JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF URBAN DEVELOPMENT,

THE REPUBLIC OF ARMENIA

THE STUDY ON

LANDSLIDE DISASTER MANAGEMENT

IN THE REPUBLIC OF ARMENIA

FINAL REPORT

VOLUME-VI

SECTORAL REPORT – 2

- PILOT PROJECTS -

February 2006

KOKUSAI KOGYO CO., LTD.

NIPPON KOEI CO., LTD.

Composition of the Final Report

VOLUME	REPORT	LANGUAGE	MEDIA
Volume I :	SUMMARY	JAPANESE	Heard copy, Compact disk
Volume II :	SUMMARY	ARMENIAN	Heard copy, Compact disk
Volume III :	SUMMARY	ENGLISH	Heard copy, Compact disk
Volume IV :	MAIN REPORT	ENGLISH	Heard copy, Compact disk
Volume V :	SECTORAL REPORT-1 PRESENT CONDITIONS	ENGLISH	Compact disk
Volume VI :	SECTORAL REPORT-2 PILOT PROJECTS	ENGLISH	Compact disk
Volume VII :	SECTORAL REPORT-3 TECHNICAL BULLETIN With Landslide Map, Inventory	ARMENIAN/ENGLISH	Compact disk

Currency Exchange Rates Adopted for the Study

USD 1.00	=	AMD 455
AMD 1.00	=	JPY 0.26

November 2005

PREFACE

In response to a request from the Government of Armenia, the Government of Japan decided to conduct the Study on Landslide Disaster Management in the Republic of Armenia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected a study team headed by Mr. Satoru TSUKAMOTO of Kokusai Kogyo Co., Ltd. The study team was formed from Kokusai Kogyo Co., Ltd. and Nippon Koei. Co., Ltd. and was dispatched between March 2004 and December 2005.

In addition, JICA set up an advisory committee headed by Mr. Masayuki WATANABE. The advisory committee examined the study from technical points of view.

The team held discussions with the officials concerned of the Republic of Armenia and relevant personnel. The team members also conducted landslide inventory surveys of the whole territory and four pilot project sites. Upon returning to Japan, the team prepared this final report.

I hope that this report will contribute to the promotion of this master plan and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere application to the officials concerned of the Government of the Republic of Armenia for the close cooperation extended to the study.

February 2006

Ariyuki MATUMOTO
Deputy Vice President
Japan International Cooperation Agency

Mr. Ariyuki MATUMOTO

Deputy Vice President
Japan International Cooperation Agency (JICA)
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Sir,

It is with great pleasure that we submit to you the Final Report of the "The study on Landslide Disaster Management in the Republic of Armenia".

Because of the low precipitation in the Republic of Armenia, landslides are ordinarily stable. But in case of inappropriate surface and drainage water control, landslides can become active and cause losses to the inhabitants and endangering life. This kind of landslide capable of being stabilized by appropriate drainage works.

The heads of communities have a duty to secure the lives of inhabitants and protect community developments. But around 80% of communities have no investment budget and are unable to fulfill their obligations to the inhabitants. This report describes the technical and financial public assistance that are necessary to correct this situation. Landslide management that can be undertaken with the current abilities of communities (Community Based Approach) is efficient and practical.

Priority programmes of Armenian mountainous areas are "road, water supply, irrigation". And the overall goals of the programmes are poverty reduction. The study conducted pilot projects for which the overall goal is community development. The project's outputs are community infrastructure development that contribute to landslide mitigation and project resource acquisition (income generation). This report also described the activities of the pilot projects.

We believe that "technical materials containing landslide location map" will contribute to the planning of priority programmes for poverty reduction.

We wish to express our deep appreciation and gratitude to the personal concerned of your Agency, JICA, the Embassy of Japan in Moscow, the Ministry of Urban Development and other related authorities of the Republic of Armenia, Municipalities and Communities, and NGOs for the courtesies and cooperation extended to us during our Study.

Very truly yours,

February 2006

Satoru TUKAMOTO
Team Leader
The Study on Landslide Disaster
Management in the Republic of Armenia

LOCATION MAP OF THE STUDY AREA

THE STUDY ON
LANDSLIDE DISASTER MANAGEMENT
IN THE REPUBLIC OF ARMENIA
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Abbreviations

AMD	Armenian Drams
ARS	Armenian Rescue Service
ARC	Armenian Red Cross
ArmRIEE＆PC	Closed Joint Stock Company “Armenian Research Institute of Earthquake Engineering and Protection of Constructions
Bln	Billion
CBA	Community Based Approach
CU	Community Union
CB	Central Bank of the Republic of Armenia
CGC	Centre of Geodesy and Cartography
CIS	Commonwealth of Independent States
CJSC	Closed Joint Stock Company
CMI	Crisis Management Institute under EMA
CPI	Consumer Price Index
DCU	Dilijan Community Union
DEM	Digital Elevation Model
DfID	Department for International Development of Armenia Regional Development Programme under UK
ED	Emergency Department of the Government of the Republic of Armenia
EBRD	European Bank of Reconstruction & Development
EIA	Environmental Impact Assessment
EMA	Emergency Management Administration under the Government of the Republic of Armenia (EMA was changed the name to ARS in December 2005)
ESRI	Environmental Systems Research Institute, Inc.
GoA	Government of Armenia
GDP	Gross Domestic Product
GIS	Geographic Information System
GUI	Graphical User Interface
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit, German International Technical Corporation
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
IAEG	International Association for Engineering Geology and the Environment
ICU	Inter Community Union
IB	International Trading Bank of the Republic of Armenia
IDA	International Development Agency
IDB	Inter-American Development Bank
IFC	International Financial Community of the Republic of Armenia
IFRC	International Federation of Red Cross
IOM	International Organization of Migration under the Government
ISTD	International Scientific-Technical Center of the Republic of Armenia
IT	Information Technologies
IMF	International Monetary Fund

