For this exercise I have chosen the one below.





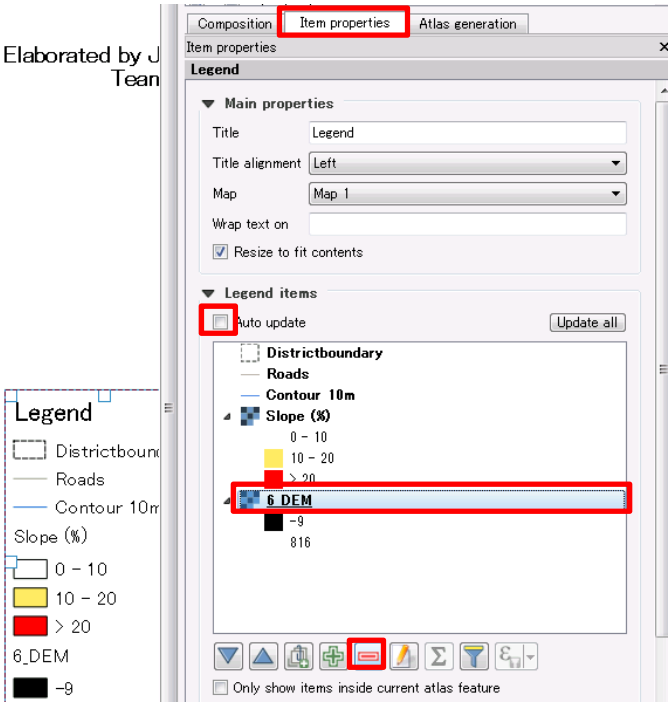
h. Now insert the letter N beneath the arrow, so that we know the arrow is pointing to the north. To do this, press the icon “Add new label”  in the toolbar in the left side of the composer window. Press and drag the mouse beneath the north arrow. Now insert N, or North in the “Main properties” tab, and set the “Font” as you like in the “Appearance” tab.



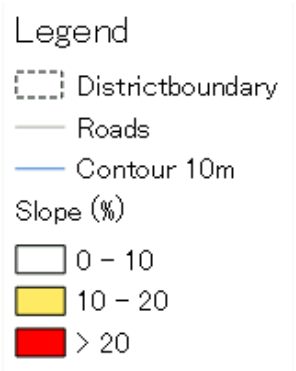


i. To insert the legend, press the icon “Add new legend”  in the toolbar in the left side of the composer window. Click and drag the mouse wherever you want to set the legend.

During this exercise the DEM layer is not visible so we can delete it from the legend. To do this, access the “Item properties” tab, uncheck the box “Auto update” in the “Legend items” tab, select the DEM layer and delete it pressing the icon.

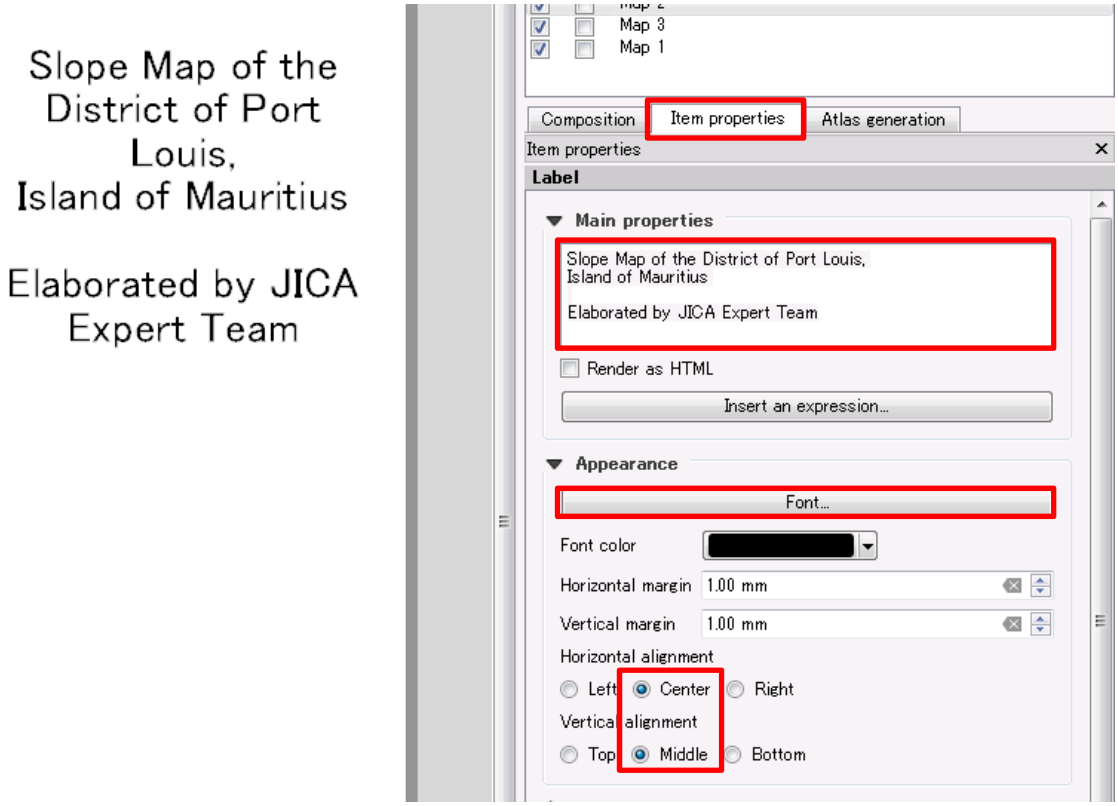


Also, the labels of the legend items are linked to the name of the layers in the project editor window. If you want to change the name label of an item in the legend, you can go back to the project editor window right click the target layer, press “Properties”, “General” and change the “Layer name”. Once you do so, it shall appear actualized in the legend of the Composer window.

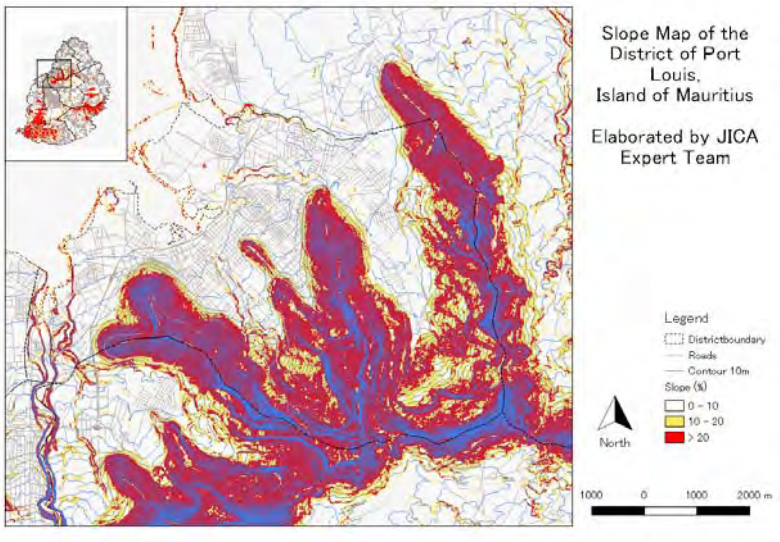


j. To end, press the icon “Add new label” , click and drag the mouse wherever you want to insert the title for the map. In the tab of “Item properties”, “Main properties”, you

can name the map as “Slope Map of the District of Port Louis, Island of Mauritius”, for example. You can also edit the font as you wish in the “Appearance” tab.



Once you completed all the steps above, your map should look like the image below.



k. Now, we will finish by saving this composition. And learning how to export it in a pdf format. To save the composition so we can open it whenever we want, press “Composer”

in the upper left part of the application and “Save as template”. Browse where you want to save the template, choose a name and press “Save”. The extension of the saved template will be “.qpt”. In order to print the map, you may print it directly pressing the “print” icon  , or export it into another format, like pdf, and print it through another document reader. To export in pdf format, press “Composer” in the upper left part of the application and “Export as PDF”.

With this, you have learnt an easy and free way to make a slope map with QGIS.

Appendix 3.2.6

Usage of Manual

Usage of Manual

a. Batelage (cut slope failure countermeasures)

The subject site is located along the A9 road in the southern coast. In February and March 2016, JET conducted the survey of a cut slope road and reviewed the slope failure countermeasure works. LMU planned countermeasure works against slope failures and proceeded to confer with RDA about the results. In July 2016, the final draft was given to RDA, confirming the scale of each countermeasure work. Furthermore, a meeting to explain to local residents the areas to conduct drilling surveys where crib walls will be implemented and to carry out the partial removal of houses located in these areas took a place in October 2016.

Moreover, according to the discussion that took place in February 2016 and the latest field survey, the principles of the countermeasure works were determined as follows:

- Removing unstable trees and stones and modifying the shape of slopes.
- The crib walls are to be settled in the colluvial deposit slopes with thick weathered layers that stand near the roads.
- The upper part of the weathered rock slopes is to be reinforced (with soil nailings, rock bolts, and mortar-spraying to prevent surface weathering)
  4) Concrete retaining walls (1.5 m height, without rockfall protection fence) for the sections with enough space between the road and the slope.
- At places where drained rainwater from houses above the slope cause problems, perpendicular drain outlets are to be applied. Drainage water such as rainwater and sewage from those houses is to be drained towards the opposite side of the slope in question.
- Construction works in the rainy season must be avoided. The contracts should be made with due consideration of the time the actual construction works will be done.
- Before the construction work starts, sufficient space must be secured. Specifically, half of the side of the road will be necessary in preparation for possible soil failures. Sand bags should be piled up on the centreline and single lane traffic should be applied during the construction.

Photo 1 The slope near the end of the road is to be mortar-sprayed (Source: JET)

Photo 2 The slope in which a retaining wall (1.5 m high) is to be applied (Source: JET)

Photo 3 The slope at middle of the road in which a crib wall is to be applied (Source: JET)

Photo 4 The upper part of the slope is to be mortar-sprayed (Source: JET)

In February and March 2016, LMU studied the plan based on the basic principles mentioned just above and talked about it with JET. There, the two parties agreed as fundamental principles to apply shotcrete to the weathered rocks, construct crib walls in colluvial deposit slopes, and retaining walls in sites with plenty of space. Furthermore, considering the area's landform, a drainage facility was also added in the plan. The diagram below is the plan for the most dangerous location at the middle of the section.

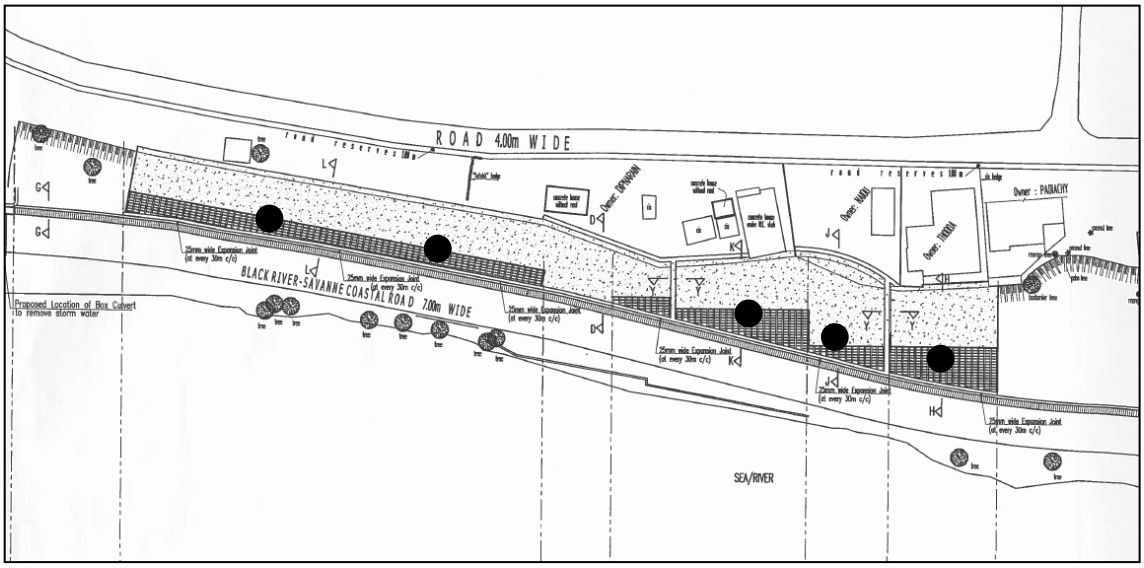


Figure 1 Diagram of the starting point of the countermeasure works (below: crib wall works, beneath: shotcrete works) (● in the diagram shows sites of drilling survey) (Source: JET)

In July 2016, JET and LMU made an inspection of the site before establishing the order for the implementation of planned slope countermeasure works. JET and LMU gave an explanation of the plan for several local contractors and determined where to conduct boring surveys as well as how deep these boring surveys should be.

Drilling surveys will be conducted at five locations where talus has deposited at the end of the slope. The basic depth for drilling surveys is five meters, however, the survey may be stopped if 1m bedrock (strong weathered rock) is confirmed. In addition, the standard penetration test (SPT) was determined to be conducted for each 1 m depth of each drilling survey.

Excavations for constructing gutters between the side of the road and the bottom of the slope are being carried out before implementing countermeasure works. As the slope behind the gutter excavation is unstable and small soil failures may occur. JET proposed the two following methods of construction, with which LMU and the local contractors agreed.

- Adoption of cast-in-place concrete:

  Cast-in-place concrete will be used instead of precast concrete to make the gutters. This implies shortening of the overall work time, decreasing the risk of possible slope failures from behind.

- Adoption of the span method (every 5 m):

  The width of the excavation to be done at one time was defined as less than 5 m. JET also proposed the span method, which consists of placing the gutter shortly after the excavation works are carried out.

Excavation for the foundations

Completed retaining wall at a place of possible slope failures

Photo 5 Site conditions on July 2016 (Source: JET)

In 26th September 2017, Mr. Annadach (MPI), Dr. Iwasaki (JET) and RDA has visited at site to confirm the result of the drilling surveys.

- ✓ The drilling core sample and the geological investigation report were confirmed by them.
- ✓ This slope consist of a basalt. It is a highly weathered rock, and had already become like a soils.
- ✓ An anchor pin length of the Crib work in the detailed design was 1,000mm, and it was confirmed that the contents of this detailed design were proper

Photo 5 Current situation of the site, Batelarge, and Confirmation of the drilling core sample and the geological investigation report (Source: JET)

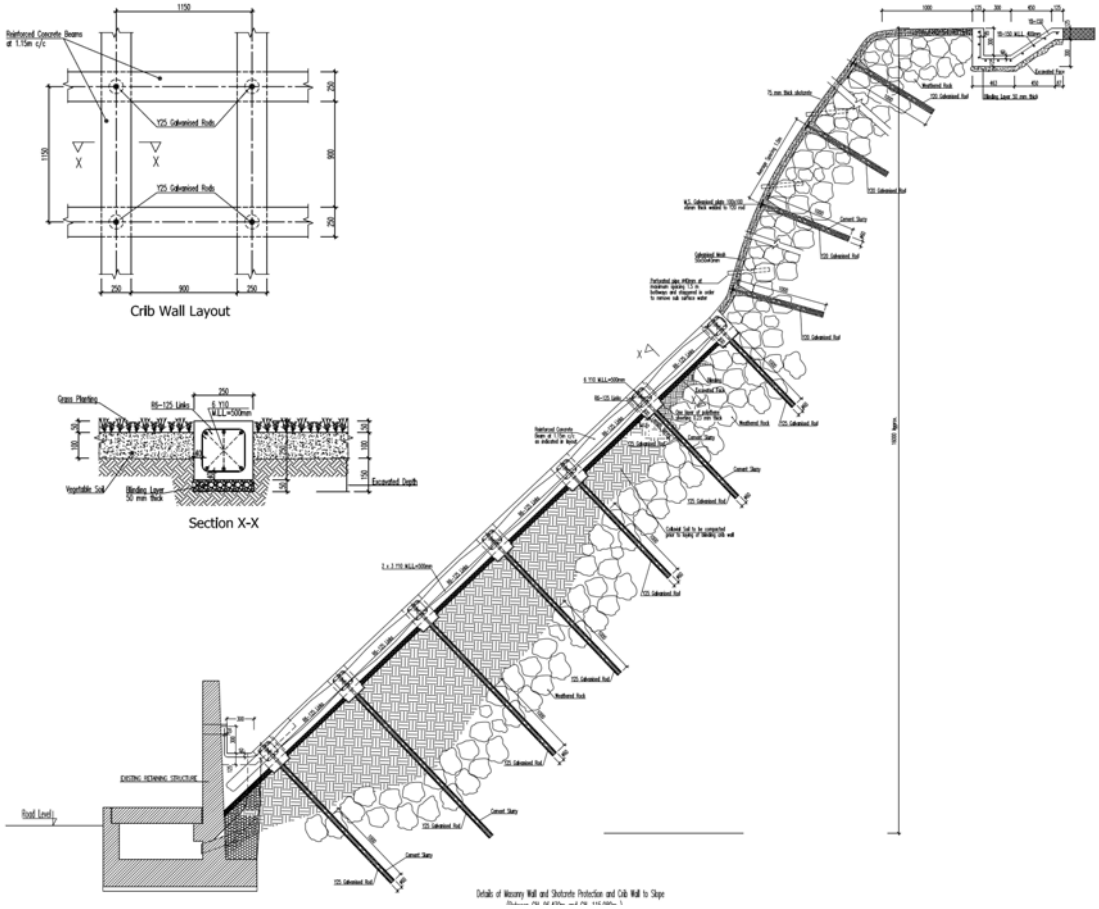


Figure 2 Detailed design of the countermeasure works (crib wall works, shotcrete works), Batelarge (Source: MPI)

b. Signal Mountain (rockfalls and debris flows countermeasures)

The road, where countermeasures are intended and is especially used by MoESD and the agency of communications, lies beside Signal Mountain (323 m high) in the south-western part of Port Louis City. The road is managed by MoESD. Although ordinary cars are prohibited to drive this road, pedestrians and joggers use the road on a daily basis. Cars of telecom companies regularly use it as well.

Rockfalls, subsidence of earth-filled road shoulders (here in after, road settlement), and debris flows have occurred in this area. The accidents happened in the interval between the points of 70 m and 300 m height, which extends to approximately 3 km. MoESD requested LMU to investigate the causes and make a countermeasure plan.

It was found that slopes that were likely to cause rockfalls were all along the road. Sites with road settlement were often found as well. Also, streams with possible risk of producing debris flows were conspicuous every 100 m to 200 m. Small waterways and a couple of badly constructed culverts were also observed.

JET classified the rockfalls into type A, B, C, and D and assumed countermeasure works for each type of rockfall.

Table 1 Rockfall types seen in the Signal Mountain Road (Source: JET)

Type	Topographic condition of road side slope and types of rockfall
A	Angle from 20 degree to 30 degree. Rolling stones
B	Angle from 30 degree to 40 degree. Bouncing and rolling stones
C	Angle over 40 degree and overhanging cliffs. Falling, bouncing and rolling stones
D	Cliff with a long distance to the road. Rockfalls

As the subject interval is 3 km long, it was decided that the surveys and countermeasure works will be carried out according to its urgency, as shown in the Table 3.2.6.

Table 2 State of emergency for survey and countermeasure works (Source: JET)

State of emergency	Damage and road condition	Survey and countermeasure works
A (Urgent)	Erosion of culvert, improper construction, risk of debris flow	Urgent survey and design of countermeasure works (culvert and drainage channel)
B (Moderate)	Rockfall, necessity of a new culvert, improper surface water management	Rockfall inventory, rockfall countermeasure works and new culvert construction, humps for diversion of surface water
C (Not urgent)	Settlement of shoulder slope, filling section, cracks on the road surface caused by improper construction	After section “A” and “B”

JET proposed to LMU the rockfall protection fence, which is the most effective countermeasure work and can be built along longer distances than any other countermeasure works. JET made Table 3.2.7 for LMU as a proposition. The plan for the rockfall protection fence in Type A (slope angle of 20-30 degrees with 1.5 m fence height) and Type B (slope angle of more than 30 degrees with 2 m fence height) was made according to this table.

Table 3 Rockfall fence index (Source: JET)

	Slop angle	Fence height	Intermediate post			End post		Spacer		High tensile cable		Galvanized fence	Foundation
			Material	Clearance	Embedded length	Material	Embedded length	Material	Clearance	Material	Interval	Material	
Type-A	θ >30	2.0m	H200*100*5.5*8	3.0m	1.0m	H175*175*7.5*11	1.0m	Plate 4.5t*65 *980	1.5m	3*7G/0 ϕ18 Ew=1.0*10^6N/mm^2 Tb=157kN Ty=118kN	300mm	ϕ3.2 50*50mm	0.5*0.5*1.0
Type-B	30> θ >20	1.5m	H200*100*5.5*8	3.0m	1.0m	H150*150*7.0*10	1.0m	Plate − 4.5t*65 *980 − 4.5t*65 *680	1.5m	3*7G/0 ϕ18 Ew=1.0*10^6N/mm^2 Tb=157kN Ty=118kN	300mm	ϕ3.2 50*50mm	0.5*0.5*1.0
Type-C	20> θ	1.0m	H200*100*5.5*8	3.0m	1.0m	H150*150*7.0*10	1.0m	Plate − 4.5t*65 *980	1.5m	3*7G/0 ϕ18 Ew=1.0*10^6N/mm^2 Tb=157kN Ty=118kN	300mm	ϕ3.2 50*50mm	0.5*0.5*1.0

Ew: Elastic coefficient
Tb: Breaking strength
Ty: Yield strength

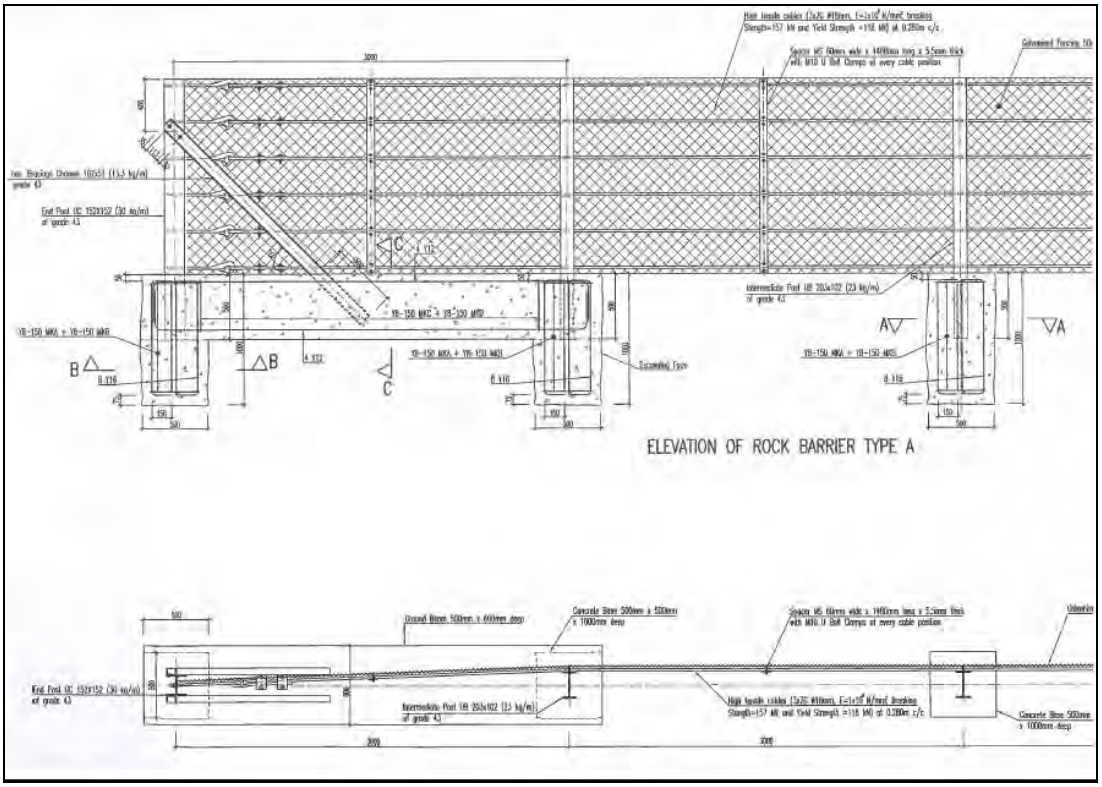


Figure 2 An example of rockfall protection fence planned by LMU (Type A, 1.5 m high) (Source: MPI)

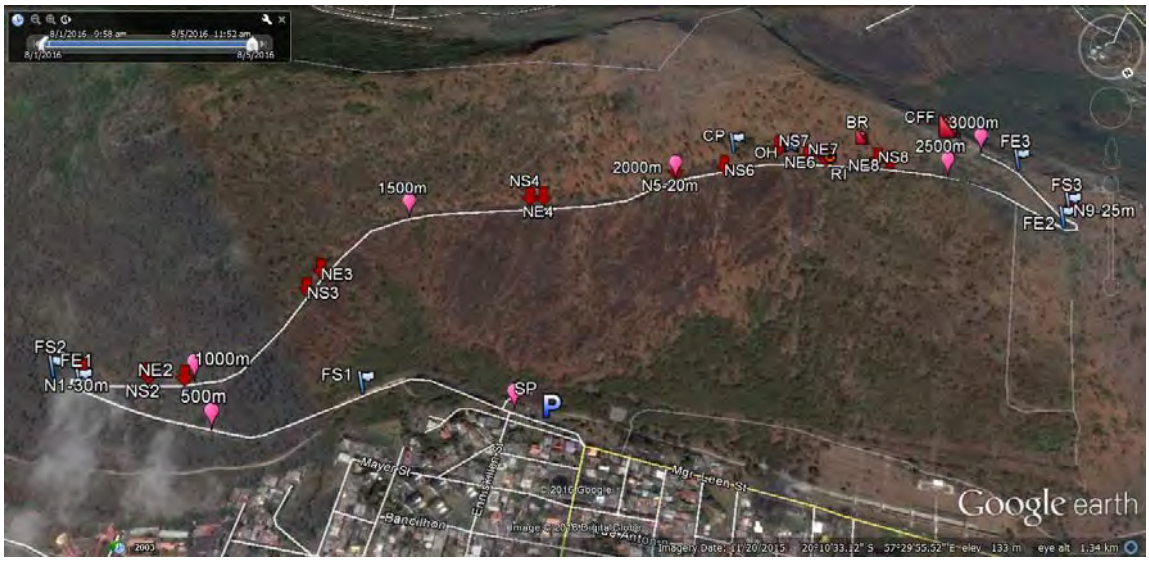


Figure 3 Port Louis City (upper right：northeast) and Signal Mountain (lower left：southwest) (Source: Google)

Photo 7 Panoramic view of the slope (from the starting point) (Source: JET)

Photo 8 Unstable rocks (Source: JET)

In July 2016, JET and LMU conducted a preparation survey in-between the interval of 2.0 km to 3.0 km (the ending point) of Signal Mountain. The aim of this operation was to make an inventory of rock falls.