KCU	Kapan Community Union
masl	meters above sea level
MoA	Ministry of Agriculture of the Republic of Armenia
MoFA	Ministry of Foreign Affair of the Republic of Armenia
MoFE	Ministry of Finance and Economics of the Republic of Armenia
MoEP	Ministry of Environment Protection of the Republic of Armenia
MoTA	Ministry for Coordination of Territorial Administration and Infrastructure Operation
MoTC	Ministry of Transport and Communication of the Republic of Armenia
MoUD	Ministry of Urban Development of the Republic of Armenia
MoWSA	Ministry of Work and Social Affairs of the Republic of Armenia
Mln	Million
MTEF	Medium Term Expenditure Framework
NA	National Assembly of the Republic of Armenia
NAS	Armenian National Academy of Science
NASA	National Aeronautics and Space Administration (United States of America)
NATO	North Atlantic Treaty Organization
NGO	Nongovernmental Organization
NSS	National Statistical Service of the Republic of Armenia
NSSP	National Survey for Seismic Protection under the EMA
OECD	Organization for Economic Collaboration and Development
OJS	Open Joint Stock Company
PTA	Public Television of Armenia
PRA	Public Radio of Armenia
PRSP	Poverty Reduction Strategy Paper
PREDP	Poverty Reduction and Economic Development Plan
RA	Republic of Armenia
SAP	NGO “STABILITY AND PROGRESS”
SCJSC	State closed Joint Stock Company
SCREC	State Committee of the Real Estate Cadastre
SDC	Swiss Agency for Development and Cooperation
SNCO	State Non-Commercial Organization
SRTM	Space shuttle Rader Topographic Mission
SSTA	Social Service Territorial Agency
LANDSAT TM	LANDSAT Thematic Mapper
LSG	Local Self Government
USSR	Union of Soviet Socialist Republics
USA	United States of America
US$	United State Dollars
UN	United Nations
UNCHS	The United Nations Center for Human Settlements (habitat)
UNDP	United Nations Development Program
UNHCR	United Nations High Commission for Refugees
USAID	United States Agency for International Development
UTM	Universe Transverse Mercator
VAT	Value Added Tax

WB	World Bank
WHO	World Health Organization
WTO	World Trade Organization
YCA	Yerevan City Administration

Explanation of Terms

ARS/EMA: Armenian Rescue Service/ Emergency Management Administration under the Government of the Republic of Armenia

The EMA became a sub-organization of the Ministry of Territorial Administration in June 2005. EMA was renamed the ARS in December 2005.

CVM: Contingency Value Method

Method of estimating “Willingness to Pay (WTP)” using a questionnaire

Community Union

Armenian Community Law describes that the adjoining community can formulate "Inter-Community Union : ICU" based on mutual agreement

The DfID assists in the ICU formation. GTZ assists in the formation of CU as a temporary organization until the ICU is formed based on law. GTZ supports the communities' projects through CU.

Marz

RA is subdivided into 11 regions（Yerevan Privilege City and 10 Marz）Marzes are regional administrations of the central government. The regional administrations do not have the assembly, and the function of regional law formulation.

MEASUREMENT UNITS

Area

cm^2 ＝ square-centimeter(s) (1.0 cm x 1.0 cm)
m^2 ＝ square-meter(s) (1.0 m x 1.0 m)
km^2 ＝ square-kilometer(s) (1.0 Km x 1.0 km)
ha ＝ hectare(s) (10,000 m^2)

Volume

cm^3 ＝ cubic-centimeter(s) (1.0 cm x 1.0 cm x 1.0 cm)
m^3 ＝ cubic-meter(s) (1.0 m x 1.0 m x 1.0 m)
L ＝ Liter (1,000 cm^3)

Length

mm ＝ millimeter(s)
cm ＝ centimeters (cm ＝ 10 mm)
m ＝ meters (m＝ 100 cm)
km ＝ kilometers (km ＝ 1,000 m)

Weight

g ＝ gram(s)
kg ＝ kilogram(s) (1,000 g)
t ＝ metric ton(s) (1,000 kg)

Currency

USD ＝ United State Dollars
JPY ＝ Japanese Yen
AMD＝ Armenian Drams

Time

s ＝ second(s)
min ＝ minute(s) (60 s)
hr ＝ Hour(s) (60 hr)

CHAPTER-1 SELECTION OF PRIORITY PROJECT

1.1 Selection of Pilot / Priority Projects

Propose of the pilot projects is the verification and the improvement of the daft M/P.
When pilot/ priority projects were selected, the following selecting policy of the pilot/ priority project was made as follows.

Selecting policy of pilot/ priority project

- Priority projects are selected from highest priority rank 12 landslides: Damages are progressing with many and important risk objects.
- About the community related landslide, the ownership and the aggressiveness (motivation) of the object community were important as selecting point.
- About the interstate and interregional importance infrastructure related landslides, the jurisdiction organization (government or private company) basically decides priority.

The pilot/ priority projects were selected based on the above-mentioned policy are shown in Table 1.1.1.

Table 1.1.1 Selection of Pilot/ Priority Projects

No.	Landslide Name	Marz	Community/ settlement	Risk object large division		Selected landslide
				Community	Infra	
1	Kharbert	Ararat	Kharbert S.	Yes*1	-	-
2	Martuni	Gegharkunik	Martuni	Yes	-	Selected
3	Voghjaberd	Kotayk	Voghjaberd		Yes	-
4	Geghadir toxic waste	Kotayk	Geghadir	-	Yes	-
5	Karahunj	Syunik	Karahunj	Yes	-	-
6	Kapan-Harutyunyan	Syunik	Kapan/Harutyunyan Street	Yes	Yes	Selected
7	Odzon	Rory	M-6 Road, Tbilisi-Vanadzor Rail way	-	Yes	-
8	Haghartsin	Tavush	Ijevan-Yerevan Rail Way 69km	Yes	Yes	-
9	Gosh	Tavush	Gosh	Yes		Selected
10	Hovq	Tavush	M-5 Road 117 km	-	Yes	-
11	Martiros	Vayotsdzor	Martiros	Yes		-
12	Nubarashen Graveyard	Yerevan City	Nubarashen Graveyard	-	Yes	Selected*2

1* : It is a second house area and the comminute organization doesn't exist.
2* The landslide technology transfer is to be a main purpose.

1.2 Background of Selecting Landslides

Four (4) community and landslide sites were selected in consideration of the short project period of eight (8) month and the input of the Study Team members. They were selected from 12 landslide sites with the highest priority evaluated in the inventory survey of phase I. Purposes and activities of each pilot projects are shown in Table 1.2.1

(1) Gosh Community, Tavush Marz

- This is selected as representative of a village-type community landslide.
- There is an extremely active landslide that may cause causalities. This is appropriate as a pilot for crises management.
- The following community initiative activities have already been undertaken:

In Soviet times – Subbotnik on Saturday of every year in April involved action for village cleaning

Sometimes people participated in reconstruction of internal roads as free work.

- The experience transferred to the vicinity of communities and small-scale countermeasure accounting was secured by using an existing Dilijan community union organization.
- There are many landslides in the Tavush Martz and some effect on them by the exhibition is hoped.

(2) Martuni Community, Gegharkunik Marz

- This is selected as representative of a village-type community landslide.
- The following community initiative activities have already been undertaken:

Reconstruction of destroyed houses, construction of detour road in village

- There are several landslides in the vicinity of the area and it is hoped there will be some effect on them due to the exhibition.

(3) Kapan Community (Harutyunyan Street Landslide), Syunik Marz

- This is selected as representative of a city-type community landslide.
- It is preferable to treat the landslide problems in relation to an urban development plan.
- Kapan city people show a keen interest in this project, and have shown some initiative.
- The following initiative activities have already been undertaken:

Organized cleaning of territory once every month, reconstructed part of irrigation network, connected drinking water pipeline to water sources (for some families)

- There are many landslides in Kapan city and surroundings and the effect of the exhibition on them is hoped.

(4) Nubarashen Grave Yard Landslide, Yerevan City

-The selection criteria for the Nubarashen Grave Yard landslide differed from that of the first three above. They were selected to implement landslide countermeasures on their

own initiative but this latter site was selected to clarify a specific countermeasure technology (even though all four are intended to lead and encourage other communities).

- This is selected as representative of active landslide zones widely distributed in the southeast of the capital/ Yerevan City and vicinity area of Ararat and Kotayk Marz. This landslide zone has been active for 15 years, and is an important place for development of capital areas.
- It is useful for similar type landslides to clarify the characteristics and treatment methods for the problem soils, which are widely distributed around the Nubarashen graveyard landslides.
- The project can play a pilot role for the same landslides types by clarifying effective countermeasures and management methods to combat them.

Table 1.2.1 Selection Criteria for Community Initiative Pilot Project Site and Their Result

	Community	Marz	Communities feature	Magnitude of damage		Communities self-reliance effort & Sustainability						Total
				Infrastructure &Transportation	Buildings	Leadership	Possibility of commitment/ solidarity	Cooperation request to the outside	Presence of community union	Population growth	Other consideration matters	
1	Kharbert	Ararat	Almost houses are summer houses	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
2	Martuni	Gegharkunik		severe 1 point	very severe 2 point	very good 2 point	very good 3 point	good 1 point	bad 0 point	very good 2 point		11 point
3	Voghjaberd	Kotayk	All village resettlement execution by MoUD	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
4	Geghadir Toxic waste	Kotayk	None Community	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
5	Odzun	Lori	Risk object is railway and road	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
6	Karahunj	Syunik		severe 1 point	very severe 2 point	good 1 point	good 2 point	very good 2 point	bad 0 point	bad 0 point		8 point
7	Kapan, Harutyunyan	Syunik		severe 1 point	very severe 2 point	good 1 point	very good 3 point	very good 2 point	good 1 point	good 1 point	The first priority place of Kapan city	11 point
8	Haghartsin	Tavush	Ijevan-Hrazdan railroad 69 km)	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
9	Gosh	"		very severe 2 point	very severe 2 point	very good 2 point	good 1 point	very good 2 point	good 1 point	very good 2 point		12 point
10	Hovq	Tavush	Consultation committee is not yet established by MoTC	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A
11	Martiros	Ditto		very severe 2 point	very severe 2 point	good 1 point	good 2 point	good 1 point	bad 0 point	very good 2 point		10 point
12	Nubarashen	Yerevan City	Action method clarification			N/A	N/A	N/A	N/A	N/A		N/A

very good/very severe 2 point, good/ severe 1 point, medium or bad 0 point. However, considering of emphasize of 'possibility of commitment', very good 3 point good 2point
N/A: Not applicable

CHAPTER-2 OUTLINE OF THE PILOT PROJECTS

2.1 Outline of the Pilot Projects

2.1.1 Purpose of Pilot Projects

Purposes of pilot projects are follows.

a. Execution of part of draft M/P, inspect of its validity, and improvement of M/P.
b. Exhibition effect as model project of landslide management of RA.
c. Technology transfer to concerned people

2.1.2 Targets and Activities of the Pilot Projects

In the pilot projects, the priority projects in the following four places selected by the second phase are executed. Moreover, the publication of newsletter and the technology bulletin was published.