The slope in the road at 2.7 km was determined as a model location of the survey, because the site was a typical example of a dangerous slope. There, unstable rocks with a diameter of more than 1 m were identified, their locations were measured by GPS, their sizes were measured and each one was marked with painting.

Whether the rock is to be removed or stabilised on the spot was decided as follows:

- ✓ A: Removal
- ✓ A': Stabilisation by concrete
- ✓ B: Stabilisation by net and/or bar

Photo 9 Specification of unstable rocks, evaluation, and numbering (Source: JET)

Site Name	Signal Mountain Road	Date	12, July, 2016
Inspector	MPI/LMU : Mr. Anadachee, Mr. Gobin / JET : Mr.Tsukamoto, Dr. Iwasaki, Mr. Sato		

Coordinate : S 20 10 30.0 , E 57 29 39.1

No.	Size of Rock [m]	GPS Coordinate	Photo
A1	1.2×0.8×0.4	S 20 10 30.5 E 57 29 39.0	
A2	1.2×0.8×0.4	S 20 10 30.4 E 57 29 39.0	
A'1	1.0×0.9×0.7	S 20 10 30.3 E 57 29 38.8	
A3	0.5×0.3×0.5	S 20 10 30.3 E 57 29 38.7	
A'2	1.5×1.5×1.0	S 20 10 30.2 E 57 29 38.8	

Figure 3 An example of the rockfall inventory (Upper left: survey location map, lower right: inventory) (Source: MPI)

In October 2016, instructions on how to carry out rockfall surveys and how to make rockfall inventories were given to the Special Mobile Force (SMF), which is to sign a contract for the rockfall survey For this, JET created a manual to conduct rockfall surveys. The contents of the manual are as follows:

- Survey location
- Classification
- Survey tools
- The rocks to investigate
- Way to make the rockfall inventory
- Contents of the rockfall inventory
- Safety of the survey
- Inventory format

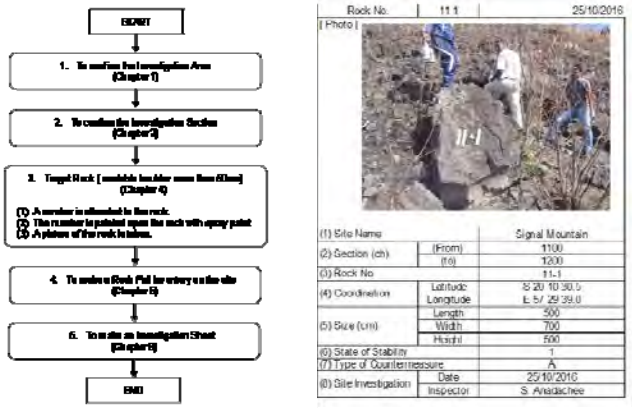


Figure 4 Rock fall inventory manual (Source: JET)

Participants in the training included: 15 members from SMF; 4 members from Group Intervention Police Mauritius; 1 member from LMU; and 2 members from JET. After LMU and JET explained the general purpose, every participant except four in charge of safety management and orientation were led to the slope. The participants were given explanations about the survey with a provisional Rockfall Inventory manual that JET had made especially for Mauritius.

Photo 10 Explanation session (Source: JET)

Photo11 Field work (Marking the rocks) (Source: JET)

The comprehensive protocol for measures against rockfalls, according to which works will be carried out, was already submitted to NDRRMC in September 2016. As a tentative safety measure for pedestrians, we requested NDRRMC to set hazard signs and information boards.

c. Maconde (rockfall countermeasures)

The measures against rockfalls in Maconde were one of the highest priorities for LMU. In July, 2016, JET and LMU made a field survey and devised a general course of action.

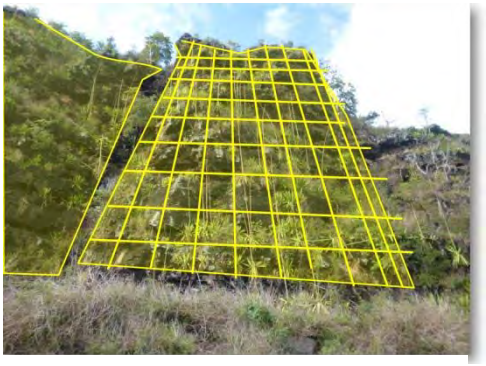


Photo 12 Tentative measure plan for Maconde (Source: JET)

Photo 13 Real instance of a rockfall net (Source: JET)

In October, 2016, LMU and JET discussed regarding the countermeasure works, preparation for order placement, and the order of process. Moreover, the existing survey plan report written by the Government of Mauritius and the cost estimate by a Japanese manufacturer for rockfall prevention nets were reviewed to assess cost efficiency. Thus, the Japanese rockfall prevention net was more cost-efficient; therefore, both parties agreed to use it from then on.

- WA・EA section：Plus net (Toff coated)
- Other sections：Chain link net (Toff coated)

Toff coating is a high dust-proof coating technology that Japanese rockfall prevention net manufacturers produce. The metallic net can be left without maintenance for more than twenty years even by the seashore. From now on, an approximate estimate construction costs and specifications for constructions are to be made based on the utilization of this metallic net.

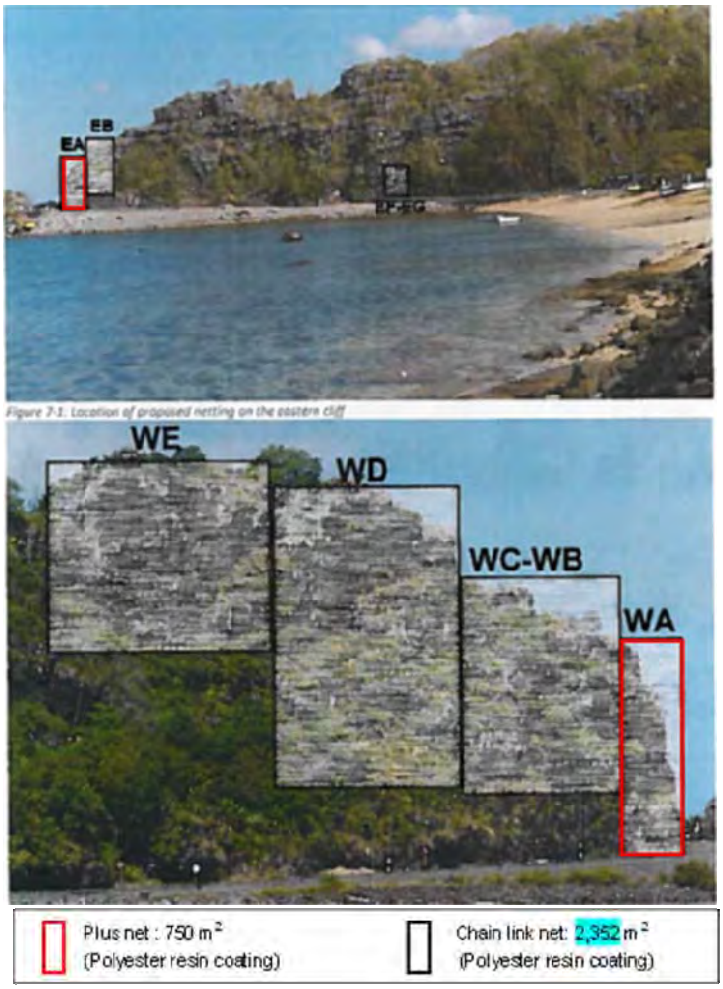


Photo 14 Scope of measurement and construction method in Maconde rockfall (Source: JET)

In November 2016, principles of countermeasure works and approximate construction costs were reviewed. As the site is located by the sea, there were concerns that the countermeasure works might be affected by the sea wind. LMU considered using Toff coating, a rockfall prevention net with salt-damage free resin coating made in Japan. The Japanese net is durable enough, even in a salty environment, for more than 40 years and has no need of maintenance for over 20 years. The proposition and cost estimate of TOKYO ROPE MFG. CO., LTD., a Japanese material manufacturer, was studied, and the effect and cost of the prevention net were considered. Making a conclusion was left to LMU to aim for an early notice for bidding.

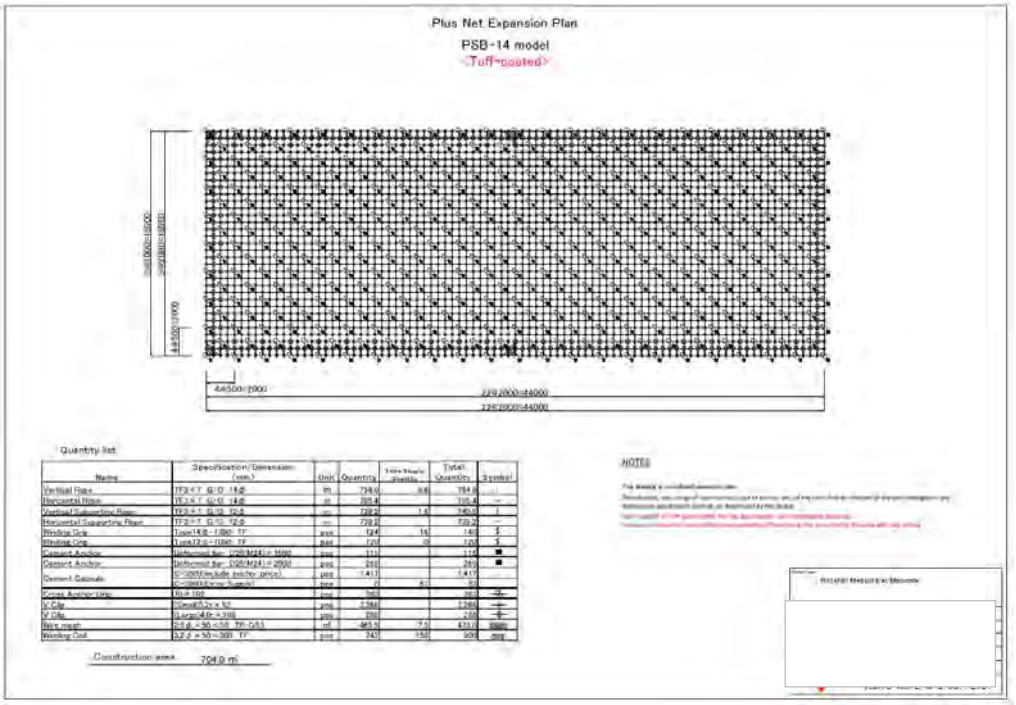


Figure 5 Image of a rockfall protection net in Maconde (Source: MPI)

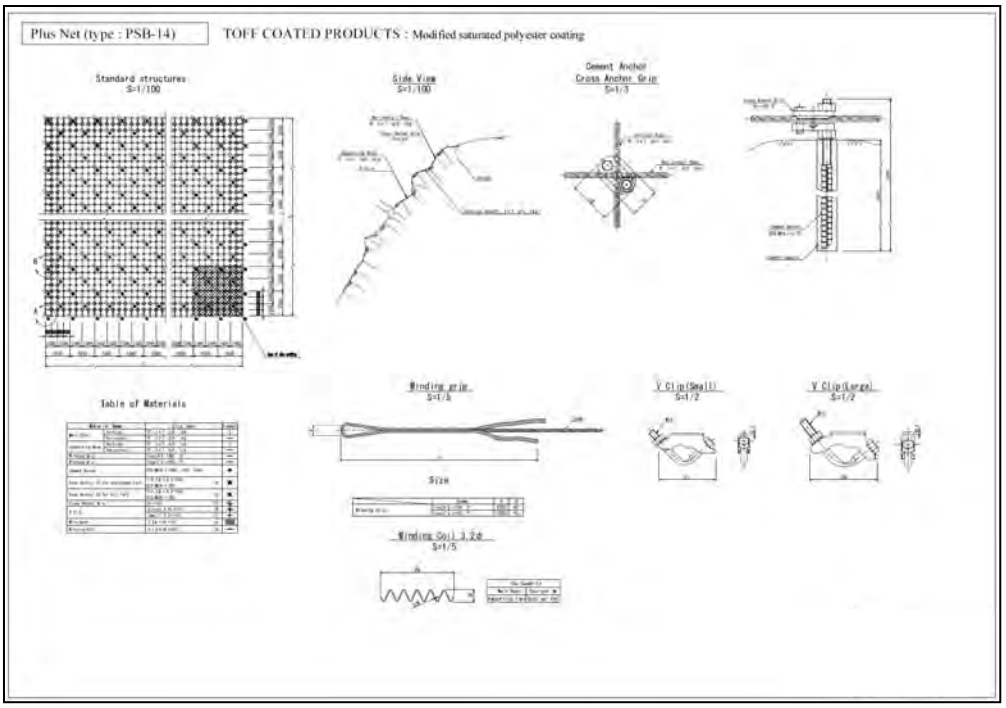


Figure 6 Rockfall protection net for Maconde (Source: MPI)

In 26th September 2017, Confirmation of the detailed design of the countermeasure for rockfall in Maconde by Mr. Annadach (MPI), Mr. Damonsin (MPI), RDA and Dr. Iwasaki (JET).

- ✓ All of the tip of the cape should be covered with a lock net.
- ✓ On the other hand, in the area (Safe zone) with the existing netting fence, the lock net is constructed only in the upper part of the cliff.
- ✓ About the area without safe zone, a road alignment is moved for 1 traffic lane by the sea side, and a safe zone is built newly.
- ✓ When a road is built newly in the sea area, as a high-wave countermeasure, the road surface should be built more highly than the present height approximately 2m.

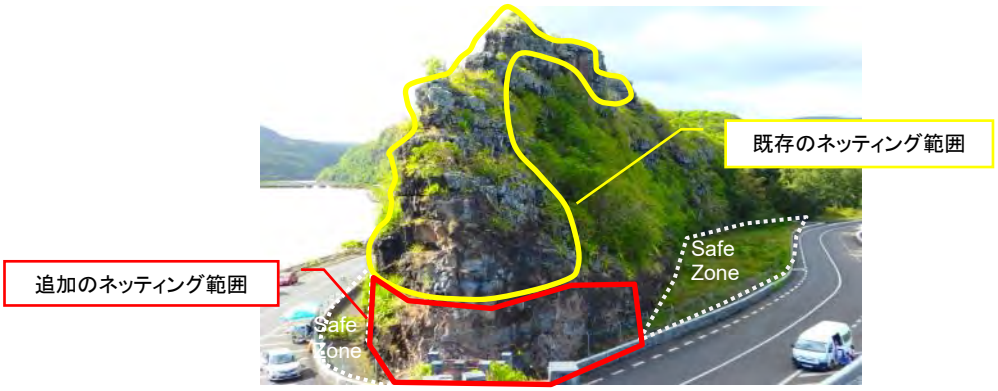


Figure 7 All of the tip of the cape should be covered with a lock net, Maconde

Figure 8 Relocation of a road alignment

d. Hermitage (slope failure and rockfall countermeasures

The target construction site of housing sits by a slope with a slope angle more than 11 degrees (gradient 20 %). The angle is in non-conformity with the PPG prescription. Slope failures and rockfalls could happen, and the moats of some nearby houses were in a dangerous state as well. After the Municipal Office issued a statement concerning the risk, the construction works have been stopped until October 2016.

The Municipal Office requested LMU to review countermeasure works. In October 2016, LMU explained to JET the survey results and countermeasure works plan.

While no measures inside the slope will be taken, concrete retaining walls, rockfall protection fences, and drainage facilities were planned for the protection of roads and houses below the slope.

JET approved the plan of LMU except for some small correction suggestions. From now on, LMU will submit the plan to the Municipal Office, after which the Municipal Office will make preparations for actual countermeasure works.

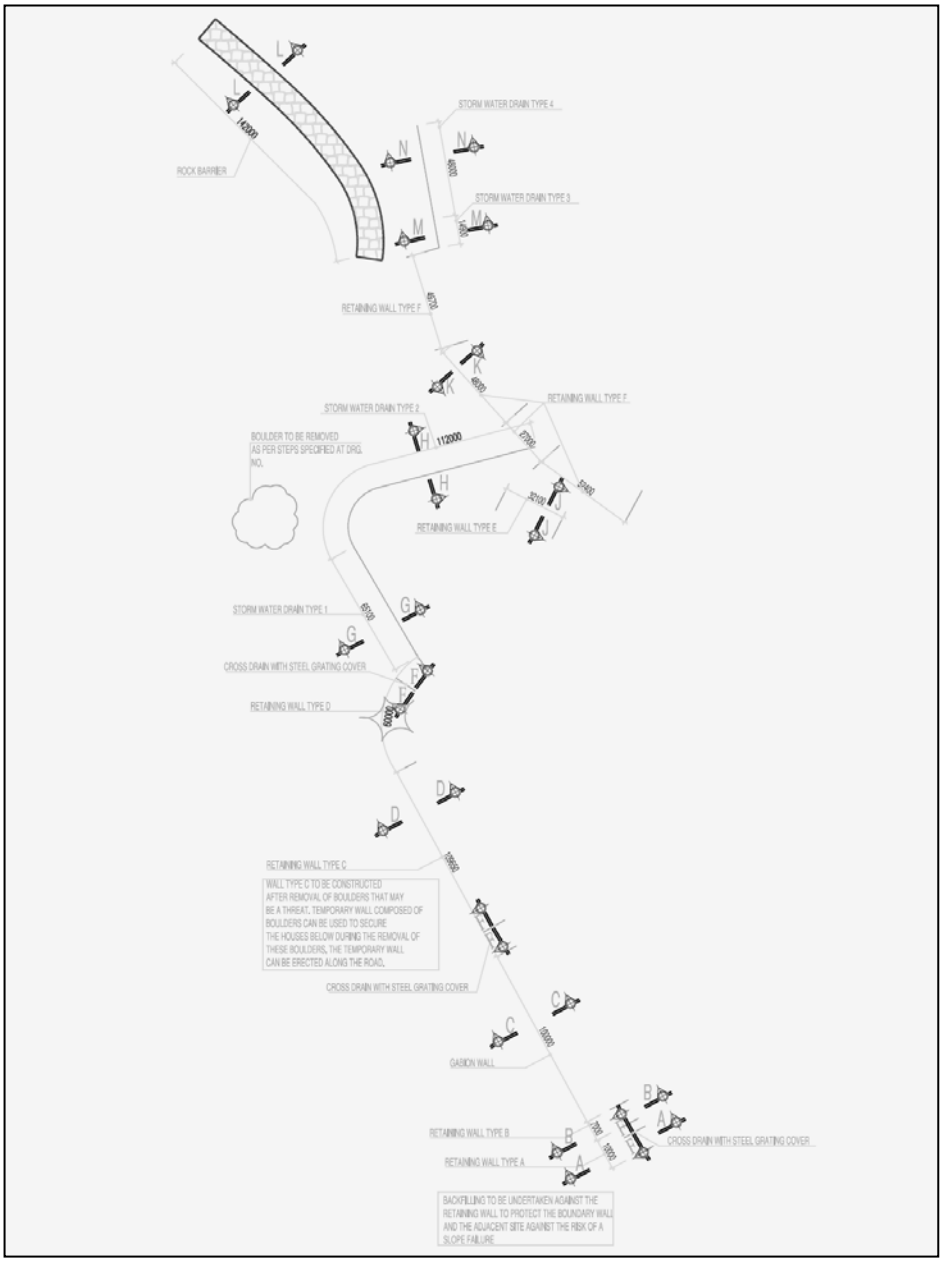


Figure 9 Tentative plan for Hermitage (slope failures and rockfalls) (Source: MPI)

Photo15 A view of the slope (Source: JET)

Photo 16 Field study (Source: JET)

e. Mount Ory (development on slope)

The subject slope is located on the M1 motorway between Port Louis and Phoenix. A colluvial deposit slope (talus) in its lower part was developed without official permission.

In June 2016, the District Council of Moka requested LMU to conduct an emergency survey of the spot. LMU asked JET to cooperate in the survey. PPG 9 prescribes that the permission for development is given only on the condition that the slope degree is below 11 or its gradient is below 20 %. In July, LMU and JET conducted a landform survey using a laser measurement device. The result showed the lower part of the slope had a lean of less than 11 degrees, and the upper part slightly over 11 degrees. The result was explained and the following process was proposed to the District Council of Moka.

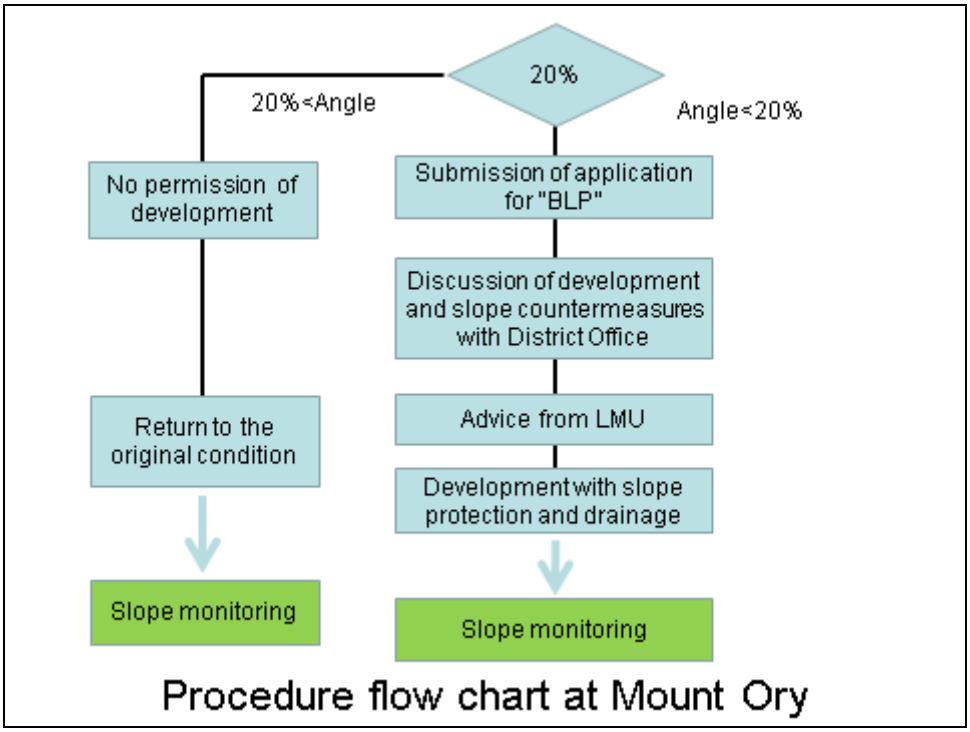


Figure10 Process flow depending on the type of slope (Source: JET)

In August 2016, LMU, with the assistance of JET, conducted a field survey and made the report.

The report was based on the previous field survey result. By defining the boundary of 20 % slope gradient, the report was intended to assist the District Council of Moka, in accordance with the PPG, in making the decision of whether or not to give developmental permission.

e.1.1 Clearing works, Terracing and Earthworks carried out on land at Mount Ory

With reference to the above subject, MPI/LMU conducted a site survey on 8 August 2016. The observations are as follows:

- Slope angle of the estimated original ground surface is 14.2 % at the lower part and 21.5 % on the mountain side.
- The steep mountain slope behind the site poses risk of steep slope failure and/or rock fall disaster.