a. Kapan city Haltunyan street landslide/ Syunik Marts
b. Gosh village landslide/ Tavush Martz
c. Martuni village landslide/ Gegharkunik Marts
d. Yereban City Nubarashen/ Arinberd cemetery landslide

The purpose and the content of each pilot project are shown in Table 2.1.1
The activities of the pilot projects are shown in Table 2.1.2

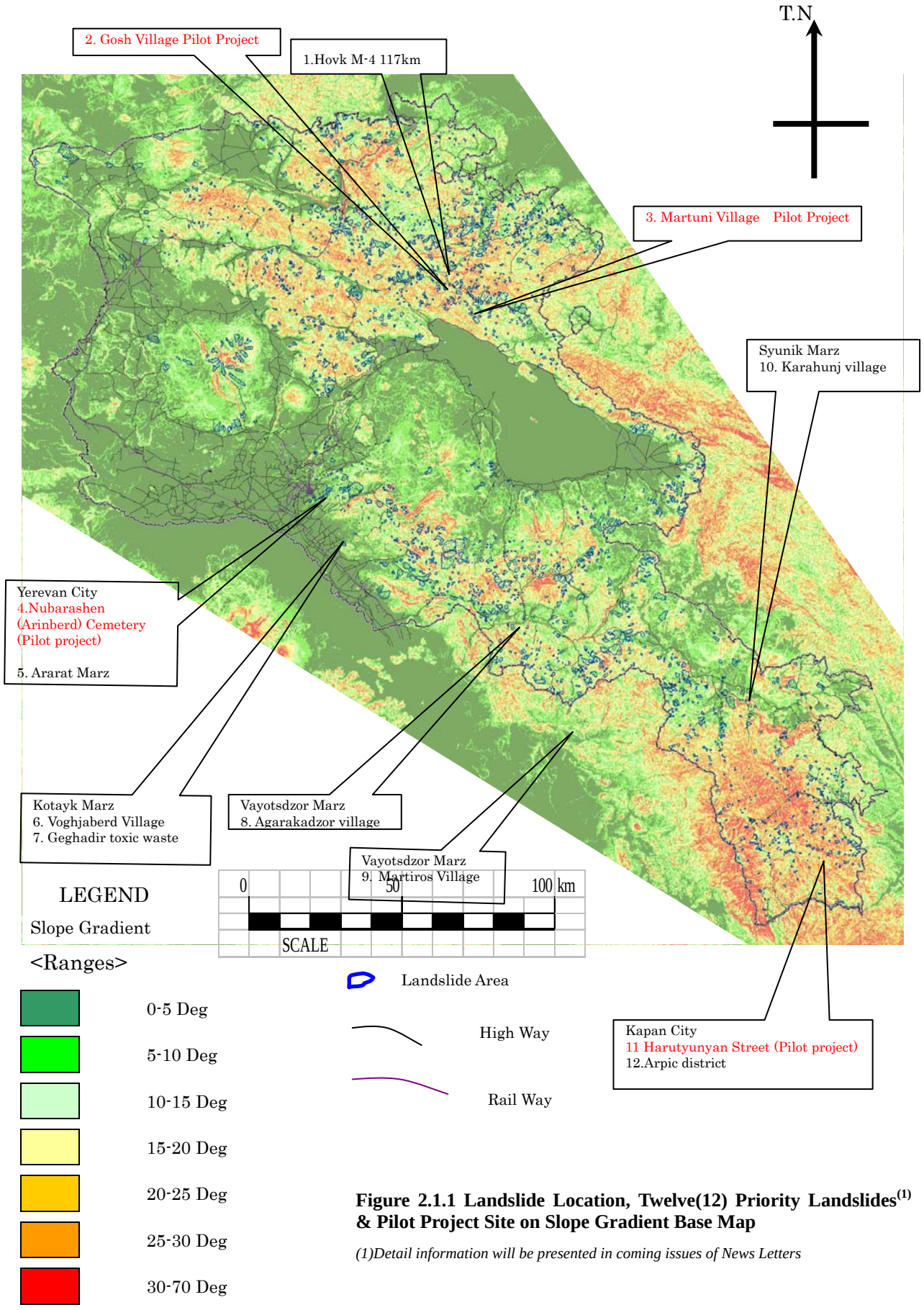


Figure 2.1.1 Landslide Location, Twelve(12) Priority Landslides[(1)] & Pilot Project Site on Slope Gradient Base Map

(1)Detail information will be presented in coming issues of News Letters

Table 2.1.1 (1/2) Target and Activities of Site Pilot Projects

	Name	Actor/community	Project purpose*/ output	Verification item	Study Team activity, Technology offer	Activity by MoUD	Associated activity by study team and communities	Activity by communities/community union	Technology transfer items	Main actor of small scale measure work	Advisory committee**
1	Syunik/ Kapan (Harutyunyan)	Kapan City	(1) (City type) /Concept planning of landslide management and urban infrastructure improving	Possibility of self-help activity, possibility of landslide management policy taking-in to urban infrastructure improving	Hazard mapping, Recommendation for landslide countermeasure and management, ground investigation	Discussion matters	Risk mapping, simple monitoring	Concept planning of landslide management and urban infrastructure improving	Scientific knowledge of concerned landslide, monitoring technology, countermeasure and management basic principle, integrated plan technology	-	Kapan Pilot Project Advisory committee Advice and evaluation
2	Tavush/ Gosh	Gosh Village	(1) (Village type) /Concept planning of Landslide management and village infrastructure improving, execution of part of the plan	Effectively of self-help activity,possibility of landslide management policy taking-in to village infrastructure improving	Ditto, planning of small scale countermeasure work	Discussion matters	Ditto	Concept planning of landslide management and village infrastructure improving, small-scale countermeasure works, experience transfer to vicinity Comminute	Ditto, small scale measure works implementation technology	Dilijian Community Union	Gosh/ Martuni Pilot Project Advisory committee Advice and evaluation
3	Gegharkunik/ Martuni	Martuni Village	Ditto	Ditto	Ditto	Discussion matters	Ditto	Ditto	Ditto	Martuni Village	
4	Yerevan City/ Nubarashen Graveyard	Yerevan City	(2) Technological document creation of mechanism and countermeasures about concerned landslide	Effective handling technology	Hazard mapping, technological document creation of mechanism and countermeasures about concerned landslide, ground investigation	Discussion matters	-	-	Scientific knowledge of concerned landslide, monitoring technology, countermeasure and management basic principle	-	Nubarashen Graveyard Pilot Project Advisory committee Advice and evaluation

Table 2.1.1 (2/2) Target and Activities of Site Pilot Projects

	Name	Actor/community	Project purpose*/ output	Verification item	Study Team activity, Technology offer	Activity by MoUD	Associated activity by study team and communities	Activity by communities/community union	Technology transfer items	Main actor of small scale measure work	Advisory committee**
	Information Exchange	MoUD	Training-up of experts	Effectiveness	1.Publication of technology magazine (Associated activity of study team and MoUD)						
			Enlightenment to residents	Effectiveness	2.Publication of newsletter to all stakeholders Planning and edit in the first half (study team and MoUD) and in the latter half Activity by Dilijan Community Union supported with the advisory committee						

Project purpose*

(1) The pilot project can be used for improving the communities' voluntary landslide measure and management.

(2) The pilot project can be used for the same landslide types by clarifying effective countermeasures and management against a landslide type.

Advisory committee**

The member should be the study team, MoUD, Marzpetaran, ARS , respectively. Regarding (3), Nubarashen Graveyard PP Advisory Committee, NAS and the university person should be added as the member

Table 2.1.2 Content of the Pilot Projects

Activity body	Activates	
	Large division	Items
JICA study team	Preparation	Preparation of workshop & meeting offices The local staff's employment and training
		Conference on community, Marz, Community union, and urban MoUD (activities of project and schedule)
		Establishment and holding of advisory committee
Community initiative activity	plan making and execution of some part	Target, activity and necessity discussion of pilot project
		Concept planning landslide management and community infrastructure development
		Environmental evaluation for pilot project
		Landslide monitoring
		Establishment of landslide management and infrastructure improvement management system, and trial
		Simple countermeasure work
		Experience sharing
	Project evaluation	Objectively verifiable indicators, and verification method setting
		Initial value measurement of objectively verifiable indicators
		Project end comments on current events value
Joint activity of community and study team	Risk resource assessment	Risk & resource mapping and assessment
Study team activity （with subcontractors, assistants） （with assistant）	Investigation and support for plan making and execution	Comminutes structure investigation
		Topographic survey
		Geophysical prospecting
		Installing of landslide monitoring
		GPS points measurement
		Investigation drilling and in-site tests
		Laboratory soil test
		Water quality test（Gosh and Martuni village）
		Horizontal drainage boring（Gosh and Martuni village）
		Hazard mapping
Advisory committee activity (Study team, Marz, ARS, community union, International organization, donors ）	Information service, technical transfer	Technology transfer
		Recommendation of simple countermeasure work（Gosh and Martuni village）
		Publication of news letter
		Publication of technical bulletin
		Support for experience sharing
		Presentation seminar

2.2 Participatory Workshop, Seminars, Study Tour

(1) Outline

Pilot projects activities were held according to the schedule of the figure 2.2.2. Almost these activities were held as participatory workshops (working committee, advisory committee, general assembly, risk resource mapping, joints works of landslide

monitoring, simple countermeasure works).