Therefore, the recommendation of the PPG 9 should be followed.

Photo 17 Investigation spot. Part of the place is already under construction (Source: JET)

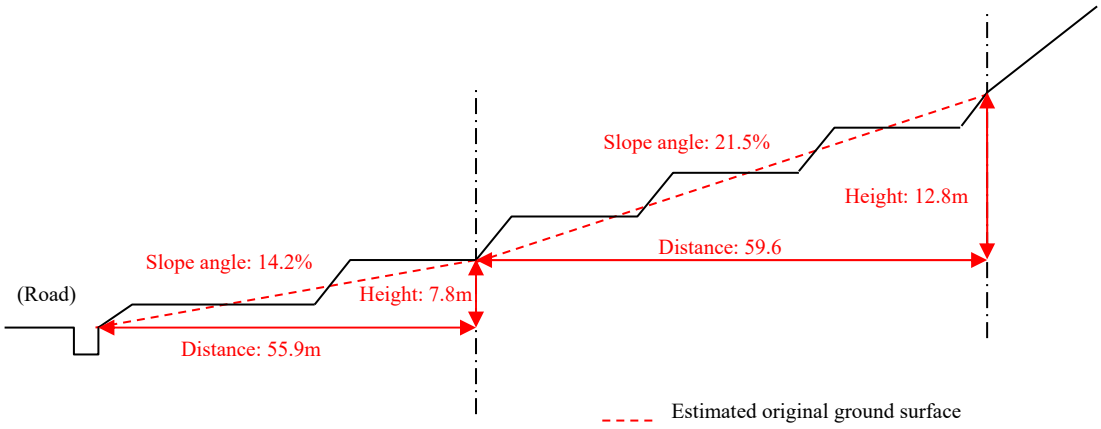


Figure 11 Cross-section of investigation location (Source: JET)

f. Mount Ory, Moka (development on slope)

The District Council of Moka requested MPI/LMU to do on-site investigation for the 'Application for the use of the slope'. In March 2016, JET along with LMU and the District Council of Moka carried out a field survey. The results are as follows:

- Presumed angle at the foot of this slope will be more than 20 %.
- A landslide might happen on the valley side of the slope (approximately 30 m length, 20 m width, 5 m depth)
- There is an almost vertical slope very close to the target land, which is also likely to cause rockfalls.
- In conclusion, development in this land is not safe.

Photo 18 The investigation spot in Mount Ory Moka (Source: JET)

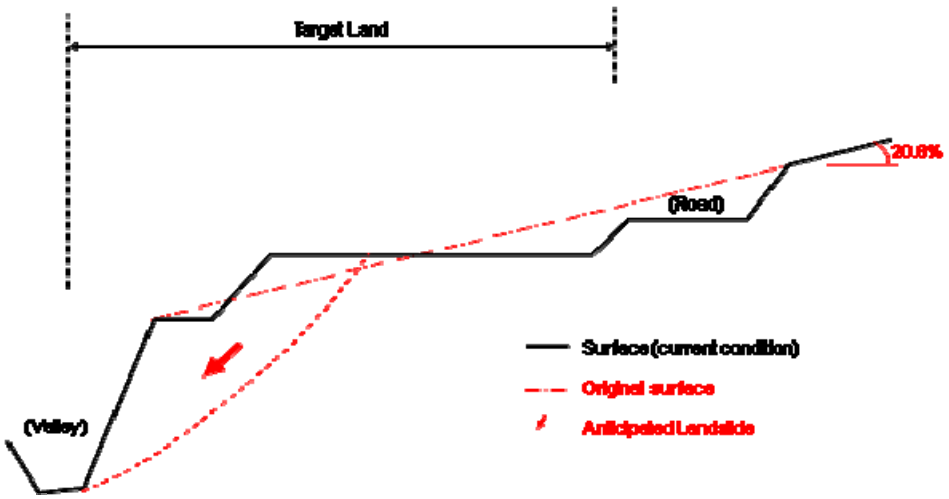


Figure 11 Cross sectional diagram of the investigation spot (Source: JET)

g. Ruisseau Creole (rockfall countermeasure)

The subject slope is facing the southern coast. Behind the nearby houses there are woods and sugar cane fields. Also, there were several huge boulders with a diameter of less than one meter on the premises of those houses. These rocks were pyroclastic rocks or solidified molten lava. Some of them were originally lying there and others were dumped from the sugar cane field into the backyard.

As this location was requested by the District Office of Savanne to be investigated in February 2016, LMU and JET carried out a joint survey in May. After that, the following principles were determined:

- Removal of unstable rocks. Bigger ones should be broken into small pieces beforehand.
- Unmovable rocks should be fixed or netted on the spot.
- A house upon the hill might need to be relocated.
- Unnecessary removal of trees must be refrained.

In July 2016, LMU and JET performed a measurement survey together. Under the supervision of JET, unstable rocks were identified and each rock was measured for countermeasure consideration. Approximately thirty rocks were coloured as follows:

- Red spray: removal
- Blue spray: stabilisation

Some of the rocks were carried away as they were, while others were so big that they had to be broken into smaller pieces before being removed out of the site. When the rocks were dropped down, due attention was paid to the houses below.

To fix and stabilise unstable rocks, reinforced concrete foundation will be used. When foundation space is hard to secure, such rocks will be covered with rockfall prevention nets.

LMU will continue studying appropriate types of countermeasure works in accordance with the survey results.

Photo 19 Consideration of measures (blue spray: stabilisation) (Source: JET)

Photo 20 Consideration of measures (red spray: removal) (Source: JET)

h. Camp Garreau, Flacq (slope failure countermeasure)

Two houses in Camp Garreau, Flacq, had a scarp with a slope failure behind them. A resident living there called the local government, MoESD, and consequently, the local government requested LMU to perform a survey. LMU and JET visited the site in August 2016, and studied the measures to be applied.

The survey result suggested the failure was triggered by surface erosion caused by the river, domestic wastewater drainage and rainwater. LMU is planning to lead the District Council and MoESD for the following measures.

h.1 Survey result by LMU and JET

- A river behind the houses scraped the lower part of the scarp, causing the surface failure.
- Domestic wastewater drainage from the nearby houses and rainwater were also the cause of surface erosion.
- Though the two houses are obviously exposed to slope failure risk, the cost of countermeasure works are likely to be expensive. Therefore, MPI and LMU recommended the relocation of those houses from the target area.

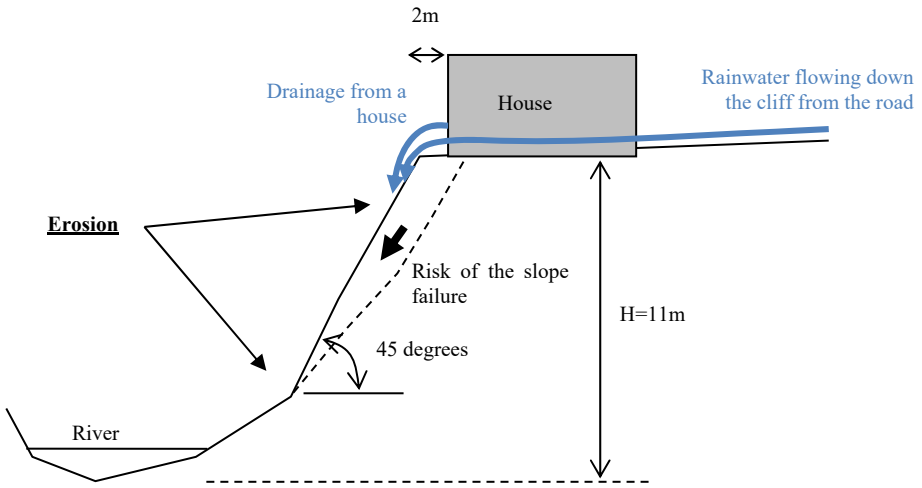


Figure 12 Cross-section of the investigation spot. Houses sit near the scarp (Source: JET)

Photo 21 The investigation spot. Two houses sit near the scarp (Source: JET)

Photo 22 Domestic wastewater drainage, a likely cause of scarp erosion (Source: JET)

i. Kewal Nagar Belle Rive (river erosion and slope failure countermeasure)

JET has performed on-site investigation of this location twice in January 2016, and with these two survey results, more detailed plans for countermeasure works were designed this time.

LMU and JET proposed the principles for the next measures and gave advice about what survey items are needed to be carried for the construction of countermeasure works.

- Considering the performability of the measures at the site, technical standards, and availability of the necessary materials, LMU decided to mainly employ Gabions to prevent erosion.

- LMU explained the detailed structure of Gabions that are normally used in Japan to plan countermeasure works.

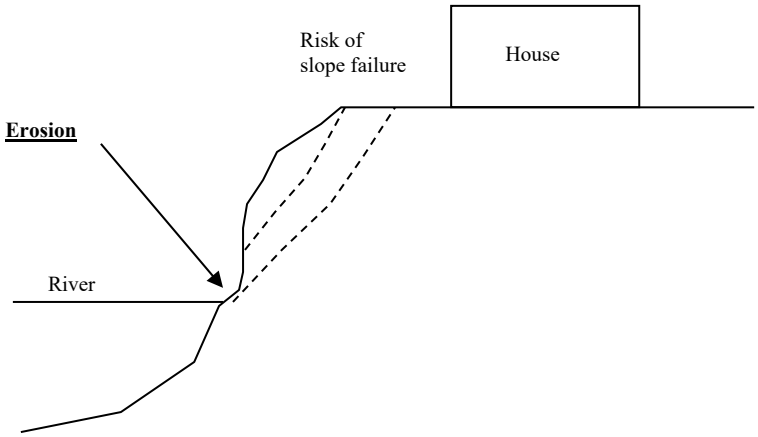


Figure13 Cross-section of the investigation site with a house sitting next to the scarp (Source: JET)

Photo 23 Current condition of the slope failure site (Source: JET)

In March 2016, another field survey was performed to review again the countermeasure works that LMU had planned. Though LMU had planned to construct the structure of the countermeasure works from the mean river water level, JET proposed that it will be sufficient to construct from the middle of the slope, judging from the status of the ground, grade of erosion, and speed of the river flow. JET advised that individual measures are needed to be taken for the locations with risk of causing small failures.

According to JET's advice, LMU added minor corrections to their countermeasure works plan. The revised fundamental plan for the countermeasure works was changed as follows:

- Leaf trees, especially bamboo that grows naturally, are advisable

- Robust slope protection measures against river erosion must be constructed in areas beneath the middle of the river bank.

- Foundation cannot be placed on the border just above the water line. It should be placed in the middle of the river bank. In order to do that, weathered rocks should be scraped away.

- During the construction of the countermeasure works, thick bushes should not be harmed.

- Continuous instruction should be given to residents concerning domestic wastewater drainage.

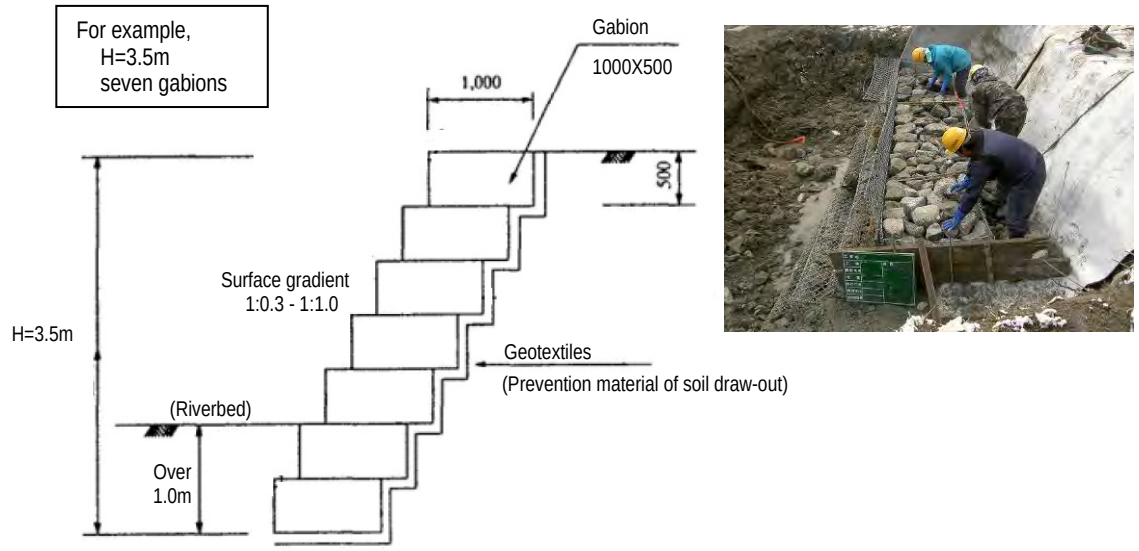


Figure 14 Example of gabion according to a Japanese standard (Source: JET)

j. Coromandel (Rockfall countermeasure)

In March 2016, LMU requested JET to carry out a field survey of a steep slope in the Coromandel region. The situation was described below.

- Following a land owner's submission of an application to build a house to the District office, LMU was asked to carry out a survey as the subject location was beside a steep slope.
- The plot has a steep slope of more than 30 degrees in gradient. The house was supposed to be built on a flat part of the land. (Figure 3.2.17).
- There were a lot of unstable rocks on the slope which were likely to fall. (Photo 3.2.32).
- When it rains, rainwater comes down from the road located above the plot.

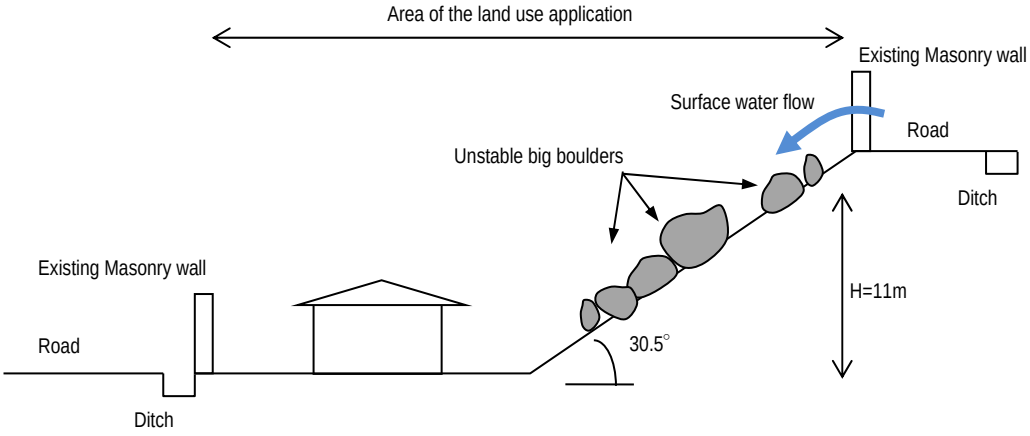


Figure 15 Cross-section of the site (Source: JET)

Photo 24 Unstable boulders on the steep slope (Source: JET)

After the survey, LMU and JET recommended the measures written below:

- Removal of the stones: all the unstable rocks on the slope are recommended to be removed or rolled down the slope.
- Retaining wall: a retaining wall with rockfall pockets is recommended to be placed.
- Drainage: a drain is recommended to be installed.
- No slope excavations or drillings are recommended to be carried out.

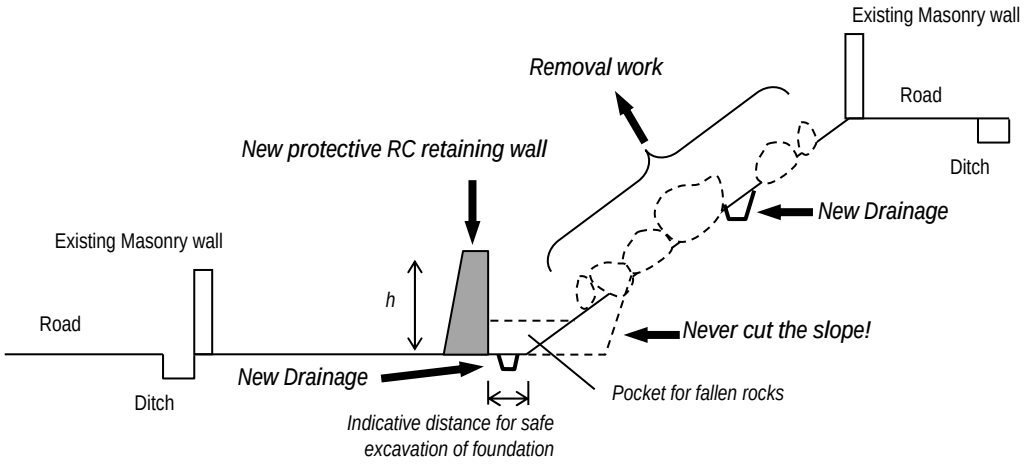


Figure 16 Cross section of the recommendation for countermeasure works (Source: JET)

k. Pilot Bel Air (cut slope failure countermeasure)

Following a field survey in February 2016 and a discussion and Technical meeting in March, the following measures were chosen. MPI staff explained measures two, three and four to the concerned residents.

- As the slope is inside a private plot of land, MPI cannot carry out countermeasure works.
- Advise residents living above the slope to cut down unstable trees so that they do not swing down due to the wind.
- Advise residents living above the slope to cover their plot with stones or lawn to prevent surface soil failure.
- Water should not be drained towards the slope as it is done currently.

Photo 25 Cut-earth slope failure (Source: JET)

l. Vallée Pitot (filled-land failure)

In February 2016, LMU and JET conducted a field survey. Damage was observed in nearby houses caused by inundation, failure of a retaining wall on the filled land, and road cave-in.

The reasons were a flash flood that flowed from the slope into the backside of the house, and the earth pressure produced by a flawed earth-filled road that pushed out a simple concrete retaining wall of a mosque that is located down the slope. The main cause was a defect in the drainage facility and the weakness of the retaining wall.

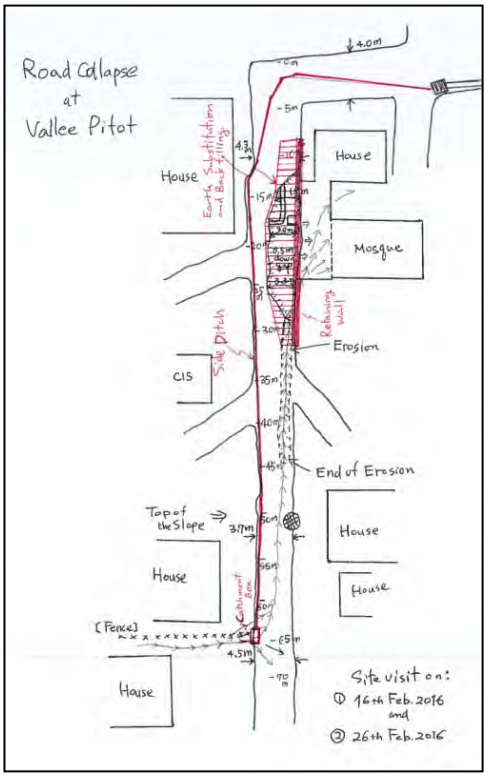
Following the discussion in February 2016, JET and LMU performed a plain land measurement, studying the damage area, and the scope of countermeasure works. The countermeasure works chosen to be carried out were as follows:

- (Upper part) drainage in the house below the slope.
- Water catchment basin.
- Drainage (mountain side of the road).
- Concrete retaining wall (LMU one structure. Masonry retaining wall was also proposed for its easiness to construct).
- Reinforced earth-fill and its drainage.

In addition, both parties recognised the importance of managing water of the slopes as a general issue in the whole Vallée Pitot region. Therefore, hydrographic surveying of the entire slope, including catchment basin and drainages areas, and the planning of the entire waterway system are needed and are recognised as long-term challenges.

Photo 26 Failure of earth-filled road (Source: JET)

Photo 27 Failure of the concrete retaining wall of the mosque located down the slope (Source: JET)



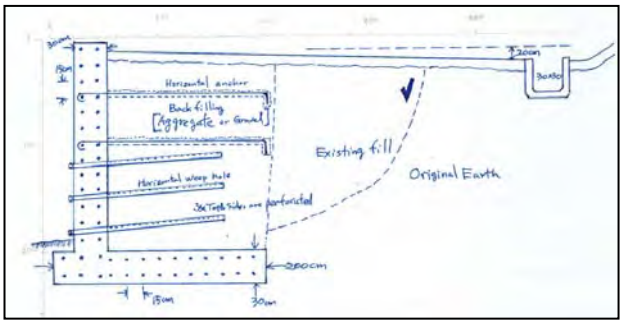


Figure 17 Sketch of the disaster location and planned countermeasure works (Source: JET)

m. Long Mountain (bank slope failure behind house)

MoESD requested LMU to perform a survey on a location where damage to housing occurred. LMU and JET conducted the survey on 8 July 2016. The subject slope failure happened due to foundation washout caused by river bank erosion in the lower part of the house. As a result of the survey carried out by LMU and JET, it was concluded that the damage was minimal and it was happening in a narrow area. Therefore, reinforcement of the foundation will be sufficient as a measure. LMU will hand out a report on this case to MoESD.

Photo 28 Slope behind the house (Source: JET)

Photo 29 Part of the concrete below the foundation was scraped (Source: JET)

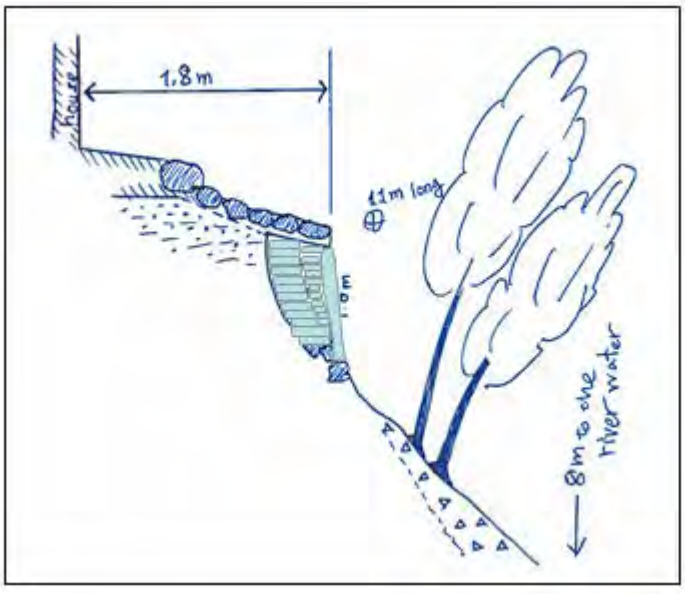


Figure 18 Slope failure at Long Mountain (Form a platform and utilize stones and a concrete retaining wall) (Source: JET)

Appendix 3.2.7

Support for preparing the materials for inspection, countermeasures and public awareness materials by MPI

Support for preparing the materials for inspection, countermeasures and public awareness materials by MPI

Using manual, JET shall support the MPI in preparing the materials, organising the existing materials of the MPI, etc., to disseminate the information and knowledge regarding the countermeasures for slope failures, rockfalls and debris flows to the local residents and relevant organisations.

a. Support for creating the document of Signal Mountain Road rockfalls

a.1 NDRRMC's meeting about Signal Mountain Road slope failures

a.1.1 Objectives

Traffic issues may occur in the subject road as there is risk of rockfall disasters and culvert collapses. NDRRMC served as chairperson at the meeting in which MoESD, the road manager; MPI, an investigational institute of rockfalls; SMF, in charge of guarding the road; and the Municipal Council of Port Louis, have attended. The aim of the meeting was to discuss appropriate countermeasures for the potential disasters of this road.

- Date：10 to 11 AM, 11 July 2016
- Place：Headquarters of NDRRMC
- Attendant： Mr. Servansing from Director General of NDRRMC; staff from NDRRMC, staff from MPI/LMU, staff from Municipal Council of Port Louis, and Mr. Tsukamoto from JET.
- Topic for discussion:

  - Mr. Servansing from DG of NDRRMC moderated the meeting. The topic for discussion was the rockfalls at Signal Mountain Road. MPI explained the rockfalls situations, slope risks, culvert collapses, and the structural measures under consideration. As non-structures measures that can be taken, NDRRMC proposed notifying road users of the risk and establishing a contact network in case of emergency. NDRRMC also proposed the following measures to be taken in the future.

  - Measurement and survey: aerial photos taken by planes and drones, elaboration of a large-scale map, and rockfall surveys.

  - Non-Structural Measures: Notification to pedestrians by displaying danger signs.

  - Structural measures: LMU to conduct a survey.

  - LMU is going to make a protocol of the measures on the subjects above. LMU has requested the support of JET to make the documents of the protocol.