And seminars, study tours were also held for experience shearing

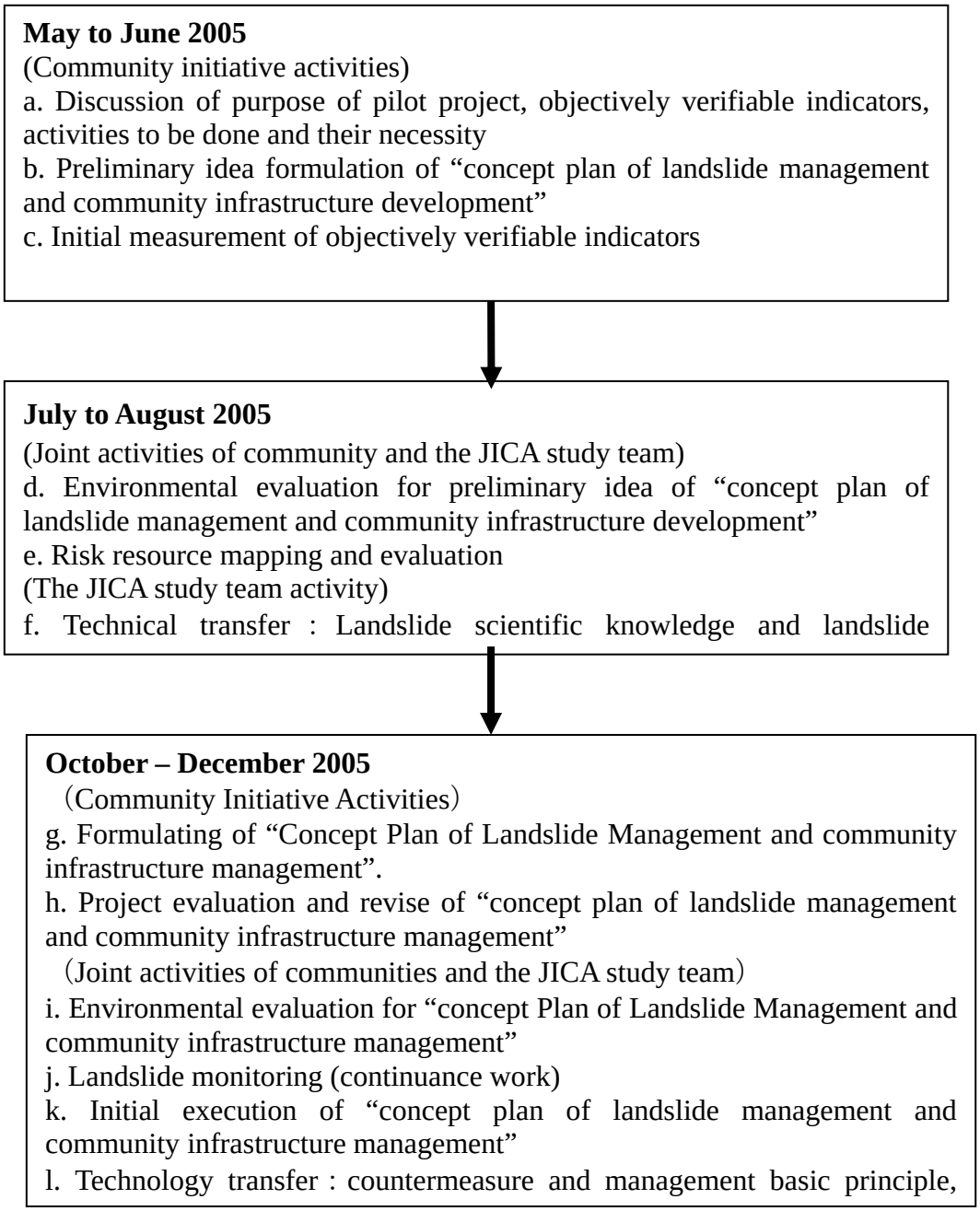


Figure 2.2.2 Work Shop Activities

(a) May to June 2005

1) Community initiative activities

a. Discussion of purpose of pilot project, objectively verifiable indicators, activities to be done and their necessity

Especially, necessity of community initiative was emphatically discussed.

b. Preliminary idea formulation of “concept plan of landslide management and community infrastructure development”

・The issues and necessary investigation items were examined.

・The improvement idea of the organization and the system were examined.

c. Initial measurement of objectively verifiable indicators

Workshop facilitator or the assistant executed them.

(b) July to August 2005

1) Joint activities of community and the JICA study team

d. Environmental evaluation for preliminary idea of “concept plan of landslide management and community infrastructure development”

At advisory committee in the second half of August, advisory member advised to community’s idea. The advisory committees correspond to stake holder meeting shown in “JICA Guidelines for Environmental and Social Considerations (2004)”

JICA study team conducted water quality tests (standards items for drinking and irrigation in RA) of spring water by subcontract before stating of simple countermeasure work.

e. Risk resource mapping and evaluation

Mapping items are risk objects (e.g. buildings and infrastructures) with damage level, land uses, springs.

2) JICA study team activities

f. Technical transfer：Landslide scientific knowledge and landslide monitoring

Transfer items were follows;

Results of landslide inventory survey in 2004 by JICA study team.
Water condition and landslide stability using landslide physical model
Installment of simple movable beams
Instruction and joint works of landslide monitoring method (excluding the GPS signposts) to communities' member

(c) September to December 2005

1) Community initiative activities

g. Formulating of "Concept Plan of Landslide Management and community infrastructure management".

The system and organization of landslide management in communities were also examined.

h. Project evaluation and revised of "concept plan of landslide management and community infrastructure management".

The communities evaluated the objectively verifiable indicators of project purpose. Moreover, the overalls goal of the projects and "concept plan of landslide management and community infrastructure management" was reviewed.

2) Joint activities of community and the JICA study team

i. Environmental evaluation for "concept Plan of Landslide Management and community infrastructure management"

JICA study team conducted water quality tests (standards items for drinking and irrigation in RA) of horizontal drainage boring water and spring water by subcontract after simple countermeasure work is completed.

j. Landslide monitoring (continuance work)

k. Initial execution of "concept plan of landslide management and community infrastructure management"

The following item were discussed and conducted.

- Simple counter measure works（Gosh and Martuni village）
-Regular check and maintenance activity of community infrastructure

- Landslide movement monitoring and early warning system

l. Technical transfer

Transfer items were follows: landslide management basic principle, integrated plan technology, appropriate technology for community initiative landslide management （technology of simple counter measure works）

m. Experience sheering of pilot projects

The seminars for experience sharing of pilot projects were done

- Seminar workshop in Yerevan, 29th September

Parties concerned of four (4) pilot projects were participated (total 68 persons).

- Seminar workshop in Dilijan, 25th November

Presentation from the Gosh Pilot projects working commission, 4 communities in Tavush Marz are participate (total 14 persons)

- Seminar workshop in Gavar, 5th December

Presentation from the Martuni Pilot projects working commission, 6 communities in Gegharkouniq Marz are participate (total 25 persons)

- Study Tour in Yerevan, 17th August

Concerned persons Erebuni community in Yerevan City were participate (total 12 persons)

- Study Tour in Martuni, 5th December

2.3 Concept Planning of Landslide Management and Infrastructure Development

Based on the predicted mechanism of landslide, countermeasures to mitigate its impacts were planned taking into consideration the condition of the country (economy, skills level and so on).

Based on the forecast mechanism of landslides, countermeasures were recommended.
The JICA study team supported the execution of the simple countermeasures in the Gosh village and the Martuni village.