Photo 1 NDRRMC's meeting about Signal Mountain Road slope failure (Source: JET)

a.2 Support for planning the protocol about measures against rockfalls

The protocol against rockfalls was made as an urgent measure was needed before the rainy season between November 2016 and March 2017. The outline of the protocol was first made in 26 July 2016. MPI/LMU and JET held a meeting to discuss and formulate the protocol. Its outline is as follows.

<Non-structural measures>

- Road chainage setting

  - Currently, chainages are placed every 500 meters along the subject road. Additionally, distance signs are to be drawn with chalk every 50 meters.

Photo 2 Existing chainage (Source: JET)

Photo 3 Drawing additional distance signs on the road (Source: JET)

- Rockfall signs and posts

  - The locations of where to set signs and posts warning of rockfalls were decided. Rockfall signs are basically set every 500 m, and posts are set at the start and the end

of the road.

- Written warning can be added to the posts, such as “Caution Rockfalls”, “Do not walk along the edge of the road”, or “Closed during rain”
- Rockfall sign posts at the start and the end of the road.
- As well as indicating dangerous places in a map, should show method and place to evacuate emergency contact number

Photo 4 Examples of rockfall signs (left: Mauritius, right: Japan) (Source: JET)

As emergent non-structural measures, it was determined that the placement of information board and rock fall warning sign precede any other measures would be prioritised. Following is its sentences.

ROCK FALL NOTICE

- Risk of rockfalls exist
- Rockfalls are unpredictable and may occur at any time
- Entrance is prohibited when there is wild fire, reported anomalies, strong wind and/or the Mauritius Meteorological Service forecasts heavy rainfall in this region
- Do not stop beneath the cut slopes
- Do not climb the mountain slopes
- If you observe any anomalies, such as rockfalls, subsidence of the ground and slope failures, please kindly inform NDRRMC… (hotline to be prepared)
- Consider the risks before using this track

Figure 1 Tentative contents of the rockfall information board (Source JET)

Photo 5 Planned place for the installation of an information board (starting point) (Source: JET)

- Establishing Emergency Warning System
  - Time setting for warning and evacuation depending on the amount of rain
  - Formulating a concrete warning and evacuation plan. Access will be prohibited for the time being.
- Regular check
  - Everyday check for rockfalls
- Survey for rockfall inventory
  - Perform a field survey to make a rockfall inventory. Structural measures or fixture of unstable rocks are considered based on the survey results
- Drafting a detailed landform map
  - A rockfall hazard map and a large-scale landform map should be made, according to the result of the rockfall inventory, in order to plan countermeasure works.

＜Structural measures＞

- Planning of structural measures
  - Preliminary measurement and survey
  - General planning and cost estimation
  - Detailed planning and precise cost estimation
  - Budgetary provision
- Implementation of structural countermeasure works
  - Bid announcement and bidding
  - Implementation of this year’s urgent countermeasure works

- Implementation of remaining urgent countermeasure works

＜Main location of structural measures＞

➢ Checking drainage facilities

- JET examined the existing surface drainage facilities (Box Culverts) for any damage, and considered the necessity of reparation or installation of new facilities.

Photo 6 An example of a damaged drainage (Source: JET)

Photo 7 An example of an intact drainage (Source: JET)

➢ Examining places that need rockfall protection nets and fences

- JET examined some locations for the placement of rockfall protection nets and fences.

Photo 8 Planned location for a rockfall protection net on the side of the mountain (Source: JET)

Photo 9 Planned location for a rockfall protection net at the top of the hill (Source: JET)

b. Maconde: Support for drafting documents on measures against rockfalls

JET supported the drafting of the protocol on structural measures against rockfalls in the Maconde region. The general plan JET made with a Japanese company is as follows.

Design Plan of the Netting, "Plus Net" provided by TOKYO ROPE MFG. Co., Ltd., at Maconde

1. Design Plan of the Netting for Rock Fall

- ✓ The design plan is prepared for a high-priority area, top part of the peninsula.
- ✓ Because there is the safe space for roads in the west side area, the net as the countermeasure covers east side area and the tip of the peninsula.
- ✓ The unstable rocks on the top of the peninsula are very big, and strength of the general steel net is not enough to hold the rocks. The countermeasure by the rope-net type such as "Plus Net" is effective for this site.

Figure 1. Area of the Netting, East Side

Figure 2. Area of the Netting, West Side & Tip of the Peninsula

- ✓ In the construction, a part of the net is cut, and it is installed in the tip of the peninsula.

Figure 3. Construction image of the netting

2. Cost Estimation

The details of the estimate are shown in the attached sheet;

- ✓ High-priority area : 704 m^2 >>> 226,460 USD (≒ \$322/m^2)
- ✓ All area : 3100 m^2 >>> 998,200 USD (= \$322/m^2 × 3100 m^2)
- ✓ Training in Japan >>> 582,705 MUR (2 parsons, 8days)

Figure 4. All Area of the Countermeasures

Figure 2 Plan against rockfalls in Maconde region (Source: JET)

c. Batelage: Support for drafting documents on measures against road cut slopes

JET, LMU and RDA performed a field survey together on the situation of road slopes, cut slope failures, and drainage from houses above the scarp. As a result of the survey, JET suggested the principles for countermeasure works, based on which LMU considered a draft countermeasure works plan and elaborated design drawings.

The principles for selecting countermeasure works are as follows:

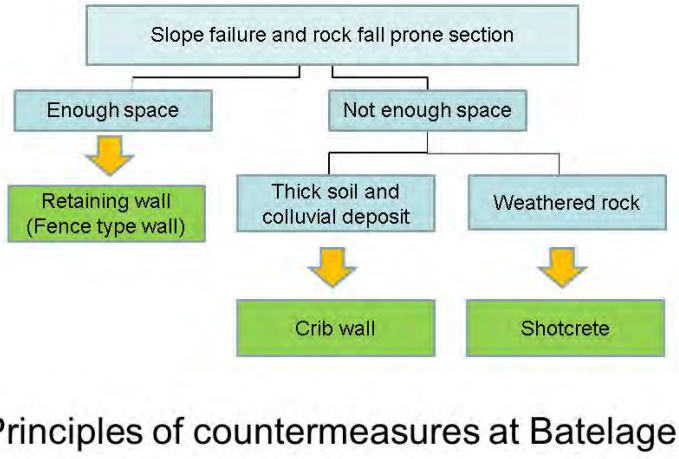


Figure 3 Principles of countermeasures at Batelage (Source: JET)

- To begin with, cut down unstable trees, put the unstable slope in order, and remove unstable rocks.
- Apply crib wall to weathered or colluvial deposit slopes where the slope is close to the edge of the road.
- Strengthen the weathered part of the rock slope by soil nailing, rock bolts and shotcrete on the upper part of the slope
- Construct concrete retaining walls (1.2 m height, without rockfall protection fence) for the sections with sufficient space between the road and the slope.
- Build gutters where rainwater drainage from houses above the slope is causing problems. Drain rainwater and sewage towards the opposite side of the slope.
- Explain to residents about the partial removal of houses located above the slope within the countermeasure construction area.

Photo 10 An example of a crib wall in Japan (Source: JET)

JET and LMU cooperated to plan the countermeasure works against cut slopes. The cooperation between JET and LMU continues in the actual construction stage, giving advice to RDA.

Appendix 3.3.1

Current monitoring system

Current monitoring system

In the Previous Project, landslide monitoring has been implemented at three sites, Chitrakoot, Vallée Pitot and Quatre Soeurs, and the MPI started monitoring the landslides at several sites additionally. Subsequently, JET and C/P have confirmed the current situation of landslide monitoring and the monitoring system.

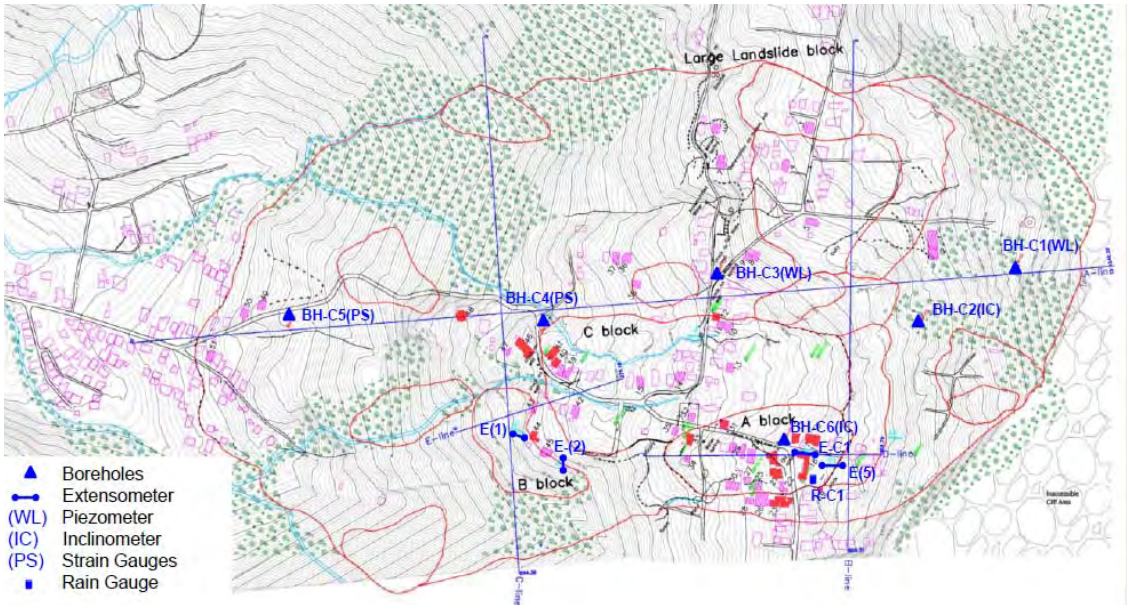
Landslide monitoring is currently carried out by MPI in three sites, Chitrakoot, Vallée Pitot, and Quatre Soeurs. In addition, landslide monitoring with extensometers in La Butte and Vallée pitot was installed in 2015. The measurement items installed in each site and the condition of the monitoring equipment are shown below.

Table 1 Measurement items and the condition of the monitoring equipment (Source: JET)

Site name	Monitorind equipment	Manegement No.	Current condition
Chitrakoot	Piezometer	BH-C1	Not measuring (breakdown of Equipment)
	Inclinometer	BH-C2	Continuous measurement
	Piezometer	BH-C3	
	Strain Gauges	BH-C4	
	Strain Gauges	BH-C5	
	Inclinometer	BH-C6	Not measuring (breakdown of Equipment)
	Piezometer	BH-11	Continuous measurement
	Extensometer	E-C1	
	Extensometer	E-1	
	Extensometer	E-2	
	Extensometer	E-5	
	Rain Gauge	R-C1	
Quatre Soeurs	Strain Gauges	BH-Q1	Not measuring (The relocation of all houses is planned as a landslide countermeasure)
	Strain Gauges	BH-Q2	
	Piezometer	BH-5	
	Extensometer (laser)	E-Q1	
	Extensometer (laser)	E-Q2	
	Rain Gauge	R-Q1	Continuous measurement
Vallée Pitot	Extensometer	E-V1	Continuous measurement
	Extensometer	E-V2	

Table 2 Measurement items and the condition of the additional monitoring equipment installed by MPI, 2015 (Source: JET)

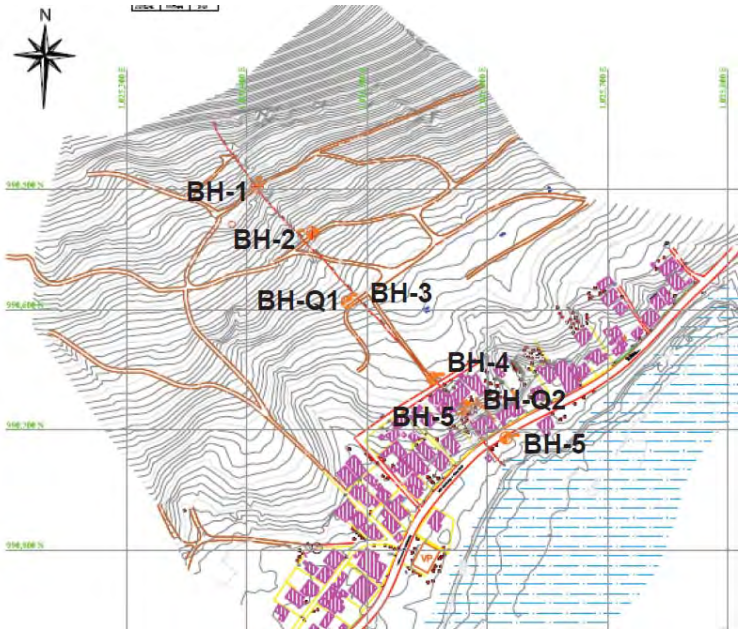
Site name	Monitorind equipment	Manegement No.	Current condition
Vallée Pitot	Extensometer	E-V3	Continuous measurement
	Piezometer	BV-1	Continuous measurement
	Piezometer	BV-2	Continuous measurement
		BV-3	Continuous measurement
	Extensometer	E-V2	Continuous measurement
La Butte	Extensometer	E-B1	Continuous measurement
	Extensometer	E-B2	Continuous measurement



Boreholes	Piezometer	BH-C1
	Inclinometer	BH-C2
	Piezometer	BH-C3
	Strain Gauges	BH-C4
	Strain Gauges	BH-C5
	Inclinometer	BH-C6

Extensometer	E-C1
Extensometer	E-1
Extensometer	E-2
Extensometer	E-5
Rain Gauge	R-C1

Figure 1 Location map of the monitoring equipment - Chitrakoot (Source: JET)

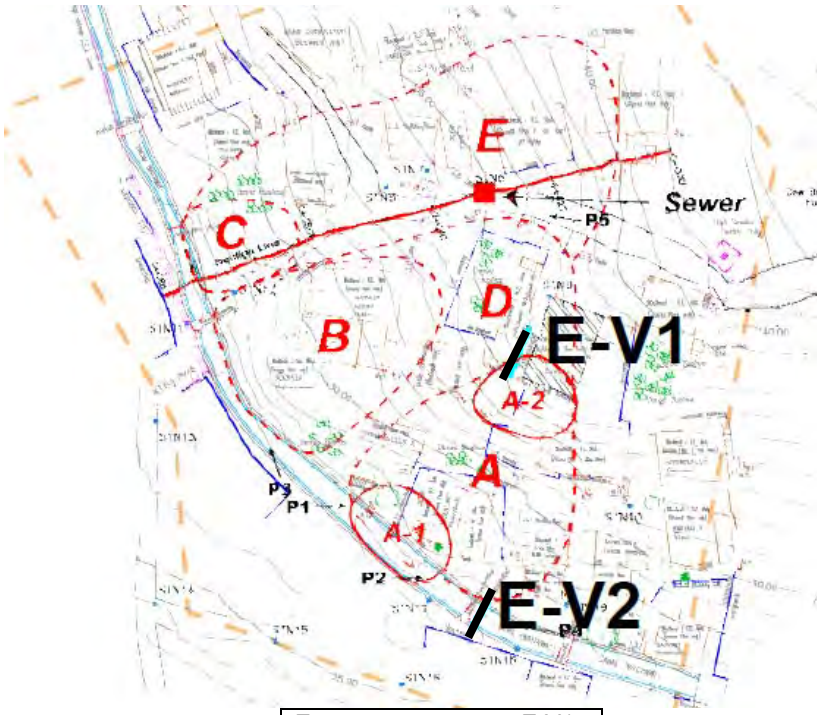


Boreholes	Strain Gauges	BH-Q1
	Strain Gauges	BH-Q2
	Piezometer	BH-5 (existing)
	Groundwater level	BH-2 (existing)
	Groundwater level	BH-3 (existing)
	Groundwater level	BH-4 (existing)

Extensometer (laser)	E-Q1
Extensometer (laser)	E-Q2
Rain Gauge	R-Q1

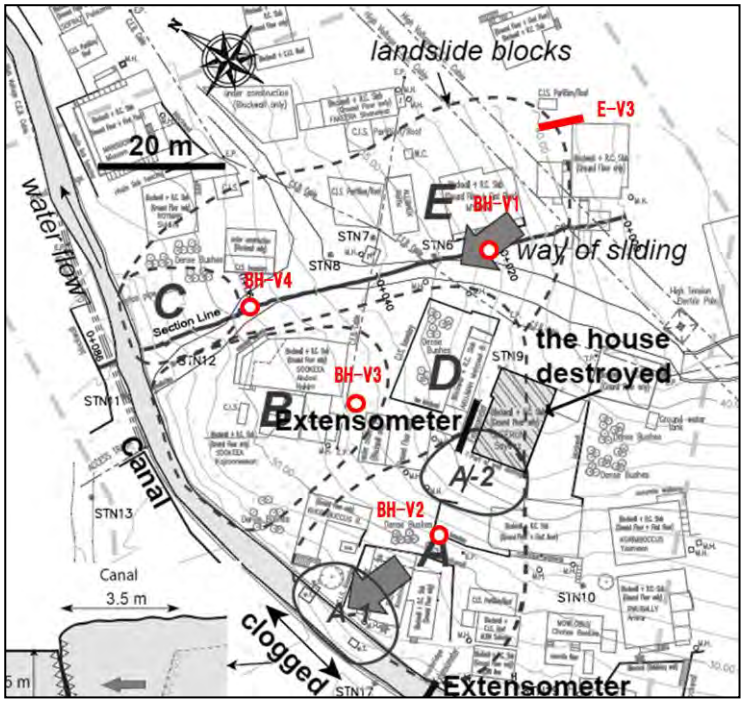
- *One rain gauge is installed out of the map*

Figure 2 Location map of the monitoring equipment - Quatre Soeurs (Source: JET)



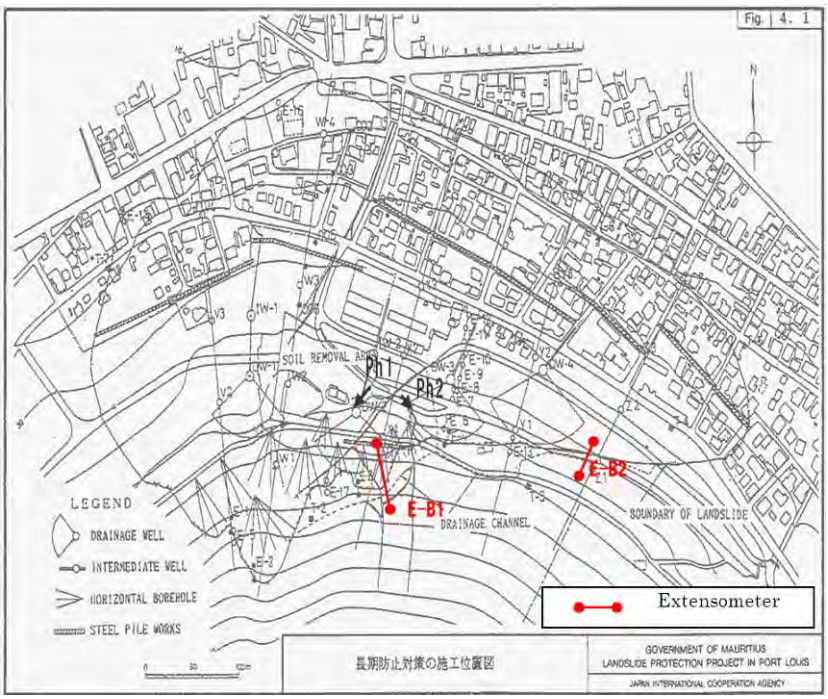
Extensometer	E-V1
Extensometer	E-V2

Figure 3 Location map of the monitoring equipment - Vallée Pitot (Source: JET)



Extensometer	E-V3
Piezometer	BV-1
Piezometer	BV-2
	BV-3
Extensometer	E-V2

Figure 4 Additional monitoring equipment installed by MPI, 2015 - Vallée Pitot (Source: JET)



Extensometer	E-B1
Extensometer	E-B2

Figure 5 Location map of the monitoring equipment - La Butte (Source: JET)

Appendix 3.3.2

Proposed remote monitoring system

Proposed remote monitoring system

a. Overview of the recommended remote monitoring system

The assumptions for studying the landslide remote monitoring system are as follows:

- There are three sites to install/implement the remote monitoring system;
- Sites to be monitored are Chitrakoot, Vallée Pitot and La Butte; and
- The implementation flow of the remote monitoring system is shown in the figure below.

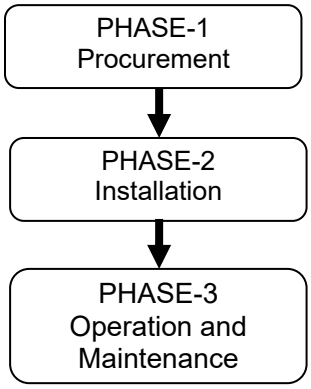


Figure 1 Implementation flow of the remote monitoring system (Source: JET)

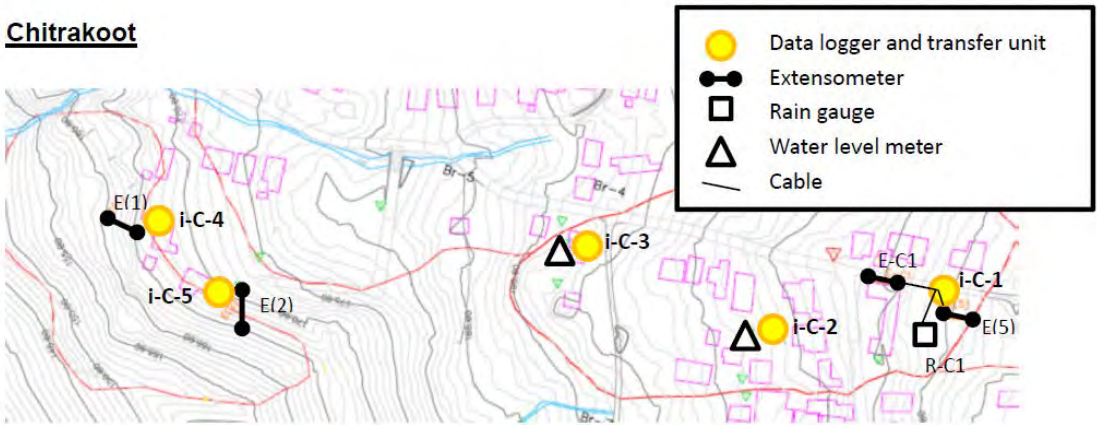
Figure 2 Image of the remote monitoring system (Source: JET)

b. PHASE-1: Procurement

<Listing of the procurement item>

The data logger and transfer unit is normally installed beside the sensor and/or in a stable area against landslides. To properly decide the installation point of the data logger and transfer unit, and establish the amount of work for the preparation of the tender document, conditions of the communication signal should be checked. All the equipment should be installed in the inside of the protection fence for security.

The tentative deployment plan is shown in Figure below.



Procurement Item	Amount
Data logger and transfer unit	5 ea
6 port hub	5 ea
RS232C translator	5 ea
Solar panel	5 ea
12 V battery	5 ea
Cable (between sensor and logger & transfer unit)	100 m
Materials for fence construction (at i-C-2, i-C-3)	2 ea

Figure 3 Deployment Plan in Chitrakoot (Source: JET)

Vallee Pitot

Procurement Item	Amount
Data logger and transfer unit	1 ea
6 port hub	1 ea
RS232C translator	1 ea
Solar panel	1 ea
12 V battery	1 ea
Cable (between sensor and logger & transfer unit)	250 m

Figure 4 Deployment Plan in Vallée Pitot (Source: JET)

La Butte

Procurement Item	Amount
Data logger and transfer unit	2 ea
6 port hub	2 ea
RS232C translator	2 ea
Solar panel	2 ea
12 V battery	2 ea
Cable (between sensor and logger & transfer unit)	10 m

Figure 5 Deployment Plan in La Butte (Source: JET)

<Permission for a transmission module approved by Information and Communications Technologies Authority (ICTA)>

In order to apply a remote monitoring system by Global System for Mobile Communication (GSM) signal, which is a common type of signal in Mauritius, permission for data transmission module should be obtained from a supervisory authority. In Mauritius, ICTA is the authority that grants this kind of permission. To smoothly obtain the permission, support by MPI is required.

c. PHASE-2: Installation

<Preparation>

The Contractor shall prepare the following items before commencement of the installation works.

- Permission of land use
  - The contractor shall investigate who are the land owners of the monitoring site.
  - The Contractor shall get necessary permission from the land owner for the installation of the remote monitoring system.
- Necessary materials/equipment
  - The Contractor shall prepare necessary materials and equipment for the installation of the monitoring instruments, such as fences, steel poles, protection boxes, cable protection pipes and cement.

<Installation>

The installation works shall be carried out in the site and the office.

- Data logger and transfer unit in the monitoring site:
  - The data logger and transfer unit shall be connected to the existing sensors which are the rain gauge, the extensometer and the water level meter.
- Data server in MPI office:
  - The data server including the data control/management software shall be set in an office designated by MPI.

<Inspection approved by MPI>

MPI shall inspect the installed instruments after completion of the installation works and issue the approval to the contractor in case of satisfaction of the criterion.

<Operation training>

The contractor shall provide the operation training to MPI at the handover of the procured and installed item. The threshold for early warning designated by MPI shall be set during the training.

d. PHASE-3: Operation and Maintenance

<Monitoring>

- Data conditions shall be checked, especially data transfer stability. Daily data check shall be carried out by the Contractor during one month after the completion of the installation works.

<Maintenance>

- Visual check and clean up every month shall be carried out by the contractor during 1 year after the completion of the installation works; and
- If something wrong happens under ordinary use, the contractor shall repair the issue as a warranty during 1 year after the completion of the installation works.

Appendix 3.4.1

Early warningevacuation system in Chitrakoot & Vallée Pitot

Early warning/evacuation system in Chitrakoot / Vallée Pitot

a. Outline of the EWS

In the Previous Project, landslide Early Warning System (EWS), consisting of extensometers and alert equipment, has been implemented at Chitrakoot and Vallée Pitot. Also, another EWS has been added in Vallée Pitot by MPI in 2015.

The equipment and the structure of the landslide EWS are shown below.

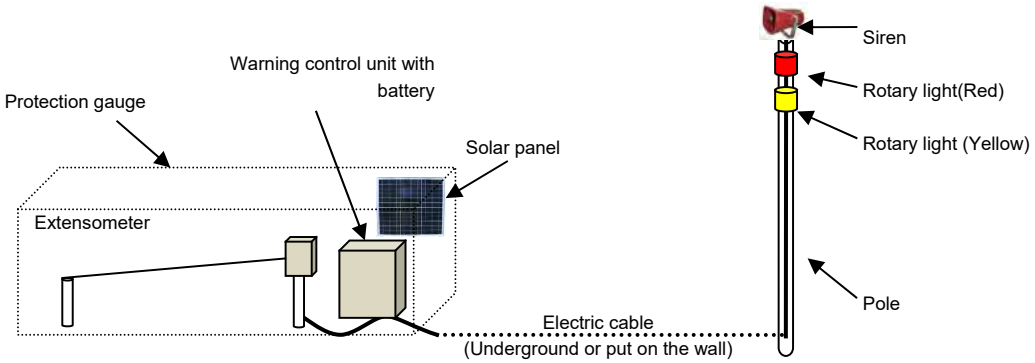


Figure.1 Conceptual Diagram of EWS (Source: JET)

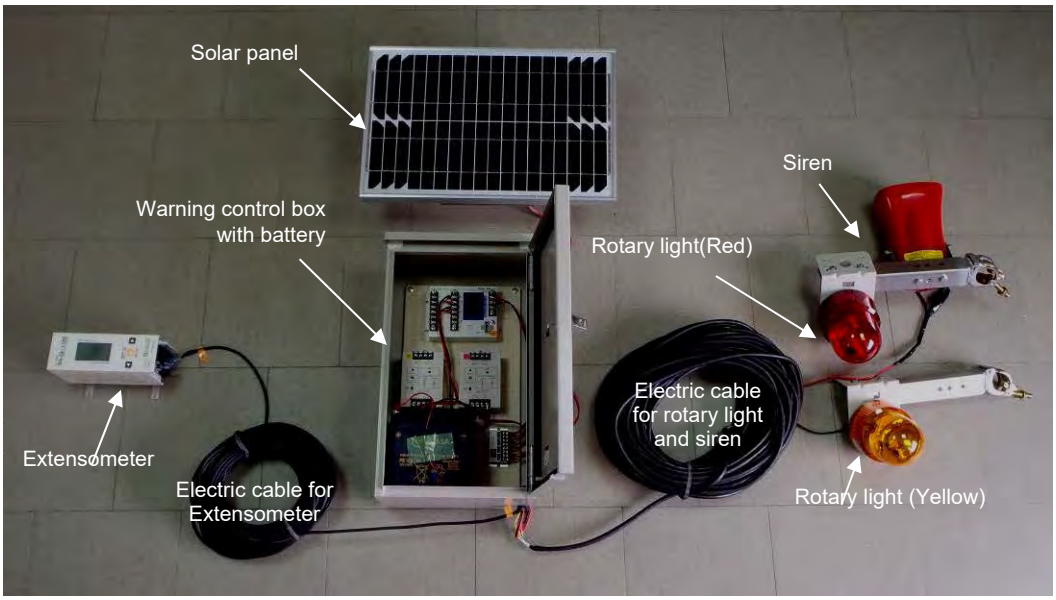


Figure 2 The Parts of the EWS (Source: JET)

Table 1 Quantity of the parts for the EWS (Source: JET)

Location	Name	Quantity	Remarks
Chitrakoot	Siren	1	Previous Project by JICA, 2014
	Rotary light (red)	1	
	Rotary light (yellow)	1	
	Warning control box	1	
	Solar panel	1	
Vallée Pitot	Siren	1	Previous Project by JICA, 2014
	Rotary light (red)	1	
	Rotary light (yellow)	1	
	Warning control box	1	
	Solar panel	1	
Vallée Pitot	Siren	1	Other project by MPI, 2015
	Rotary light (red)	1	
	Rotary light (yellow)	1	
	Warning control box	1	
	Solar panel	1	

b. Confirmation of the current conditions

The alarm is connected to the extensometers in two active landslides, Chitrakoot and Vallée Pitot. The alarm consists of rotary lights and a siren: the yellow rotary light operates during the warning stage, and the red rotary light and siren operates during the evacuation stage. The EWS operates appropriately now.

- Connected extensometer: Chitrakoot: E5, Vallée Pitot: EV-1 and EV-3

Table 2 Threshold for activation of the alarm (Source: JET)

Alarm	Stage	Threshold (for Extensometer)
Yellow rotary light	Warning stage	10 mm/day
Red rotary light and siren	Evacuation stage	20 mm/day

Chitrakoot: E5

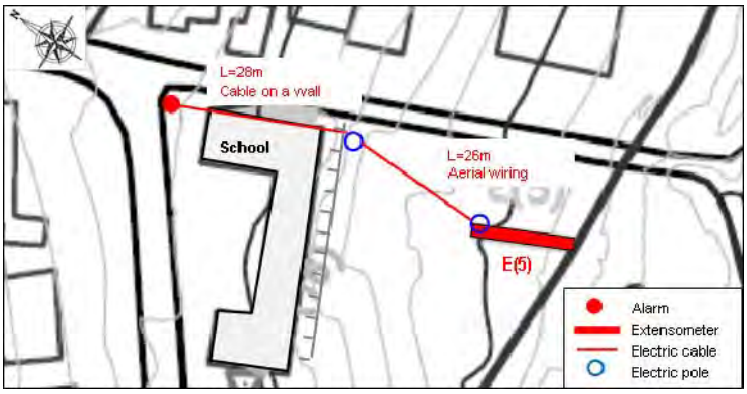


Figure 1 EWS in Chitrakoot (Source: JET)

Vallée Pitot: EV-1

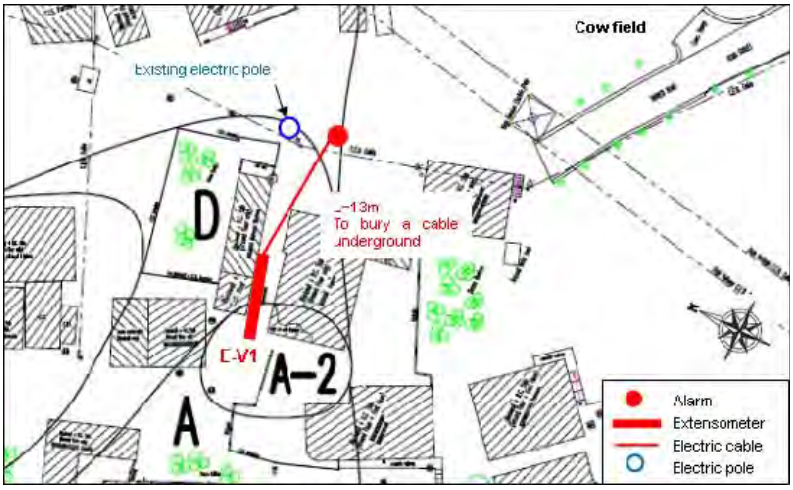


Figure 2 EWS in Vallée Pitot (Source: JET)

Vallée Pitot: EV-3

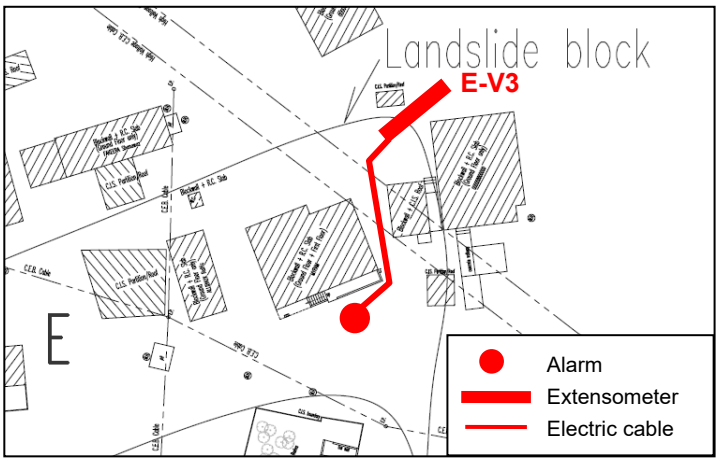


Figure 3 Additional EWS in Vallée Pitot (Source: JET)

Appendix 3.4.2

Simple setting manual for EWS

Simple setting manual for EWS

1 Operation of Alert system (cancellation of warninig)

The following operation must be carried out by MPI to avoid this malfunction.

A) The case that the following operation should be carried out.

Case 1: The case that warning devices (siren & Rotary light) worked because displacement reached the threshold. This case is right warning announcement.

Case 2: The case that a warning device (siren & rotary light) worked when the cable which connected Warning control unit (NetAL-1) and extensometer (SLG-10E) was taken off.

B) **Operation**

Step 1 : To stop a warning

The power supply of the warning device is turned off, and the warning stops (Fig.1).

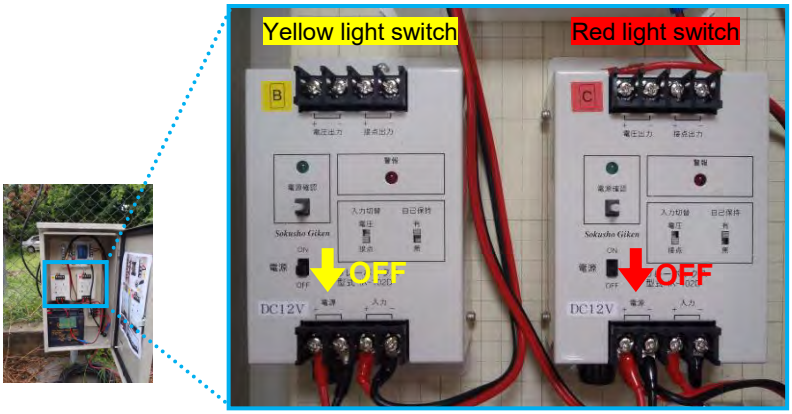


Fig.1

Step 2 : Reset of the displacement for Extensometer (SLG-10E)

As an operation of the extensometer, when the display button is pressed for a long period of time (2 seconds), the screen for selecting the various setting is displayed. If "Reset displacement" is selected in the "Instrument settings", the displacement rate can be reset. (Fig.2)

Fig.2

Step 3 : Reset of the warning signal of the Warning Control Unit (NetAL-1)

① At first, Network Controller (NetCT-1E) is connected to Warning Control Unit (NetAL-1).

NetAL-1
No. 12345678

Fig.3

② If the button of the network controller is pressed for a long period of time (2 seconds), the opening screen (Fig .3) is displayed.

ケイホウシュツリョクカイジョ

Fig.4

③ The button is pushed nine (9) times, and the screen of "Reset of the warning signal" (Fig.4) is displayed.

ケイホウシュツリョクカイジョ
シュツリョクサキ：1

Fig.5

④ Warning No. ***"1"***, yellow rotary light, is chosen (Fig.5).

ケイホウ1　ヲ　カイジョ　シマス
ヨロシイ　デスカ？　[Yes] [No]

Fig.6

⑤ And Yes (the warning is canceled) is chosen (Fig.6).

ケイホウシュツリョクカイジョ
シュツリョクサキ：2

Fig.7

⑥ Warning No. ***"2"***, red rotary light, is chosen (Fig.7).

ケイホウ1　ヲ　カイジョ　シマス
ヨロシイ　デスカ？　[Yes] [No]

Fig.8

⑦ And ***"Yes"*** (the warning is canceled) is chosen (Fig.8).

Step 4 : To turn on a warning device

The power supply of the warning device is turned on, and the warning system starts to work. (Fig.9)

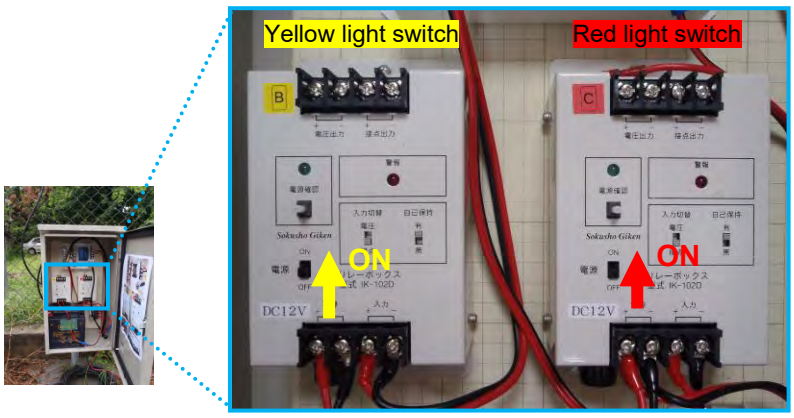


Fig.9

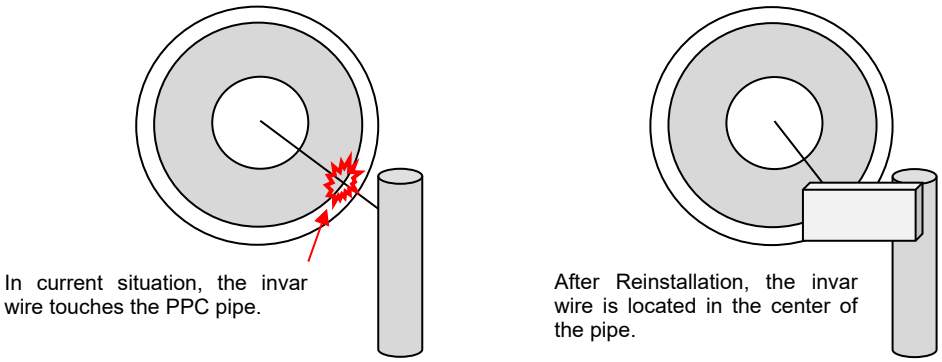
2 Procedure of the reinstallation of the invar wire for extensometer

(1) Turn off a warning unit

(2) Record a current " Total displacement " ⇒ Refer to (6)

(3) Take off the invar wire of the end part

(4) Metal plate is welded to the suitable position of the pole of the end part



Current situation After Reinstallation

(5) Attach a wire to the suitable position of the metal plate

(6) Change " total displacement " to the quantity same as (2)
When the display button is pressed for a long period of time (2 seconds), the screen for selecting the various setting is displayed. If "Total displacement" is selected in the "Instrument settings", the total displacement can be changed to the quantity same as (2).
⇒ Refer to " Instruction Manual for Extensometer, SLG-10E", p26

(7) Reset of the displacement
When the display button is pressed for a long period of time (2 seconds), the screen for selecting the various setting is displayed. If "Reset displacement" is selected in the "Instrument settings", the displacement can be reset.
⇒ Refer to " Instruction Manual for Extensometer, SLG-10E", p27

(8) Turn on a warning unit

Appendix 3.4.3

Automatic rainfall monitoring system (AWS of MMS)

Automatic rainfall monitoring system (AWS of MMS)

An automatic rainfall monitoring system is necessary for the Early Warning System (EWS) of the slope disaster. However, it is not easy to install an automatic rainfall monitoring system that covers the entire island of Mauritius. Therefore, MPI suggested the use of Automatic Weather System (AWS) of Mauritius Meteorological Service (MMS). In response to the request from MPI, MMS installed AWS in Chitrakoot in December, 2016 (refer to appendix3.4.2). JET proposes that the AWS of MMS covers the entire island. In addition, the use of a weather radar, installed by a different JICA project, shall be expected in the future.

Figure.1 AWS (Automatic Weather System) of MMS (Mauritius Meteorological Service) behind the Chitrakoot government school (Source: JET)

Appendix 3.5.1

Questionnaire survey results

Questionnaire survey on handbook

1. Outline of the questionnaire survey

- Conducted period: April – May 2016
- Purpose: to seek the views and comments from the related stakeholders as well as obtaining suggestions to improve the handbook
- Procedure method: printed survey was despatched to 41 stakeholders

2. List of stakeholders to despatch the survey

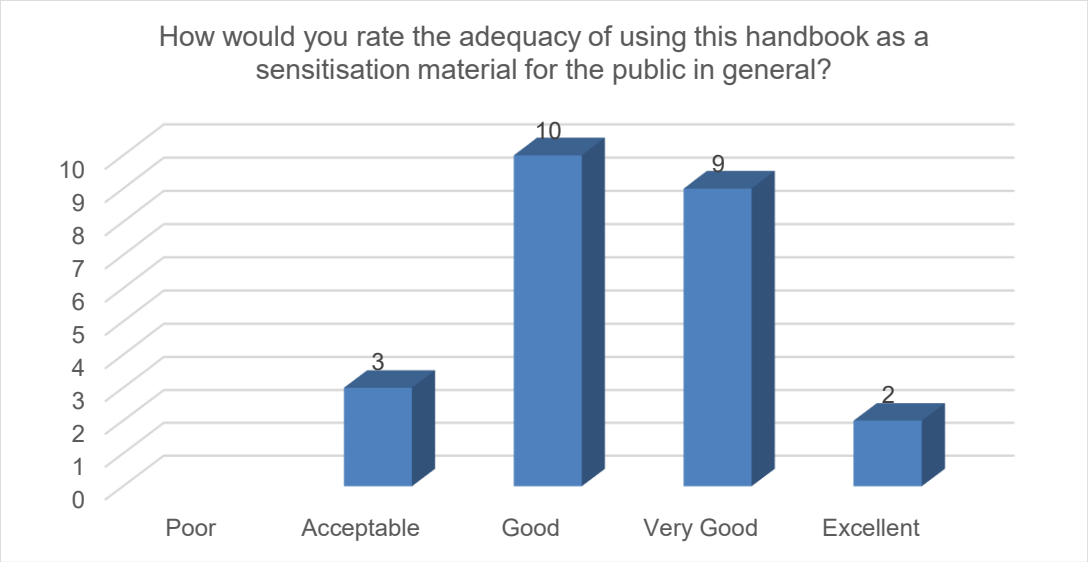
	Name of the stakeholder
1	Government Information Service
2	Mauritius Police Force
3	National Development Unit
4	Mauritius Meteorological Services
5	Ministry of Environment, Sustainable Development, and Disaster and Beach Management
6	National Disaster Risk Reduction and Management Centre
7	Ministry of Housing and Lands
8	Ministry of Local Government
9	City Council of Port Louis
10	Municipal Council of Beau Bassin
11	Municipal Council of Curepipe
12	Municipal Council of Quatre Bornes
13	Municipal Council of Vacoas Phoenix
14	District Council of Riviere du Rempart
15	District Council of Pamplemousses
16	District Council of Moka
17	District Council of Flacq
18	District Council of Grand Port
19	District Council of Savanne
20	District Council of Black River
21	Mauritius Fire and Rescue Service
22	Ministry of Health and Quality of Life
23	Ministry of Education & Human Resources, Tertiary Education, and Scientific Research
24	Ministry of Finance and Economic Development
25	Ministry of Civil Service and Administrative Reforms
26	Ministry of Gender Equality, Child Development & Family Welfare
27	Ministry of Social Security, National Solidarity & Reform Institutions
28	Ministry of Social Integration and Economic Empowerment
29	Ministry of Technology, Communication and Innovation
30	Ministry of Energy and Public Utilities
31	Water Resources Unit
32	Waste Water Management Authority
33	Central Electricity Board
34	Central Water Authority
35	Mauritius Broadcasting Cooperation
36	National Transport Authority

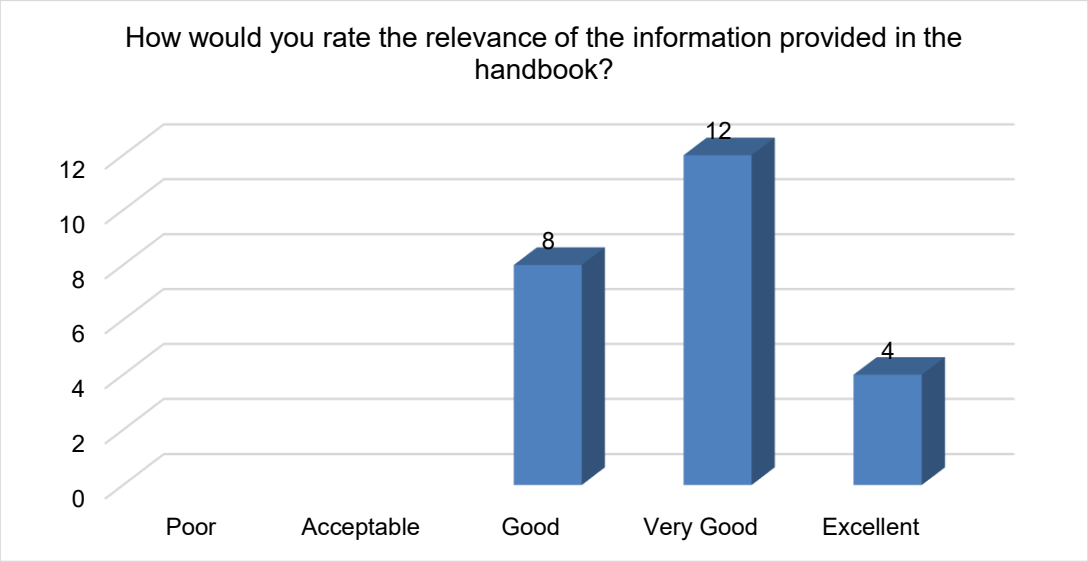
Questionnaire survey on handbook

37	Road Development Authority
38	University of Mauritius
39	Mauritius Red Cross Society
40	St. John Ambulance
41	United Nations Development Programme