2.4 Topographic Survey, Geotechnical Investigation and Risk Resource Evaluation

2.4.1 Topographic Survey (Work Supported by Local Consultant)

Topographic surveys for the area of the pilot projects were carried out. Table 2.4.1

shows the detailed survey area and work quantity

Table 2.4.1 Topographic Survey

Item	Unit	Quantity				
Pilot Project Name		Kapan Harutyunyan	Gosh	Martuni	Yerevan Nubarashen cemetery	Total
Section Survey Scale S=1:1,000	Line	3	3	3	2	11
	k m	1.22	2.17	3.06	2.98	9.43
Area Survey Scale S=1:1,000	ha	33	52	165	206	456
Compilation of Map（S= 1:5,000）and digital elevation model (2m mesh)	ha	33	208	2,843	271	2,995

2.4.2 Field Survey, Hazard Mapping

Surface information items on landslide disasters were collected during the field survey include the following:

Results of the survey were compiled into hazard maps. Hazard map were reviewed based on further information obtained during later geophysical prospecting or boring.

Table 2.4.2 Observation Phenomena of hazard mapping

Category	Observation phenomena
Topographic Symptoms	Scarp, Crack, Head, Ridge, Bulge, Collapse etc.
Geology	Lithology, Foliation, Weathering, Alteration, Component of Lithic Materials, Size of grains, Sorting, Humidity, etc.
Damage of Construction	Crack, Bending, Dimension and Intensity of Stress
Others	Planting, Seepage, Deformation of trees

2.4.3 Geophysical and Ground Water Prospecting (Work Supported by Local Contractor)

Geophysical and ground water prospecting for the pilot project was carried out at the selected sites. The survey was comprise the following:

Table 2.4.2 Geophysical Prospecting

Item	Unit	Quantity				
		Kapan Harutyunyan	Gosh	Martuni	Yerevan Nubarashen cemetery	Total
Seismic sectional prospecting Sensor interval 2 meter	Line	3	0	0	0	3
	meter	1,220	0	0	0	1.22
Electrical sectional prospecting	Line	0	3	3	2	8
Sensor interval 2 meter	meter	0	2.17	3.06	2.98	8.21
Ground water prospecting	hole	0	2	2	3	7

2.4.4 Boring survey and Soil Tests (Work Supported by Local Contractor)

A boring survey and soil tests for the pilot project was carried out at the four pilot projects sites. After the investigation result was analyzed, the horizontal drainage boring hole was constructed in an appropriate site in the Gosh and the Martuni village. This investigation and construction are supported by a local contracture. A set of Japanese drilling machine set into the Martuni village, and was execute technical transfer of drilling.

The proposed work items and quantities are presented in Table 2.5.3:

Table 2.4.3 Work Item and Quantity of Boring Survey

Item and Specification	Unit	Quantity				
		Kapan Harutyunyan	Gosh	Martuni	Yerevan Nubarashen cemetery	Total
All-core Drilling 66 mm Diameter (Installation of Pipe Strain Gauge or Borehole Inclinometer)	Hole	3	2	2	3	9
	meter	18,16,15	35,50	50,30	20,36,33	350
None-core Drilling 66 mm、 (Installation of Perforated Pipe for Observation of Ground Water)	Hole	2	2	2	2	9
	meter	27,10	12,38	37,15	20,15	210
Standard Penetration Test (1m in the depth direction is executed in no core bore hole.)	Numbers of tests	14	50	26	34	210
Horizontal Drainage Boring	Site	0	2	2	0	4
	meter	0	400	400	0	800
Dynamic Cone Penetration Tests	Numbers of Test	0	10	10	10	30

Table 2.4.4 Work Item and Quantity of Laboratory Soil Test

Item and Specification	Unit	Quantity				
		Kapan Harutyunyan	Gosh	Martuni	Yerevan Nubarashen cemetery	Total
Specific Gravity	Numbers of Tests	5	7	8	10	30
Moisture Content	Numbers of Tests	5	7	8	10	30
Atterberg Limit	Numbers of Tests	5	7	8	10	30
Grain Size Analysis (Sieve and Hydrometer)	Numbers of Tests	0	3	4	5	12
Dispersive Characteristics (Double Hydrometer Analysis) ASTM D4221-91	Numbers of Tests	0	3	4	5	12
X-ray analysis of clay mineral	Test	0	3	4	5	12
ESP: Exchangeable Sodium Percentage	Test	0	3	4	5	12

2.4.5 Installation of Landslide Monitoring Equipment

Some sets of the landslide monitoring equipment were installed to monitor landslide behavior.

Some simple movable beams, a relatively simple piece of equipment for monitoring, was also be installed to test the general use of equipment.

Table 2.4.5 Work Item and Quantity of Landslide Monitoring

Item and Specification	Unit	Quantity				
		Kapan Harutyunyan	Gosh	Martuni	Yerevan Nubarashen cemetery	Total
Extension Meter Installation	Numbers	5	10	5	0	20
Rain Gauge Installation	Numbers	1	1	1	0	3
GPS Movable Points Installation	Numbers	0	20	0	0	40
Borehole Water Pressure Gauge Installation	Holes	2	2	2	3	7
Pipe Strain Gauge Installation	Holes	3	1	0	3	7
Guide Pipe of Pipe Strain Gauge Installation	Holes	0	1	2	0	3
Movable Wooden Beam Installation （by Community）	Numbers	4	12	3	6	25

2.4.6 Analysis of Results of Monitoring and Landslide Mechanism

Based on the results of the above-mentioned surveys, landslide stability analysis and mechanism analysis were carried out. Items of analysis included the following:

- Characteristics of topography and geology
- Factors that induce landslides
- Prediction of future movement likely to result in landslide disasters

2.4.7 Risk & Resource Evaluation

Community and the Study Team jointly investigate the existing damage situation on the landslide-land, and the risk object within the existing and future assumed hazard area.

Community and the Study Team also did mapping of resource (include agricultural land, existing infrastructure, springs and other objects which contribute community development).