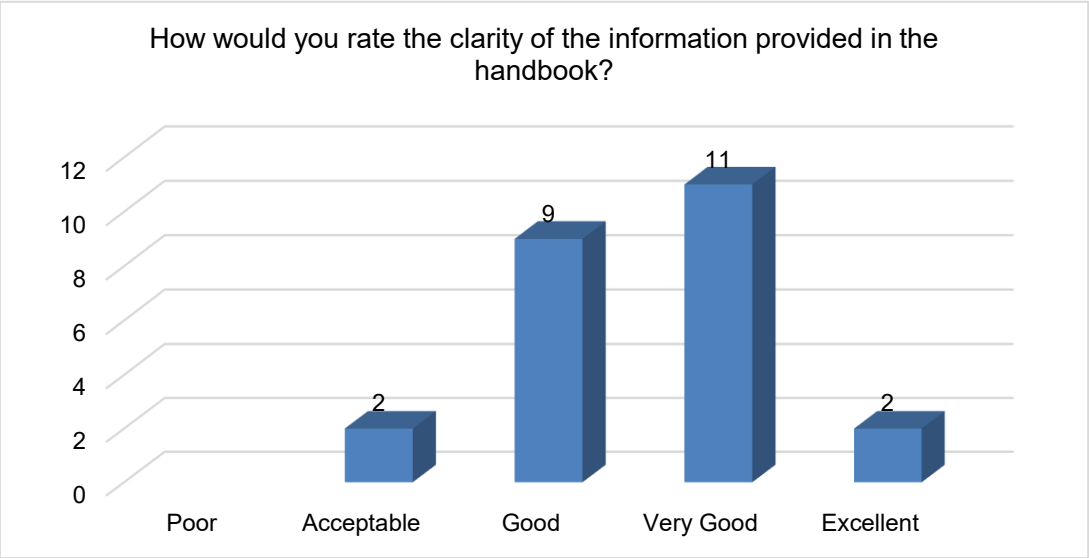
3. Results

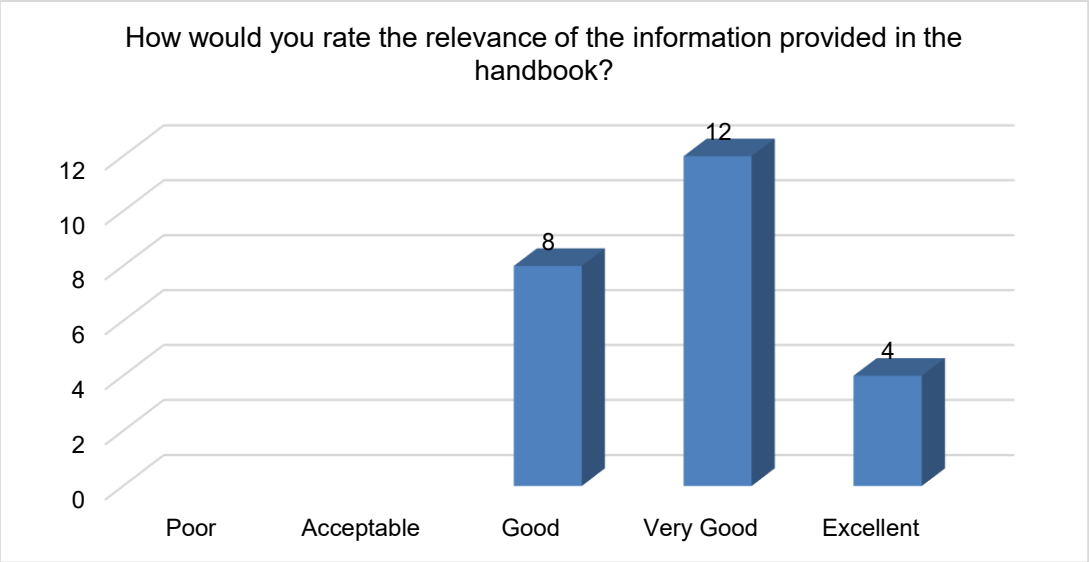
- 24 stakeholders responded



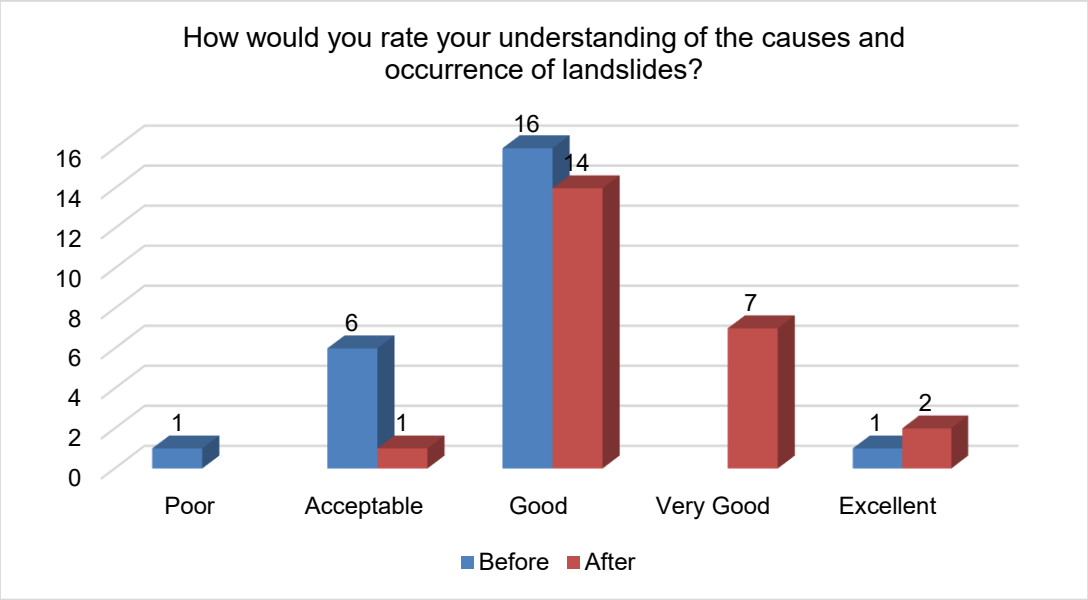


Questionnaire survey on handbook





Questionnaire survey on handbook



4. Comments and suggestions

<Positive comments in general>

- The Manual is **child friendly**
- Has **enough information** for general public
- These elements B6 **impact** on presentation and final product

<Comments for specific section to be improved>

- **Section 3 (page 7)**: JET may wish to refine Table 1 in conjunction with section 2.3.1 and Table 2.3.11 of the "Project of Landslide Management in the Republic of Mauritius - Final Report";
- **Section 4 (page 8)**: Label "landslide block" on diagram
- **Section 4 (page 9)**: In paragraph 4, human activities, example may have been given as landslide treatment at terre rouge verdun link road where start of landslides occurred as a result of re-profiling of mountain slopes to provide a …
- **Section 4 (pp. 8-9)**: It is important to stress that, landslides may occur as a result of a combination of more than one factor
- **Section 6 (page 12)**: relating to PPG should be amended with the proper cover page of PPG 9, and the appropriate name of PPG 9: "Developments on sloping sites and landslide hazard areas"
- **Section 6 and 7 (pp. 12-14)**: More detailed information is to be made available
- **Section 7.2 (page 13)**: It may be better to characterise the pros and cons, rather than, quantify them by assigning a percentage

Questionnaire survey on handbook

- **Section 7.3 (page 14)**: development has to be made for disaster prevention
- **Section 8 (page 18)**: figure 2 is not clear enough. Information missing. Few wordings could be added to better explain the flow chart. Too congested.
- **Section 8 (page 18)**: JET should update and review criteria for Termination stage, which is not in conformity with the recommendations of the "Project of Landslides Management in the Republic of Mauritius - Final Report";
- **Section 2.2, 4, 5, and 8**: It is understood that the updated handbook will incorporate the other types of landslides like rockfall, debris flow, creep and slope failure with necessary amendments brought among others, to sections

<Comments in general to be improved>

- **Simplification:**
  - The contents are quite clear except for a few terms which need to **be simplified** further.
  - The document appears to be a bit bulky and requires **further simplification**
  - **Less literature** recommended, **more simple illustrations**
  - Improvements on the clarity of the provided information may be explored with **use of diagrams/illustrations**
  - Some pages look **too crammed with information**, which hinders comprehension and ease of reading
  - A handbook for the younger ones with **more cartoon** and **less technical explanation**
- **Creole version:**
  - consider having one version in **Creole** language
  - To have a **Creole** version of the handbook
  - A **Creole** version of the handbook should be made to sensitize people with low literacy. A quite complex French language is being used in the handbook.
  - Contents should be also circulated in **Creole** language
  - Consider a simplifies version in **Creole** so as to reach a greater number of people
- **Accuracy:**
  - **Avoid printing formatting mistakes**. Twice pages 9 and 10 to avoid misunderstanding
  - Publication must be more rigorously **scrutinised for language mistakes,** especially for the French version.
  - Layout could be improved, along with special attention as regards to **proof reading**

- There is a need to **proofread the contents** of the documents for typographical and grammatical inconsistencies.

- **Contents:**
  - The information provided should be made **more user friendly**
  - It may **not be easily read/understood** by the general public.
- **Other:**
  - Improve **quality of maps**
  - **Increase the size of the photos** showing cracks/deformation to create more impact on awareness
  - It may be more appropriate to **restyle the title** of the handbook to "The Landslide Preparedness Handbook or Learning to Live with Landslides" to suit the content thereto
  - It may be more convenient to **use "prevention and mitigation"** in tandem throughout the handbook rather than "prevention" only
  - The item **countermeasure works to be more explicit** for information of the public
  - The handbook contains **more info on Chitrakoot**. Understanding of landslide prone areas at other listed places would add to knowledge.
  - There is still a bit of **confusion about rainfall data** collection at different warning stages
  - The information/illustrations are well explicit for any person, though not conversant with the issue of landslide to understand same clearly.
  - In the local context, it is important to consider the pervasive influence of "culture and belief" on the perception of natural disasters. Moreover, people can be indifferent to the sensitisation material, unless they have experienced an even of the like.

<Suggestions to add the contents>

- **Evacuation Centre:**
  - The **location for refugee centres** of hazardous sites should be identified and included in the booklet. The new protocol that mandates the power of the police to force evacuation should be inserted as a clause in the booklet
  - **Evacuee Centres in Landslide prone areas** and to be included in the handbook
- **Institutional framework:**
  - To include provision of the **NDRRMC legislation** which now renders non-

compliance to evacuation order by police as an offence
- To mention **national coordination at the level of NEOC** during emergency
- The **role of the community response team**, especially at Quatre Soeurs
- The **role of the NDRRMC committee**

- **Other:**
  - A **"what NOT to do" list** could be included
  - **Practical safety precautions** to be taken by inhabitants of areas likely to be affected by landslides, e.g, use of helmets; to move towards assembly points; specific type of building foundation etc.
  - List of **contact details** (fire, utility, LA, disaster centre) to be inserted to inform of disaster. Hotline and contact person
  - To include that prior to engaging in any development, owners have to make themselves **informed on hazards present** within the area they intend to do so
  - **Separate pamphlet for technical information and warning system** may be considered
  - **Losses due to landslide** (directs and indirects)
  - consider including information with respect to **recent landslide occurrences** in nearby regions, giving indications on possible causes and the extent/seriousness of their effects. These should be reported with statistical evidence/pictured and which may have a greater impact on the awareness of the public in general, promoting awareness, amongst others
  - Course of **action during and after** a landslide disaster
  - **Psychological preparedness**

<Comments beyond the handbook>

- **Presentation** and audio visual should be targeted to some specific groups, eg, mass, students, senior citizens
- **Community participation** is essential to target the public and response mechanism during a landslide event
- **Dissemination process** has to be done well. For instance, handbook could be distributed at primary and secondary schools and a special class could be made to sensitise. Students could be means to sensitise parents and relatives
- The people residing at the listed landslide prone areas must be **sensitised first**

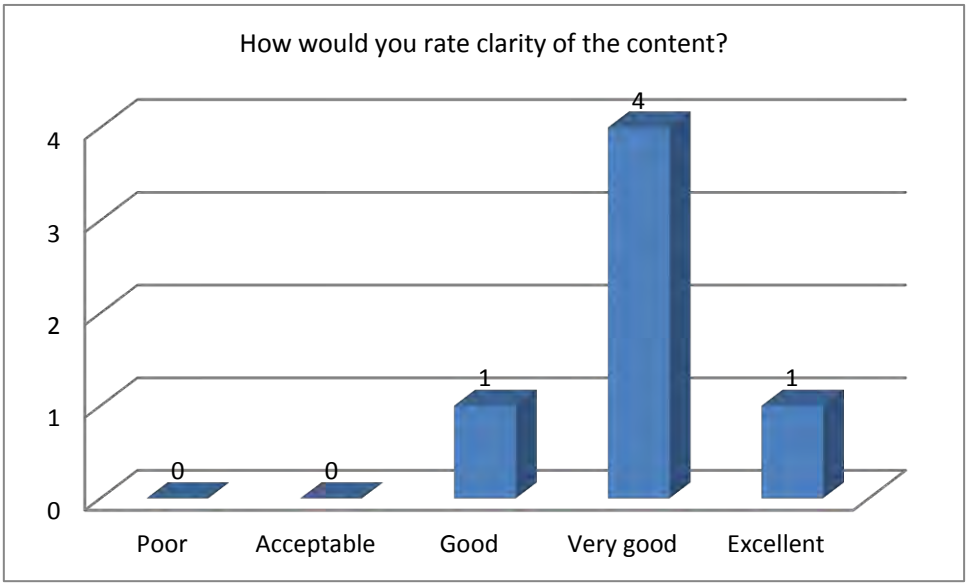
Questionnaire survey 2 on handbook

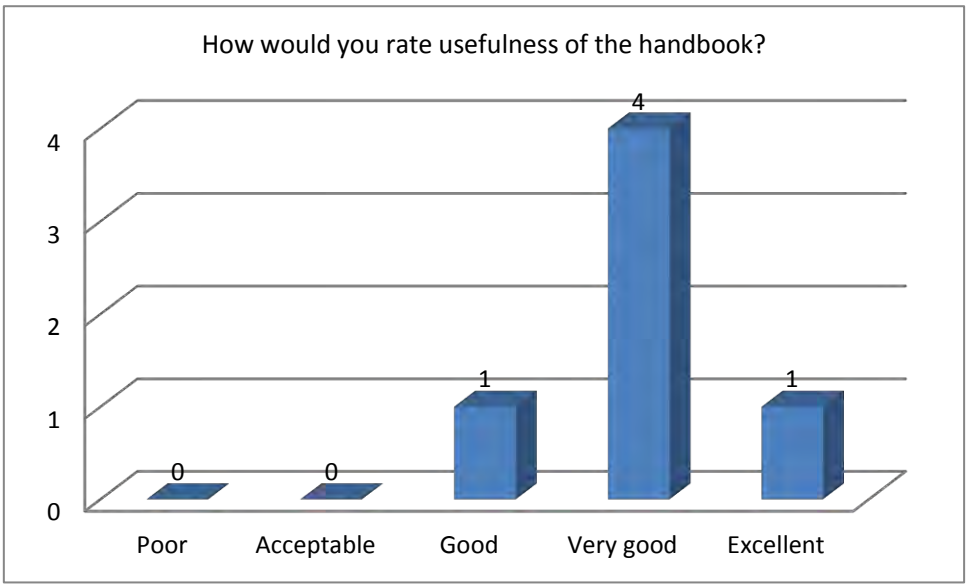
1. Outline of the questionnaire survey

- Conducted period: 01 - 24 March 2017
- Purpose: to seek the views and comments on the revised handbook from the related stakeholders
- Procedure method: printed survey was distributed to approximately 40 participants in the seminar held on 1 March 2017

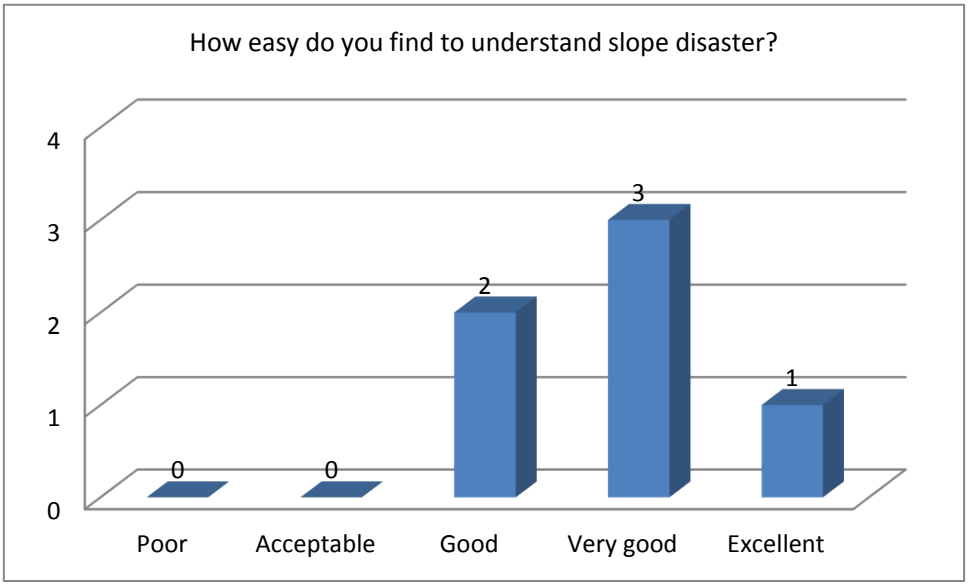
2. Results

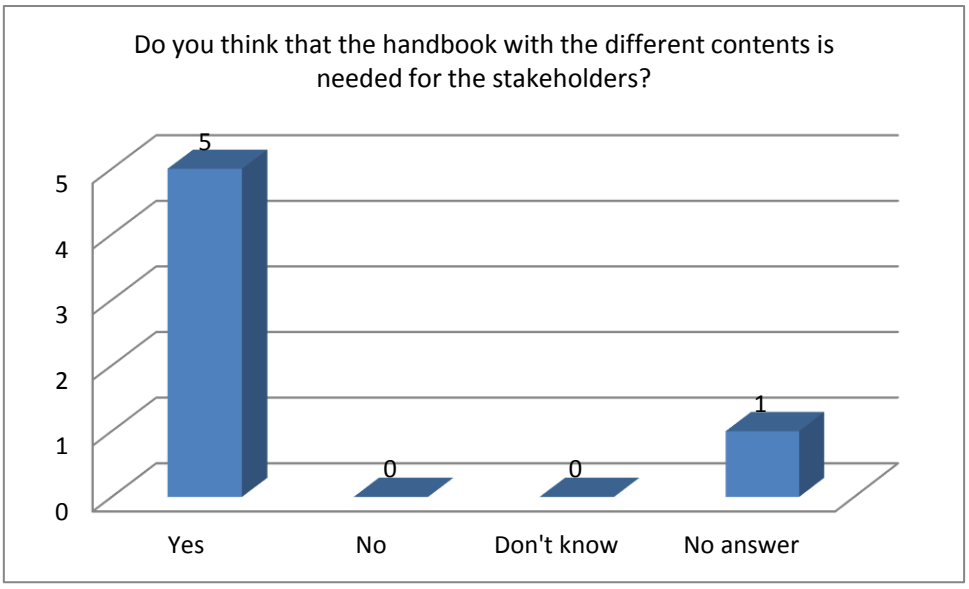
- 6 stakeholders responded





Questionnaire survey 2 on handbook





3. Comments and suggestions

<Handbook for general public>

- There should include a preface section/ or message section from an appropriate individual or team
- Must provide a list of emergency shelters
- A section to describe the terms used in slope disaster preparedness and management
- A section on why there is a need to prepare a slope disaster plan
- A section on how to prepare your children and protecting animals (pet owners)

Questionnaire survey 2 on handbook

before, during and after a slope disaster

- A complete section on recovering from a slope disaster, including psychological issues
- Slope disaster preparedness for people with disabilities
- Planning for evacuation
- Emergency sheltering characteristics
- To enhance the reading and presentation of the handbook, possible use of a colour code may be appropriate
- More information regarding consideration and specifications would be a good guidance
- Security issue should be added to avoid vandalism

Appendix 3.5.2

Sensitisation materials

THE SLOPE DISASTER PREPAREDNESS HANDBOOK

Prepare Yourself for Slope Disasters

Ministry of Public Infrastructure and Land Transport
in collaboration with
Japan International Cooperation Agency (JICA)

December 2017

CONTENT

PREFACE & ACKNOWLEDGEMENT:

This handbook has been prepared as a guide to allow a correct appreciation of problems associated with slope disasters and how to react during emergency situations to ensure the security of inhabitants. We are convinced that this handbook will prove to be a very useful tool to fulfil our objectives.

The Ministry of Public Infrastructure and Land Transport & Japan International Cooperation Agency wish to thank all officers for their valuable contributions in the preparation of this handbook.

EMERGENCY CONTACTS

999 MAURITIUS POLICE FORCE

115 MAURITIUS FIRE AND RESCUE SERVICES

EMERGENCY SHELTERS

Emergency shelters are located in the slope disaster hazard areas.
Please find the nearest emergency shelter from your home.

CLASSIFICATION OF DISASTER	AREA NAME	EMERGENCY SHELTER (TEL NO.)
LANDSLIDE	Chitrakoot, Vallée des Prêtres	217 5335
	Vallée Pitot (near Eidgah)	Temporary Centre
	Mgr. Leen Street and nearby vicinity, La Butte *(stabilised)*	Temporary Centre
	Old Moka Road, Camp Chapelon	208 7596
	Quatre Soeurs, Marie Jeanne, Jhummah Street, Old Grand Port	417 6548
	Candos Hill at LallBahadoor Shastri and Mahatma Gandhi Avenues	5738 7624
SLOPE FAILURE	Les Mariannes Community Centre (Road area)	-
	Pailles: (i) access road to Les Guibies and along motorway, near flyover bridge	286 6591
	Pailles: (iii) Soreze Region	286 6591
	Plaine Champagne Road, opposite "Musée Touche Dubois"	684 1053/ 5290 1348
	Bambous Virieux, Rajiv Gandhi Street (near Bhavauy House), Impasse Bholoa	-
	Trou-aux-Cerfs	5950 1070
	Morcellement Hermitage, Coromandel	467 6609
ROCK FALL	Baie du Cap: (ii) Maconde Region	622 8673
DEBRIS FLOW	Baie du Cap: (i) Near St Francois d'Assise Church	622 8673

1

Slope Disasters and Causes

DEFINITION

"Slope disasters" are defined as the movement of a mass of rock, debris or earth down a slope, and categorised as four types.

LANDSLIDE

A phenomenon where the soil mass on one or more failure surfaces deep in the ground gradually shifts downward.

SLOPE FAILURE

Slope failure mass detaches from a steep slope/cliff along a surface with little or no shear displacement. It moves quickly on a small scale and the inclination angle is relatively high.

ROCK FALL

A phenomenon where foliated rocks and gravel start to fall down a slope.

DEBRIS FLOW

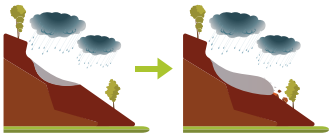
A phenomenon where soil and boulders are liquefied by surface water or groundwater and tend to flow downward rapidly through a mountain torrent.

CAUSES OF SLOPE DISASTERS

There are several factors/triggers which provoke the slope disasters. Slope disasters may occur as a result of a combination of more than one factor/trigger. Human activities are the common cause of all types of slope disasters.

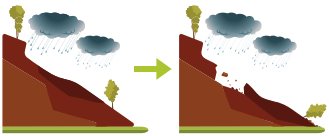
LANDSLIDE

Slope inclination, geological features, stratum, groundwater and continuous heavy rainfall.



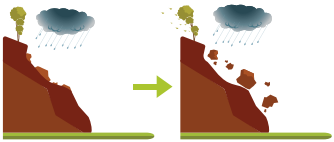
SLOPE FAILURE

Intense and heavy rainfall in a short period of time.



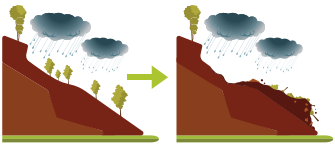
ROCK FALL

Rainfall, strong wind, erosion, growth of roots.



DEBRIS FLOW

Increase of surface water due to heavy rainfall.



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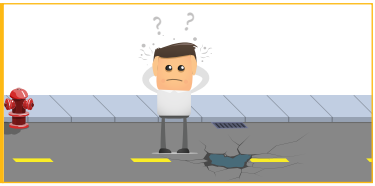
SIGNS OF WARNING

Slope disasters have signs of warning before they actually occur.

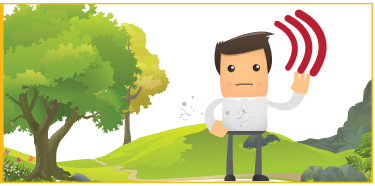
NEW CRACKS
- Cracks on ground, retaining wall, paved roads, and walls and floors of houses.



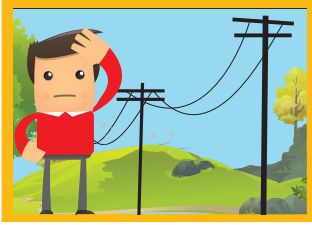
CHANGE OF WATER VOLUME AND QUALITY
- Rapid increase, decrease or drying up of water.
- Sudden muddiness of spring water, mountain stream and groundwater.
- Groundwater from the earth.

UNUSUAL SMELLS
- Earthly smell, burning and woody smell.

UNUSUAL SOUNDS
- Breaking of tree roots.
- Rubbing of tree branches.
- Rumbling of the mountain.



OTHERS
- Breaking down of rocks into smaller pieces.
- Loosening or tensioning of electric cables.
- Changing the shape of the building (i.e. unable to close the door).
- Falling of small rocks from the slope.
- Swelling up/ cave-in of ground.



3

Features of Slope Disasters

The following scenes are common characteristics which can be observed in the slope disaster areas. Necessary precautions should be taken if you find these characteristics as illustrated below:

LANDSLIDE AREAS

Tilted Poles

Deformation in the Steps

Deformation of the House

Bent Road

SLOPE FAILURE AREAS

Slope Collapsed from the Top

Crack on the Road

Fence Damaged by Slope Failure

Slope covered by loose Soil is prone to Slope Failure

ROCK FALL AREAS

Unstable Boulders

Rock Constituting Cliff

Fallen Rocks

DEBRIS FLOW AREAS

Large Volume of Fill

Stacked Big Boulders

Slope Disasters in Mauritius

In Mauritius, slope disaster issues have become major concerns today due to recent natural disasters resulting from environmental changes and the increase of land development on the slope areas.

Slope Disasters in Mauritius

LIST OF SLOPE DISASTER HAZARD AREAS IN MAURITIUS

No.	CLASSIFICATION OF DISASTER	AREA NAME	DISTRICT COUNCIL/ MUNICIPALITY
1	LANDSLIDE	Chitrakoot, Vallée des Pretres	Municipality of Port Louis
2		Vallée Pitot (near Eidgah)	Municipality of Port Louis
3		Mgr. Leen Street and nearby vicinity, La Butte *(stabilised)*	Municipality of Port Louis
4		Old Moka Road, Camp Chapelon	Municipality of Port Louis
5		Quatre Soeurs, Marie Jeanne, Jhummah Street, Old Grand Port	Grand Port District Council
6		Candos Hill at LallBahadoor Shastri and Mahatma Gandhi Avenues	Municipality of Quatre Bornes
7	SLOPE FAILURE	Les Mariannes Community Centre (Road area)	Pamplemousses/ Rivière du Rempart District Council
8		Pailles: (i) access road to Les Guibies and along motorway, near flyover bridge	Municipality of Port Louis
9		Pailles: (iii) Soreze Region	Municipality of Port Louis
10		Plaine Champagne Road, opposite "Musée Touche Dubois"	Black River District Council
11		Bambous Virieux, Rajiv Gandhi Street (near Bhavauy House), Impasse Bholoa	Grand Port District Council
12		Trou-aux-Cerfs	Municipality of Curepipe
13		Morcellement Hermitage, Coromandel	Municipality of Beau Bassin - Rose Hill
14	ROCK FALL	Baie du Cap: (ii) Maconde Region	Savanne District Council
15	DEBRIS FLOW	Baie du Cap: (i) Near St Francois d'Assise Church	Savanne District Council

Source: JICA final report: The Project of Landslide Management in the Republic of Mauritius (March 2015)

Landslide Damage (Vallée Pitot)

Landslide Damage (Quatre Soeurs)

Slope Failure(Batelage)

Debris Flow (Baie du Cap)

Rock Fall (Baie du Cap)

Rock Fall (Maconde)

5

Disaster Preparedness

We never know when the slope disaster strikes. **'Disaster Preparedness'** is important in order to minimise damage to property and keep you and your family safe. It is also essential to learn what to do in a disaster.

PSYCHOLOGICAL PREPAREDNESS

Psychological preparedness is a way to assist people to think disasters more clearly, help people to make rational decisions and enhance resilience to the traumatic events.

MANAGE YOUR SAFETY

Understand the risks you might face and check the local emergency plan to manage your safety.

REMAIN CALM AND CONFIDENT

Obtain techniques to manage your feelings of anxiety, stress and fear. Feel confident when you face an emergency.

BUILDING COMMUNITY CONNECTION

Build connections in the community before an emergency so that family, friends and neighbours can support each other when the disaster strikes.

PREPARE

EMERGENCY KIT

An emergency kit with the following items should be prepared. Place your emergency kit near the doorway for an easy access.

EMERGENCY KIT

FOODS	• Drinking Water • Emergency Food such as Biscuit, Tinned/ Packed Food, Powdered Milk, Baby Bottle
MEDICAL SUPPLIES	• First-aid Kit • Medicine • Diapers • Sanitary Products • Tissue Paper
VALUABLES	• Cash • Credit Card • Important Documents (NIC, Insurance Policies, Property Deeds, Vehicle Registration, Bank Details etc.)
CLOTHING	• Underwear • Towels • Raincoat
DAILY GOODS	• Torch • Mobile Phone • Portable Radio • Batteries • Cooking/eating Utensils • 1 Gallon Water Containers • Pens • Plastic Bags • Fire Lighter • Matches • Blanket • Helmet

Disaster Preparedness

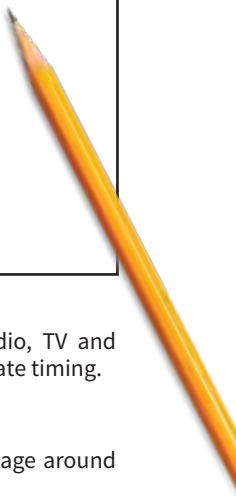
EMERGENCY SHELTER AND EVACUATION ROUTE

Check your nearest local emergency shelter and make an access map from your home to the shelter.

You need to avoid the hazard areas for the evacuation route (Please check with the appropriate authority).

MY EMERGENCY SHELTER : .....

MAP :



EARLY WARNINGS

Try to obtain the latest information through the reliable sources such as radio, TV and internet. Always be alerted to the early warnings to be evacuated at the appropriate timing.

PREPARE YOUR HOME FOR HAZARDS AND EMERGENCIES

You should carry out regular check of your house and repair if necessary. Drainage around your house should be also checked and cleared.

DISCUSSION WITH YOUR FAMILY

You should check the emergency shelter and the route, and discuss a communication method in an emergency situation with your family.

6

Do's and Don'ts during Slope Disasters

Slope disasters can occur in many areas. Always be prepared and stay informed of any changes in and around your home.

DO'S

SUSPECTING IMMINENT DANGER

BE AWARE

- Listen for unusual sounds such as tree cracking or boulders knocking together as these might indicate the cause of slope disasters.
- If you are near a stream or channel, be alert for any sudden increase or decrease in water flow, or changes of water colour from clear to muddy.

EVACUATION

- If you suspect imminent danger, evacuate immediately and contact your local district authority, fire or police department.
- Listen to local radio for warnings. Also, get information from your neighbours or friends for any potential dangers.

DON'TS

DON'T PUT YOURSELF AT RISK!

- Inform neighbours who may not be aware of potential threats and evacuate together.

MANUEL DE PREPARATION AUX MOUVEMENTS DE TERRAIN

(pour mieux se préparer)

Ministère des Infrastructures publiques
et du Transport routier en collaboration avec
L'Agence japonaise de coopération internationale (JICA)

Décembre 2017

CONTENU

PREFACE / REMERCIEMENTS:

Ce manuel sert de guide visant à une meilleure compréhension des problèmes liés aux mouvements de terrain afin de préparer les habitants à mieux se protéger en cas de sinistre. Nous sommes convaincus que ce manuel s'avérera un outil vraiment utile pour atteindre nos objectifs.

Le Ministère des Infrastructures publiques et du Transport routier et L'Agence japonaise de coopération internationale tiennent à remercier tous les officiers pour leur précieuse contribution à la préparation de ce manuel.

CONTACT (NUMEROS) D'URGENCE

999 MAURITIUS POLICE FORCE

115 MAURITIUS FIRE AND RESCUE SERVICES

ABRIS D'URGENCE

Les abris d'urgence sont situés dans les zones à risque.
Veuillez repérer l'abri d'urgence le plus proche de votre maison.

CLASSIFICATION DES CATASTROPHES	NOM DE LA REGION	ABRIS D'URGENCE (TEL)
GLISSEMENT DE TERRAIN	Chitrakoot, Vallée des Prêtres	217 5335
	Vallée Pitot (à proximité de Eidgah)	Centre provisoire
	Rue Mgr. Leen et dans la région de La Butte *(stabilisée)*	Centre provisoire
	Old Moka Road, Camp Chapelon	208 7596
	Quatre Soeurs, Marie Jeanne, Rue Jhummah, Vieux Grand Port	417 6548
	Colline Candos aux Avenues LallBahadoor Shastri et Mahatma Gandhi	5738 7624
AFFAISSEMENT	Centre communautaire Les Mariannes (zone des routes)	-
	Pailles: (i) Chemin d'accès à Les Guibies et au long de l'autoroute à proximité de la passerelle	286 6591
	Pailles: (iii) Région de Sorèze	286 6591
	Route Plaine Champagne, vis-a-vis de "Musée Touche Dubois"	684 1053/ 5290 1348
	Bambous Virieux, Rue Rajiv Gandhi (à proximité de Bhavauy House), Impasse Bholoa	-
	Trou-aux-Cerfs	5950 1070
	Morcellement Hermitage, Coromandel	467 6609
EBOULEMENT (ROCHES)	Baie du Cap: (ii) Région de Macondé	622 8673
COULEE DE DEBRIS	Baie du Cap: (i) à proximité de l'église St François d'Assise	622 8673

1

Les mouvements de terrain et leurs causes

DEFINITION

"Les mouvements de terrain" sont définis comme le mouvement d'une masse rocheuse, de débris ou de terre le long d'une pente et sont classés selon quatre types.

GLISSEMENT DE TERRAIN

Un phénomène où la masse de terre, sur une ou plusieurs surfaces de défaillance profondes dans le sol, se déplace graduellement vers le bas.

L'AFFAISSEMENT

La masse cédée de la pente se détache d'une pente raide / falaise le long d'une surface avec peu ou pas de déplacement en cisaillement. Cela se déplace rapidement sur une petite échelle et l'angle d'inclinaison est relativement élevée.

EBOULEMENT (ROCHES)

Un phénomène où les roches feuilletées et le gravier commencent à tomber le long d'une pente.

COULEE DE DEBRIS

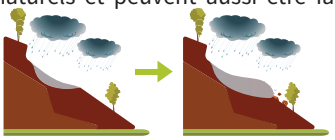
Un phénomène où la terre et les rochers sont liquéfiés par les eaux de surface ou les eaux souterraines et ont tendance à s'écouler rapidement à travers un torrent de montagne.

CAUSES DES MOUVEMENTS DE TERRAINS

Il existe plusieurs facteurs déclenchants qui provoquent les mouvements de terrain. Ces mouvements peuvent survenir en raison d'une combinaison de plusieurs facteurs déclenchants. Les mouvements de terrain sont issus de phénomènes naturels et peuvent aussi être favorisés par l'activité humaine.

GLISSEMENT DE TERRAIN

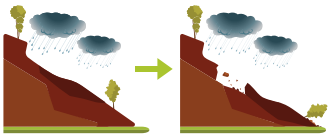
Inclinaison de la pente, caractéristiques géologiques, strate et eaux souterraines, etc.



AFFAISSEMENT

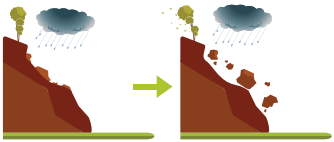
Pluviométrie

Des précipitations intenses et fortes dans un court laps de temps.



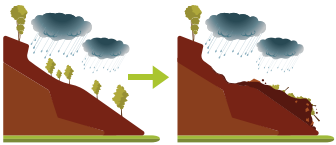
EBOULEMENT (ROCHES)

Précipitations, vents forts, érosion, croissance des racines.



COULEE DE DEBRIS

Augmentation des eaux de surface due à de fortes précipitations.



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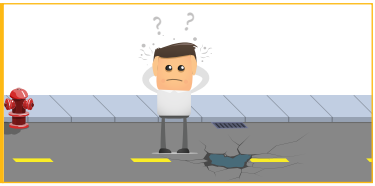
SIGNES PRECURSEURS

Les mouvements de terrain sont précédés de signes précurseurs notamment :

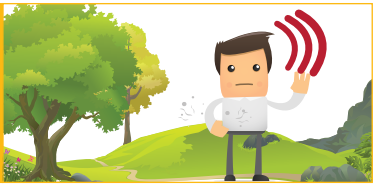
NOUVELLES FISSURES
• Fissures sur le sol, les murs de soutènement, les routes pavées, les murs et planchers des maisons.



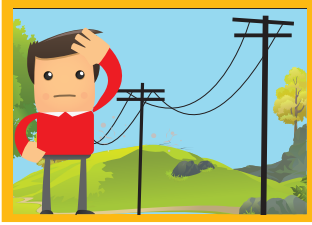
CHANGEMENT DE VOLUME ET DE QUALITE DE L'EAU
• Augmentation rapide, diminution ou assèchement de l'eau.
• L'eau de source, ruisseau de montagne et eaux souterraines deviennent soudainement boueuses.
• Remontée des eaux souterraines de la terre.

ODEURS INHABITUELLES
• Odeur de la terre, de feu et de bois.

BRUITS INHABITUELS
• Craquements d'arbres
• Frottement des branches d'arbres.
• Grondement de la montagne.



AUTRES
• Cassure des roches en petits morceaux.
• Desserrage ou tension des câbles électriques.
• Modifications dans les constructions (Ex : les portes).
• Chute de petites roches de la pente.
• Gonflement /affaissement du sol.



Caractéristiques de mouvements de terrain

Les scènes suivantes sont des manifestations communes qu'on peut observer dans les zones avec mouvements de terrains. Des précautions nécessaires doivent être prises si vous constatez ces signes précurseurs:

REGIONS DE GLISSEMENT DE TERRAIN

Poteaux inclinés

Déformation des marches d'escalier

Déformation de la maison

Rues courbées

REGIONS D'EFFONDREMENT DE PENTES

Effondrement de la pente

Fissures sur la route

Clôture endommagée par affaissement de la pente

Pente couverte par le sol mou sujette à un éffondrement de la pente

REGIONS DE EBOULEMENT DE ROCHES

Rochers instables

Roche constituant une falaise

Chute de pierres

REGIONS DE COULEE DE DEBRIS

Grand volume de remplissage

Gros rochers empilés

Catastrophes dues aux mouvements de terrain à Maurice

À Maurice, les problèmes liés aux mouvements de terrain sont aujourd'hui devenus des préoccupations majeures en raison des catastrophes naturelles récentes résultant des changements environnementaux et du développement accru sur les versants.

Catastrophes dues aux mouvements de terrain à Maurice

LISTE DES ZONES A RISQUE DE CATASTROPHES A MAURICE

No.	CLASSIFICATION DES CATASTROPHES	NOM DE LA REGION	CONSEIL DE DISTRCT/ CONSEIL MUNICIPAL
1	GLISSEMENT DE TERRAIN	Chitrakoot, Vallée des Pretres	Municipalité de Port Louis
2		Vallée Pitot (à proximité de Eidgah)	Municipalité de Port Louis
3		Rue Mgr. Leen et dans la région de La Butte	Municipalité de Port Louis
4		Old Moka Road, Camp Chapelon	Municipalité de Port Louis
5		Quatre Soeurs, Marie Jeanne, Rue Jhummah, Vieux Grand Port	Conseil de District de Grand Port
6		Colline Candos aux Avenues LallBahadoor Shastri et Mahatma Gandhi	Municipalité de Quatre Bornes
7	AFFAISSEMENT	Centre communautaire Les Mariannes (zone des routes)	Conseil de District de Pamplemousses/ Rivière du Rempart
8		Pailles: (i) Chemin d'accès à Les Guibies et au long de l'autoroute à proximité de la passerelle	Municipalité de Port Louis
9		Pailles: (iii) Région de Sorèze	Municipalité de Port Louis
10		Chemin Plaine Champagne, vis-a-vis de "Musée Touche Dubois"	Conseil de District de Riviere Noire
11		Bambous Virieux, Rue Rajiv Gandhi (à proximité de Bhavauy House), Impasse Bholoa	Conseil de District de Grand Port
12		Trou-aux-Cerfs	Municipalité de Curepipe
13		Morcellement Hermitage, Coromandel	Municipalité de Beau Bassin - Rose Hill
14	EBOULEMENT (ROCHES)	Baie du Cap: (ii) Région de Macondé	Conseil de District de Savanne
15	COULEE DE DEBRIS	Baie du Cap: (i) à proximité de l'église St François d'Assise	Conseil de District de Savanne

Source: Raport final de JICA:The Project of Landslide Management in the Republic of Mauritius (March 2015)

Dégâts de glissement de terrain (Vallée Pitot)

Dégâts de glissement de terrain (Quatre Soeurs)

Affaissement (Batelage)

Coulée de débris (Baie du Cap)

Eboulement de roches (Baie du Cap)

Eboulement - roches (Macondé)

Préparation aux catastrophes

Nous ignorons quand une catasphone peut survenir. La ‘préparation aux catastrophes' est importante afin de minimiser les dégâts de propriété et d’assurer votre sécurité et celle de votre famille. Il est également essentiel d'apprendre comment agir face à une catastrophe.

PREPARATION PSYCHOLOGIQUE

La préparation psychologique est un moyen d'aider les gens à réfléchir plus clairement aux catastrophes, à les encourager à prendre des décisions rationnelles et à renforcer la résilience face aux événements traumatisants.

SE METTRE EN SECURITE

Comprenez les risques que vous pourriez rencontrer et disposez d'un plan d'urgence pour gérer votre sécurité.

RESTER CALME

Se renseigner sur les techniques de gestion des émotions telles que l’anxiété, le stress et la peur. Ne cédez pas à la panique lorsque vous faites face à une urgence.

ETABLIR DES LIENS AU SEIN DE LA COMMUNAUTE

Etablissez des contacts au sein de la communauté avant qu’une urgence ne survienne afin que la famille, les amis et les voisins puissent se soutenir mutuellement lors de la catastrophe.

PREPARER

KIT D'URGENCE

Un kit d'urgence avec les items sousmentionnés doit être préparé. Placez votre kit d'urgence près de la porte pour un accès facile.

KIT D'URGENCE

NOURRITURE	• De l'eau potable • Aliments d'urgence tels que biscuit, boîtes de conserve /aliments emballés, lait en poudre, biberon de bébé
FOURNITURES MEDICALES	• Trousse de premiers secours • Médicaments • Couches • Produits sanitaires • Papier toilette
OBJETS DE VALEUR	• Argent Liquide• Carte de crédit • Documents importants (NIC, Polices d'Assurance, Acte de Propriété, Enregistrement de Véhicule, Détails de la Banque, etc.)
VETEMENTS	• Sous-vêtements • Serviettes • Imperméable
PRODUITS DU QUOTIDIEN	• Torche • Téléphone portable • Radio portable • Batteries • Ustensiles de cuisine • 1 gallon d’eau • Stylos • Sacs en plastique • Briquet pour feu • Allumettes • Couverture • Casque

Préparation aux catastrophes

ABRI D'URGENCE ET ROUTE D'EVACUATION

Repérez l'abri d'urgence local le plus proche et établissez l'itinéraire de votre domicile jusqu'à l'abri.

Vous devez éviter les zones dangereuses pour l'itinéraire d'évacuation (veuillez vérifier avec l'autorité compétente).

MON ABRI D'URGENCE : .....

CARTE :

SIGNAUX D'ALERTE

Essayez d'obtenir les dernières informations grâce aux sources fiables telles que la radio, la télévision et Internet. Soyez toujours attentif(s) aux avertissements afin d'évacuer au moment approprié.

PREPAREZ VOTRE MAISON AUX RISQUES ET URGENCES

Vous devez effectuer un contrôle régulier de votre maison et faire les réparations si nécessaire. Les décharges d'eau autour de votre maison doivent également être vérifiées et dégagées.

COMMUNIQUEZ AVEC VOTRE FAMILLE

Vous devez vérifier l'abri d'urgence et l'itinéraire et discuter d'une méthode de communication en cas d'urgence avec votre famille.

6

MOUVEMENTS DE TERRAIN: A FAIRE ET A NE PAS FAIRE

Les mouvements de terrain peuvent survenir dans de nombreuses régions. Soyez toujours préparé(s) et restez informé(s) de tout changement dans votre maison et aux alentours.

A FAIRE

RESTEZ EN ALERTE COMME SI VOUS DEVRIEZ TOUJOURS FAIRE FACE A UN DANGER IMMINENT

ETRE ATTENTIF

• Restez à l'écoute des bruits inhabituels tels que des craquements d'arbres ou des rochers s'entrechoquant, car cela pourrait indiquer des mouvements de terrain.

• Si vous êtes près d'une étendue d'eau ou d'un canal, soyez attentif à toute augmentation soudaine ou diminution de la circulation d'eau, ou des changements de couleur d'eau de clair(e) à boueux(se).

EVACUATION

• Si vous soupçonnez un danger imminent, évacuez immédiatement et contactez l'autorité de votre district local, les pompiers ou la police.

• Ecoutez la radio locale pour les avertissements. Obtenez aussi des informations auprès de vos voisins ou amis concernant tout danger potentiel.

A NE PAS FAIRE

NE VOUS EXPOSEZ PAS AU DANGER!

• Informez les voisins qui ne connaissent peut-être pas les menaces potentielles et évacuez ensemble.

KI ETE MOUVMAN TERIN ?

GLISMAN TERIN
Enn fénomenn kot later finn sédé ek koumans glisser.

ENN LAMAS KI DESANN
Kan later détasé dépi enn lapante/falaise dépi enn sirfas ki déplaser doucemen. Li bouz pli vite lor enn lapante ki assez haute.

ROS KI DEGRIGOLE
Enn fénomenn kot bann ros koumans dégringolé lor enn lapante.

MOUVMAN DEBRI
Kan later ek ros vinn liquid avek délo sirfas ou délo souterin dessan kan éna gro lapli.

CONTACT (NUMERO) D'URGENCE

999
MAURITIUS POLICE FORCE
(LAPOLIS)

115
MAURITIUS FIRE AND RESCUE SERVICES
(PONPIÉ)

logos 301117

GUIDE PRATIK
POU FAIRE FACE A BANN MOUVMAN TERIN

Ministère des Infrastructures publiques et du Transport routier
avek kolaborasion
Japan International Cooperation Agency (JICA)

Décembre 2017

REGIONS GLISSEMENT TERIN

Poto ki versé

Lakaz ki déformé

REGIONS KOT LAPANT GRAINER

Lapant ki grainer

Baraz ki endomager avek lapant ki dessan

REGIONS KOT ROS INN DEGRINGOLER

Ros ki péna lasize

Enn falez avek ros

REGIONS KOT DEBRIS DESSAN

Gros remplissage

Gros ros antasé

KUMA FAIRE FAS A BANNES CATASTROFS

BOITE DE SECOURS

- Prepare enn boite de secours
- Rode enn plas en sécurité ki pli près avek ou
- Faire enn plan pou ou évakué pli vite
- Prepare enn laliste bann kontact dan ou lendroit pou aide ou prochain

PANDAN BANNES CATASTROFS

- Pa paniké!

- Pa mett ou lavi an danzé!
- Ecoute bann warning/conseils lor radio ek television

- Si ou pansé ena danzé pé vini ou bizin sauvé

Appendix 3.5.3

Distribution plan of sensitisation materials

【DISTRIBUTION PLAN】

Organisation	No to be provided		
	Handbook (ENGLISH)	Handbook (FRENCH)	Leaflet (CREOLE)
Ministry of Public Infrastructure and Land Transport (MPI)	5	5	5
Ministry of Social Security, National Solidarity and Environment and Sustainable Development	5	5	5
Ministry of Housing and Lands	5	5	5
Ministry of Education, Human Resources, Tertiary Education and Scientific Research	5	5	-
Ministry of Home Affairs, External Communications and National Development Unit	5	5	5
Ministry of Youth and Sports	5	5	5
Ministry of Gender Equality, Child Development and Family Welfare	5	5	5
Ministry of Local Government and Outer Islands	5	5	5
City Council of Port Louis	5	5	5
District Council of Black River	5	5	5
District Council of Fracq	5	5	5
District Council of Pamplemousses	5	5	5
District Council of Moka	5	5	5
District Council of Riviere du Rempart	5	5	5
District Council of Savanne	5	5	5
District Council of Grand Port	5	5	5
Municipal Council of Vacoas-Phoenix	5	5	5
Municipal Council of Beau Bassin/Rose Hill	5	5	5
Municipal Council of Quatre Bornes	5	5	5
Municipal Council of Corepipe	5	5	5
The Mauritius Police Force	5	5	5
Mauritius Fire and Rescue Services	5	5	5
Primary School (state and private aided, private unaided: 307 schools)	310 (1 copy each)	310 (1 copy each)	-
Secondary School (state and private: 175 schools)	350 (2 copies each)	175 (1 copy each)	-
Youth Centre (25 centres)	125 (5 copies each)	-	-
Citizens Advice Bureau (36 bureaus)	-	110 (3 copies each)	-
Social Welfare Centre (59 centres)	-	180 (3 copies each)	-
Women Centre (16 centres)	-	50 (3 copies each)	-
Public (15 prone areas)	-	-	1,800
National Library of Mauritius	5	5	5
Workshop (6 December)	60	60	60
JICA	15	15	15
	975	1,015	1,985

Appendix 3.6.1

Memorandum issued by MPI

REPUBLIC OF MAURITIUS

MEMORANDUM

M. G. Form 4 (L)

My Ref:

From: Director
(Engineer's Section, Infrastructure Division, Technical Branch, Phoenix)

To: Senior Chief Executive

(Attention: Permanent Secretary)

Date: 24 January 2017

Re-Organisation of Engineering Section to cope with Government Priority Projects

Please refer to the Management Meeting held on 16 November 2016 and to the meeting with The Honourable Nandcoomar Bodha, Minister of Public Infrastructure and Land Transport on 11 January 2017.

This is to confirm that all the staff who worked as Counterparts on the JICA Landslide Management Project has now been redeployed to a new Design Unit responsible for Government priority projects.

Until a decision is taken regarding the operational and legal framework of a Landslide Management Unit, we are not entertaining any new request for investigations or attendance of meetings in connection with landslide and rock-fall matters as we do not have any personnel posted in the LMU anymore.

It would be appreciated if you could kindly inform all relevant Ministries/Authorities especially the NDRRMC.

M B Jewon
Director Engineering

DDCE
Mr. Chinasamy
All Engineers (Design Unit 2) Mr.
JICA

Appendix 3.6.2

Programmes and attendance lists for kick-off workshop, working session, seminar and workshop/seminar

Workshop on Sendai Disaster Risk Reduction Framework and Promotion of Mainstreaming Disaster Risk Reduction and Reinforcement of Quick Response Capacity

Date: Wednesday 10 February 2016

Time : From 09:00 am – 16:00 pm

Venue: Flying Dodo, Bagatelle

Agenda

[Opening] **(Moderator : MPI)**

08:30 – 09:00 Welcome of guests

09:00 – 09:10 Introduction for Opening Seminar (JICA Madagascar)

09:10 – 09:20 Opening Remarks by Mr. Nishimoto, Chief Representative of JICA Madagascar

09:20 – 09:30 Opening Remarks by Hon Minister of Public Infrastructure

[Lecture 1] **(Moderator : MPI)**

09:30 – 10:15 Lecture from Dr. Baba on Sendai Disaster Risk Reduction Framework and Promotion of Mainstreaming Disaster Risk Reduction

10:15 – 10:30 Question and Answer session

10:30 – 11:00 Photo session & Point of Press with the Minister / Coffee Break

[Sharing the actual situation] **(Moderator : MPI)**

11:00 – 11:30 Presentation from MPI on DRR activities in Mauritius

11:30 – 11:45 Presentation from MEPATE/CPGU/BNGRC of Madagascar on DRR activities in Madagascar

11:45 – 12:00 Presentation from JICA Experts Team attached to MPI

12:00 – 12:30 Question and Answer, Free discussion session

12:30 – 13:30 Lunch

[Lecture 2] **(Moderator : JICA)**

13:30 – 14:30 Lecture/WS for reinforcement of response capacity (Dr. Baba)

14:30 – 15:00 Question and Answer

15:00 – 15:15 Coffee Break

15:15 – 15:45 Wrap-up Session (De-briefing from the participants)

15:45 – 15:55 Closing remarks by the Permanent Secretary, MPI

END

WORKING SESSION ON LANDSLIDE MANAGEMENT

Date: Monday 13 June 2016
Time: 13.00 – 15.00
Venue: Le Labourdonnais Hotel, Port Louis

No.	Name	Organisation	Designation
1	Nandcoomar Bodha	Ministry of Public Infrastructure and Land Transport (MPI)	Minister
2	E. Kissoon- Luckputtya	MPI	Deputy Permanent Secretary (DPS)
3	R. Bhooghawon	MPI	OIC- Eng CME
4	R. Jewon	MPI, Civil Engineering Section	Director
5	D. Chinasamy	Landslide Management Unit (LMU), MPI	Lead Engineer
6	S.P Anadachee	LMU, MPI	Engineer/ Senior Engineer
7	M. Gobin	LMU, MPI	Engineer/ Senior Engineer
8	T.R. Damonsing	LMU, MPI	Engineer/ Senior Engineer
9	S. M. Ramdowar	LMU, MPI	Engineer/ Senior Engineer
10	M. K. Mosaheb	LMU, MPI	Engineer/ Senior Engineer
11	O.K. Dabideen	Prime Minister's Office	Per. Secretary
12	D. Bahadoor	Ministry of Housing and Lands	Ag. SDCO
13	C. Charitar	Ministry of Finance and Economic Development	L. Analyst
14	C. Moosudihee	Ministry of Education	Ag. SCE
15	G. H. Laine	Ministry of Local Government and Outer Islands	Permanent Secretary
16	J. T. Reetoo	Ministry of Foreign Affairs	First Secretary
17	R. S. Sonea	Ministry of Energy and Public Utilities	DPS
18	HCH How Fok Cheung	Ministry of Health and Quality Life	Senior Chief Executive
19	B. Boyramboli	Ministry of Social Integration	Permanent Secretary
20	N. Caunhye	Attorney General Office	Senior Counsel
21	R. Bhugwant	Ministry of Social Security, National Solidarity and Reform Institutions	Ag. Permanent Secretary
22	S. Ramburn	Ministry of Social Security, National Solidarity and Reform Institutions	PSSD
23	A. Aseriah	Ministry of Social Security, National Solidarity and Reform Institutions	Ag Assistant Commissioner
24	O. Jadoo	Ministry of Environment, Sustainable Development, and Disaster and Beach Management	Permanent Secretary
25	K. Servansing	National Disaster Risk Reduction and Management Centre	AG
26	M. Boodhun	Ministry of Gender Equality	Room secretary
27	Hebrard	Central Electricity Board	General Manager
28	C. Dabeed	Central Electricity Board	TED Manager
29	L. Pallen	Mauritius Fire and Rescue Service	CFO
30	C. Matadeen	Central Water Authority	Ag. DGM (Technical)
31	M. S. Jewon	Traffic Management and Road Safety Unit	Director
32	N. R. Khadun	National Transport Authority	Deputy Commissioner
33	D. Seebaluck	MLQB	HPID
34	F. Shamtally	Mauritius Research Council	Researcher
35	S. Luchoomun	Civil Service	Director of Human Resource Management
36	L. Juggoo	Water Resources Unit	Director
37	S. Zaedally	Water Resources Unit	Senior Executive Officer
38	A. K. Bissessur	Water Resources Unit	Engineer/ Senior Engineer
39	R. Mungra	Mauritius Meteorological Services	Director
40	N. Jowaheer	Wastewater Management Authority	Deputy General Manager
41	Z. Alimohamed	Road Development Authority	OIC
42	K. Jhugroo	Police	DCP
43	M. Chatturdharry	University Technology of Mauritius	Ag. Regitrar
44	J. Mulloo	City Council of Port Louis	Chief Executive
45	G. V. Ramriporto	District Council of Moka/ Curepipe	Civil Engineer
46	M. Seeparsad	Municipal Council of Quatre Bornes	Chief Executive
47	G. Rughoo	Municipal Council Vacoas/ Phoenix	Acting Deputy Chief Executive
48	S. Lalloo	Municipal Council Vacoas/ Phoenix	Civil Engineer
49	P. Balloo	District Council Riviere Du Rempart	Head of Public Infrastructure
50	H. Ramhul	District Council Riviere Du Rempart	Ag, Assistant Chief Executive
51	R Gaupollen	District Council Pamplemousses	Chief Executive
52	V. Thakoor	District Council of Flacq	Chief Executive
53	S. Teeluck	District Council of Grand Port	Chief Executive
54	M.K. Bhoyrag	District Council of Black River	Civil Engineer
55	F.S. Keovisan	District Council of Black River	Chief Executive
56	M. Discour	Agence Francaise de Developpement	Director
57	Ayumi Takahashi	JICA Madagascar	Adjointe au Representant Resident
58	Kensuke Ichikawa	JICA Expert Team	Chief Adviser
59	Nirvana Neehaul	JICA Expert Team	Project Coordinator
60	Ayaka Tamai	JICA Expert Team	Intern

PROGRAMME FOR THE WORKING SESSION ON LANDSLIDE MANAGEMENT

13.00 – 13.05	Welcome Address by Mr. R. Jewon, Director, Civil Engineering Section, Ministry of Public Infrastructure and Land Transport.
13.05 – 13.10	Address by Mr. K. Ichikawa, Chief Adviser, JICA Expert Team.
13.10 – 13.25	Address by Hon. Nandcoomar Bodha, Minister of Public Infrastructure and Land Transport.
13. 25 –13.40	Coffee/Tea Break
13.40- 13.45	Presentation of participants/stakeholders
13.45- 13.55	Presentation on History of JICA Expert Team's Intervention on Landslide Disaster Issues and Status of Current "Landslide Adviser for Mauritius" Project., Mr. K. Ichikawa, Chief Adviser, JICA Expert Team.
13.55- 14.10	Presentation on the Landslide Management Unit in Mauritius - Roles and Responsibilities of All Relevant Stakeholders. Mr. D.Chinasamy, Lead Engineer, Landslide Management Unit, Ministry of Public Infrastructure and Land Transport.
14.10- 15 .00	Question and Answer/ Discussion Session

Civil Engineering Division

Technical Cooperation Project: Landslide Adviser for Mauritius

First seminar on slope disasters

Date: Wednesday 01 March 2017

Time: 9.00-15.35

Venue: Le Meridien Hotel, Point aux Piments

Attendance list

No.	Name	Organisation	Designation
1	Hon. Nandcoomar Bodha	Ministry of Public Infrastructure and Land Transport (MPI)	Minister
2	S.K. Seechurn	MPI	Ag Head Public Infrastructure
3	V. Ramtohul	MPI	Assistant Permanent Secretary
4	M. R. Jewon	MPI	Director of Civil Engineering Section
5	D. Chinasamy	MPI	Lead Engineer
6	M. R. Mosaheb	MPI	Engineer/ Senior Engineer
7	Damonsing Jerry Robin	MPI	Engineer/ Senior Engineer
8	M. Gobin	MPI	Engineer/ Senior Engineer
9	Sumedha Ramprosand	Ministry of Finance	Analyst/ S. Analyst
10	R. Soborun	Ministry of Housing and Lands	Ag Principal Planner
11	D. Cyparsade	Ministry of Local Government	Technical enforcement Officer
12	Deonath Shibnauth	Ministry of Agro Industry & Food Security- Forestry Services	Chief Forest Conservation and Enforcement Officer
13	N. Nawjee	Forestry Services	Divisional Forest Officer
14	I Auliar	Ministry of Environment and Sustainable Development	Environment Officer
15	Ravi Shanker Mungra	National Disaster Risk Reduction and Management Centre	Chief Inspector
16	A. Moniaruch	Mauritius Meteorological Services	
17	Hromesh Gopaul	Wastewater Management Authority	Senior Engineer
18	B. Thorul	CIW	
19	M. Seebaruth	Special Mobile Force	Superintendent
20	K. Gooljar	Central Electricity Board	Engineer
21	K. Joyram	Central Water Authority	Executive Engineer
22	F. Lallmahomed	Traffic Management and Road Safety Unit	Engineer/ Senior Engineer
23	Dr Kumar Dookhitram	University of Technology, Mauritius	Lecturer
24	N. Bheekharry	Mauritius Fire and Rescue Services	Station Officer
25	R. K. Seetohul	Mauritius Fire and Rescue Services	Station Officer
26	R. Kowal	Municipal Council of Beaubassin Rosehill	Civil Engineer
27	J. Unuth	Municipal council of Beau Bassin Rosehill	Trainee Engineer
28	S. Jeetun	Municipal Council of Curepipe	HPID
29	N. Khadaroo	Municipal Council of Curepipe	Senior Building Inspector
30	K. D. Appadu	Municipal Council of Quatre Bornes	Chief Inspector
310	B. J. Banjhu	District Council of Pamplemousses	Planning and development officer
32	Radha Ramdhun	District Council of Pamplemousses	SWF
33	P. Balloo	District Council of Riviere du Rempart	Head of Public Infrastructure
34	K. Domah	District council of Flaq	Head of Public Infrastructure
35	Mehreen Sheik Dioumone		Planning and Development Officer
36	M. Nepaul	European Comission	Project Manager
37	K. Ichikawa	JICA Expert Team (JET)	Chief Adviser
38	T. Iwasaki	JET	JICA Expert
39	Haruka Yoshida	JET	JICA Expert
40	C. Keshav Bhuckory	JET	Project Coordinator

Technical Cooperation Project: Landslide Adviser for Mauritius

FIRST SEMINAR

Date: Wednesday 1 March 2017
Venue: Le Meridien, Pointe Aux Piments
Organised by: Ministry of Public Infrastructure and Land Transport (MPI) in collaboration with JICA Expert Team (JET)

Time	Agenda	Presenter
9.00-9.30	*Registration/ Welcome coffee*	
9.40-9.50	Opening speech	MPI and JET
9.50-10.10	Presentation on slope failure and landslide	Civil Engineering Section/MPI
10.10-10.30	Presentation on rockfall and debris flow	Civil Engineering Section/MPI
10.30-10.50	Manuals Usage and Explanations	Mr. Iwasaki, JET
10.50-11.10	*Coffee/tea break*	
11.10-11.30	Countermeasure works in Chitrakoot	Civil Engineering Section/MPI
11.30-11.50	PPG, relocation and land acquisition issue	Mr. Bhuckory, JET
11.50-12.10	Emergency response	NDRRMC
12.10-12.30	Slope disaster handbook	Ms. Yoshida, JET
12.30-13.30	*Lunch*	
13.30-14.10	Discussion: Current slope disaster issues in the Local Authorities	Chaired by MPI and JET
14.10-14.30	*Coffee/tea break*	
14.30-14.40	Current status of the project	Mr. Ichikawa, JET
14.40-14.50	Speech	Minister for MPI
14.50-15.10	Organisational structure of LMU	MPI Head Office
15.10-15.30	Q & A, open discussion	
15.30-15.35	Closing speech	Mr. Jewon, MPI

Workshop on Landslide Management					
Wednesday 06 December 2017					
SN	**Surname**	**Name**	**Title**	**Organisation**	**Designation**
1	BUNDHOOA	Geaneshwar	Mr	Ministry of Public Infrastructure (MPI)	DPS
2	MAWAH	Parmanand	Mr	MPI	DPS
3	ARLANDA	Jean Christian Laval	Mr	MPI	APS
4	PARBHUNATH	Telkraj	Mr	MPI	Director of Civil Engineering Section
5	CHINASAMY	Deevarajen	Mr	MPI	Lead Engineer
6	ABEELUCK	Charun	Mr	MPI	Eng/Senior Eng
7	ANADACHEE	S. P.	Mr	MPI	Eng/Senior Eng
8	CHUKOWRY	Trisnah Devi	Ms	MPI	Eng/Senior Eng
9	GOBIN	Mukteshwar	Mr	MPI	Eng/Senior Eng
10	KOWAL	Ramsewar	Mr	MPI	Eng/Senior Eng
11	MOSAHEB	Mohammad Khalid	Mr	MPI	Eng/Senior Eng
12	GOODASAHIB	Muhammad Irfaan	Mr	MPI	Technical Officer
13	RAMCHURN	Visham	Mr	MPI	Technical Officer
14	MAHADEO	Ritisha	Ms	MPI	Technical Officer
15	NOHUR	RABAH …	Mr	MPI	Trainee Engineer
16	RAMDHANY	Ajay	Mr	Ministry of Finance and Economic Development	Lead Analyst
17	RUMZAN-MAUDARBACCUS	Raziana	Mrs	Ministry of Finance and Economic Development	
18	CYPARSADE	Dhinesh	Mr	Ministry of Local Government and Outer Islands	Technical Enforcement Officer
19	NEETHALIA	Vikash	Mr	Ministry of Foreign Affairs, Regional Integration and International Trade	First Secretary
20	NG WONG HING	Kelvyn	Mr	Ministry of Education and Human Resources, Tertiary Education and Scientific Research	Director
21	MORABY	Bibi Mehroon	Mrs	Ministry of Social Security, National Solidarity and Environment and Sustainable Development (Environment Department)	Environment Officer
22	BISSESUR	Heman	Mr	National Disaster Risk Reduction and Management Centre (NDRRMC)	Communication officer
23	HEERAH	Vipin	Mr	NDRRMC	Police Officer
24	OOCHIT	Rushmee	Ms	NDRRMC	STM Intern
25	SUNNASSY	Venoo	Mr	NDRRMC	Coordinator, CMLCSP
26	CYPARSADE	Smreetee	Mrs	NDRRMC	Disaster Monitoring Officer
27	CYPARSADE	Cecily	Mrs	Ministry of Agro Industry & Food Security	Assistant Conservator of Forests (ACF)
28	DESVAUX	Danielle Dominique	Mrs	Ministry of Housing and Lands (MHL)	Senior Surveyor
29	JUGROOP	Davis Jason	Mr	MHL	Development Control Officer
30	SOBORUN	Rugnishsingh	Mr	MHL	Ag Principal Town and Country Planning Officer
31	SUNASSEE	Nevin	Mr	MHL	Housing Development Officer
32	JEERAKUN	Veeraj	Mr	City Council of Port Louis	Civil Engineer
33	JOOMRATTY	Mohammad Fouad	Mr	District Council of Black River	Senior Inspector of Works
34	DOMAH	Kaleem	Mr	District Council of Flacq	Head Public Infrastructure
35	RAMPERGOSS	Chandan	Mr	District of Council of Pamplemousses	Trainee Engineer Civil
36	SOOKUN	Aumrajsingh	Mr	District Council of Moka	Head, Public Infrastructure Dept
37	LANGUR	Navindranath	Mr	District Council of Riviere du Rempart	Chief Health Inspector
38	BHOYRAG	Mahesh Kumar	Mr	District Council of Savanne	Ag Head of Public Infrastructure Dept
39	MONEBHURRUN	Vidianand	Mr	District Council of Grand Port	Inspector of Works
40	RAJCOOMAR	Dushil Sharma	Mr	Municipal Council of Vacoas/Phoenix	Trainee Engineer
41	APPADU	Karamcharan Dass	Mr	Municipal Council of Quatre Bornes	Chief Inspector of Works
42	MUDALLI	Dharmarajan	Mr	Municipal Council of Curepipe	Ag Principal Health Inspector
43	BOONEEADY	Prithiviraj	Dr	Mauritius Meteorological Services	Divisional Meteorologist
44	UJOODHA	Hemlata	Mrs	Traffic Management and Road Safety Unit	Eng/Senior Eng
45	ZEADALLY	Salim Ali	Mr	Water Resources Unit	Senior Hydrological Officer

46	HANRADHUN	Vedprakash	Mr	Special Mobile Force (SMF)	Corporal
47	GANGARAM	Sunil Roy	Mr	SMF - Mauritius Police Force	Police Constable
48	KHADOOA	Rishi	Mr	SMF - Mauritius Police Force	Police Sergeant
49	JALEEM	Kushal	Mr	Road Development Authority (RDA)	Ag Manager
50	BHOLAH	Hurrydeo	Mr	National Development Unit (NDU)	Chief Project Manager
51	BUSGEETH	Sewraj	Mr	Central Water Authority	
52	NARAYYA	Devanand	Mr	Mauritius Fire and Rescue Service	Senior Station Officer
53	DUSORUTH	Tajkumar	Mr	Wastewater Management Authority	Eng/Senior Eng
54	ANTOINE	Karen	Ms	Government Information Services (GIS)	Senior Information Officer
55	NOWBUTH	Manta Devi	Ms	University of Mauritius	Associate Professor, Civil Engineering Dept
56	RUGHOOPUTH	Reshma	Mrs	University of Mauritius	Head of department, Civil Engineering Department
57	DOOKHITRAM	Kumar	Dr	University of Technology Mauritius	Lecturer
58	GOODARY	Rajeshwar	Dr	University of Mascareignes	Lecturer of Universite des Mascareignes
59	AMMERALLY-NISTAR	Sadna	Mrs	Association Francaise de Development (AFD)	Chargee de Mission
60	KATO	Yoshiharu	Mr	Embassy of Japan in Mauritius	Ambassador Extraordinary and Plenipotentiary
61	GOMAKUBO	Junji	Mr	Embassy of Japan in Mauritius	Counsellor
62	IMAMURA	Ryo	Mr	JICA Headquarters	Country Officer (Africa Department)
63	MURAKAMI	Hironobu	Mr	JICA Madagascar	Resident Representative
64	ICHIKAWA	Kensuke	Mr	JICA Expert Team	Chief Advisor
65	IWASAKI	Tomoharu	Mr	JICA Expert Team	Advisor for Construction and Maintenance
66	YOSHIDA	Haruka	Ms	JICA Expert Team	Adviser for Organisation Enhancement
67	BHUCKORY	Chetan Keshav	Mr	JICA Expert Team	Project Coordinator

DRAFT

LIST OF GUESTS – One-day Workshop on Landslide Management
Wednesday 06 December 2017

Workshop	Opening Ceremony
Information Section, Government Information Service, Prime Minister's Office	2
Ministry of Finance and Economic Development	1
Ministry of Housing and Lands	1
Ministry of Foreign Affairs, Regional Integration and International Trade	1
Ministry of Education and Human Resources, Tertiary Education and Scientific Research	1
Ministry of Environment, Sustainable Development	2 (Director & PS)
National Disaster Risk Reduction and Management Centre (NDRRMC)	1 (Director)
Ministry of Local Government and Outer Islands	1
Waste Water Management Authority	1 (Director)
Mauritius Meteorological Service (MMS)	1 (Director)
Traffic Management and Road Safety Unit	1 (Director)
Water Resource Unit	1 (Director)
Forestry Department	1 (Conservator of Forest)
Special Mobile Force	1 (Ag Commanding Officer)
Police Department	1 (CP)
Road Development Authority (RDA)	2 (OIC & DGM)
National Development Unit	1
Central Water Authority	1 (General Manager)
Fire services	1 (Chief Fire Officer)
Staff of MPI	12 Mr J. M. Simonet, Senior Chief Executive Mr S. Ragen, Permanent Secretary Mrs M. Nathoo, Permanent Secretary Mrs Z. Auladin Auckburally, Deputy

Workshop	Opening Ceremony
	Permanent Secretary Mrs Z. Gaungoo, Assistant Permanent Secretary Mr V. Joysuree, Assistant Permanent Secretary Mr R. Emrith, Assistant Permanent Secretary Mr C. Arlanda, Assistant Permanent Secretary Dr J. Lallchand, Senior Adviser Mr Daniel Simpson, Adviser Mr P. Goburdhone, Adviser Mr Daniel Raymond, Road Safety Adviser
Members of the Press	20
Total	**55**

Workshop on Landslide Management

Organised by the

MINISTRY OF PUBLIC INFRASTRUCTURE AND LAND TRANSPORT (PI Division)

in collaboration with

Japan International Cooperation Agency (JICA)

Date: Wednesday 06 December 2017

Venue: Intercontinental Resort, Balaclava Fort, Balaclava

MC: Mr T. Parbhunath, Director, Civil Engineering and Mr K. Ichikawa, Chief Adviser, JET

Programme

09 00 hrs – 09 30 hrs	Registration/Welcome coffee
09 30 hrs – 09 35 hrs	Address by *Mr Parbhunath*, *Director, Civil Engineering* & *Mr Ichikawa, JICA Expert Team (JET)*
09 35 hrs – 09 40 hrs	Speech by Mr Murakami, Chief Representative of *JICA Madagascar*
09 40 hrs – 09 45 hrs	Keynote Address by *Hon. Nandcoomar Bodha, Minister of Public Infrastructure and Land Transport*
09 45 hrs – 09 50 hrs	Handing over ceremony and group photo with *His Excellency Mr Kato, the Ambassador of Japan*
09 50 hrs – 10 10 hrs	Coffee/Tea break
Workshop starts	**Presentations** by *Engineer/Senior Engineers* of *Landslide Management Unit:*
10 10 hrs – 10 30 hrs	**Debris flow at Batelage and Rock Fall at Signal Mountain by** *Mr S. P. Anadachee*
10 30 hrs – 10 45 hrs	**Countermeasure works in Chitrakoot and monitoring at Vallée Pitôt by** *Mr M. K. Mosaheb*
10 45 hrs – 11 00 hrs	**Slope stability at Quatre Soeurs, and Ruisseau des Créoles and Rock Fall at Macondé by** *Mr J. R. Damonsing*
11 00 hrs – 11 15 hrs	**General Assessment by of the Landslide Management Unit by** *Mr M. Gobin*
11 15 hrs – 11 35 hrs	**Manuals Usage and Explanations by** *Dr T. Iwasaki*, *JET*
11 35 hrs – 11 50 hrs	**Proposed Organisational structure of Geotechnical Engineering Office** by *Mr G. Bundhooa, Deputy Permanent Secretary, MPILT(PI Division)*
11 50 hrs – 13 10 hrs	Lunch
13 10 hrs – 13 30 hrs	**Role of Land Use Planning in Landslide Management, Relocation and Land Acquisition** I**ssue** by *Mr R. Soborun, Acting Principal Town and Country Planning Officer and Mrs D.Desvaux, Senior Surveyor, Ministry of Housing and Lands*
13 30 hrs – 13 50 hrs	**Emergency response** by *Mr H. Bissessur, Coordinator for Community Mobilisation and Local Community Support, Natural Disaster Risk Reduction and Management Centre*
13 50 hrs – 14 10 hrs	**Slope disaster** by *Mr M. Bhoyrag, Ag. Head, Public Infrastructure Division of the District Council of Savanne*
14 10 hrs – 14 30 hrs	**Sensitization materials and activities** by *Ms. H. Yoshida*, *JET*
14 30 hrs – 15 00 hrs	Coffee/Tea break
15 00 hrs – 15 30 hrs	**Q & A, Open discussion**
15 30 hrs – 15 35 hrs	**Closing speech** by *Mr T. Parbhunath, Director, Civil Engineering*

Appendix 3.6.3

Media coverage for workshop/seminar

Monday, December 18, 2017 Last Update: 5:50 AM

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[VIDEO] Comprendre et mieux gérer le glissement de t err ain

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Le ministère des Infrastructures Publiques en collaboration avec l'agence japonaise de coopération internationale, la JICA, organise un atelier de travail à Balaclava avec les différents partenaires sur la préparation aux catastrophes, les mouvements de terrain et leurs causes, et aussi comment se préparer pour mieux gérer un glissement de terrain a Maurice. Maurice bénéficie actuellement de l'expertise de JICA pour une meilleure compréhension de ce problème.

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