Working committee recognizes the risk and the resource based on this map, and makes “concept plane of landslide management and infrastructure development”.

CHAPTER-3 RESULT OUTLINE OF PROJECTS

3.1 Mutual Agreement at Project Stating and Project Design

3.1.1 Mutual Agreement at Pilot Project Start

The mutual agreements when the pilot project began were shown in Table 3.1.1.

3.1.2 Projects Design

The projects design includes, the output and outcome to be expected, objectively verifiable indicators, and inputs and activities by communities. The study team and communities discussed and revised several times.

The latest project design matrixes are shown in Table 3.1.2-Table 3.1.5.

Table 3.1.1 Mutual Agreement at Pilot Project Entrance

<table>
<tr><td>Item</td><td>Gosh Village in Tavush Marz Pilot Project</td><td>Martuni Village in Gegharkunik Marz Pilot Project</td><td>Kapan City Harutyunyan Street Landslide Pilot Project</td><td>Yerevan City Nubarashen (Arinberd) Cemetery Landslide</td></tr>
<tr><td>Purpose</td><td colspan="3">Initiation of long-lasting efforts for integrated management of the landslide by the inhabitant themselves.
Transference or dissemination of their experiences for the landslide management to other communities that are suffered from landslide disasters.</td><td>Accumulation of knowledge and know-how on peculiar landslide concentration area where is important for urban development.</td></tr>
<tr><td rowspan="3">Activities to be carried by the JICA study team and MoUD</td><td colspan="4">Scientific research on landslides by the JICA study team
Hazard mapping by the JICA study team and the MoUD
Satellite image analysis on landslides by the MoUD</td></tr>
<tr><td colspan="2">(4) Movable point monitoring by the JICA study team</td><td colspan="2">(4) Movable point monitoring by the MoUD</td></tr>
<tr><td colspan="3">(5)Supporting of the community’s landslide management by the JICA study team and MoUD</td><td></td></tr>
<tr><td>All of parties concerned' joint execution</td><td colspan="4">(6)Distribution of the information on the results of the project to other similar landslide region in Armenia</td></tr>
<tr><td>Preconditions for the implementation of the simple landslide counter measures</td><td colspan="2">Details of simple landslide countermeasure plan(The plan) shall be submitted by the chief of the community
The plan shall be considered as a part of the landslide management within the conceptual development plan of the village
The plan has to be created through participation of the inhabitants of the community, representing the predominant inhabitants’ wishes.</td><td colspan="2">Counter measures doesn't execute in the pilot project.</td></tr>
<tr><td>Signer of this agreement</td><td>-Gosh Village
-The JICA study team
-The MoUD
-Tavush Marz
-Dilijan community Union</td><td>-Martuni Village
-The JICA study team
-The MoUD
-Gegharkunik Marz</td><td>-Kapan City
-The JICA study team
-The MoUD
-Syunik Marz
-Dilijan community Union</td><td>-Yerevan City
-The JICA study team
-The MoUD</td></tr>
<tr><td>Date</td><td>June 1, 2005</td><td>June 2, 2005</td><td>June 3, 2005</td><td>June 6, 2005</td></tr>
</table>

Table 3.1.2 Project Design Matrix (PDM) for Gosh Village Landslide

Narrative Summary	Objectively Verifiable Indicators	Verification Methods	Important Assumptions
Overall Goal Villager's revenue growth, as an effect of community initiative landslide management and community infrastructure development	New building construction on landslide countermeasures and infrastructure development area An increase in earnings and number of employers	Annual report of community	Government and other donor's support for community initiative activity
Project Purposes a. Community life circumstance improvement b. Risk reduction c. Risk avoidance of casualty	a. Reduction of muddy area on dwelling surroundings and road b. Reduction of damage progress c. No causality	a. Record of hodograph b. Record of landslide monitoring c. Annual record of community	Community members participation
Output a. Concept plan of landslide management and infrastructure development b. Inter community road drainage c. Intercept duct in active landslide block d. Establishment of landslide monitoring and alarm system e. Establishment of organization of community infrastructure maintenance	a. Plan itself b. Length of road drainage c. Length of intercept duct d. System itself e. Organization itself	a. Plan and it's making record b. c Record of simple counter measure works d. Record of system activity e. Record of organization activity	Community member's voluntary acts "The concept plan of landslide management and infrastructure development" has to be created through participation of the inhabitants of the community, representing the predominant inhabitants' wishes.
Activities **JICA Study tam** Hazard mapping Advisory activity **MoUD** Technical advice **Joint activity** Risk resource evaluation **Activity of Gosh village** Working commission activities Concept planning of landslide management and infrastructure development Labor for road drainage and interceptor duct	**Input from JICA** Man power Working commission member Study team members 1-2 persons Study team assistant 1 person Machine Landslide monitoring equipment Local subcontract work expense Topographic survey Geotechnical investigation Installation of landslide monitoring Materials, construction machines and other support for simple countermeasure work **Input from RA** **MoUD** Advisory committee Geomorphologic investigation (subcontract expense) **Gosh Villager** Risk resource mapping Simple counter measures labor（AMD 1200/day）		**Preconditions** Villager's will of self-help effort

Table 3.1.3 Project Design Matrix (PDM) for Martuni Village Landslide

Narrative Summary	Objectively Verifiable Indicators	Verification Methods	Important Assumptions
Overall Goal Villager's revenue growth, as an effect of community initiative landslide management and community infrastructure development	New production establishment by using the existing buildings in landslide countermeasure and infrastructure development area Establishing of agricultural products market Reduction of migration and increase of village population An increase in earnings and number of employers	Annual report of community	Government and other donor's support for community initiative activity
Project Purposes a. Community life circumstance improvement b Risk reduction c. Risk avoidance of casualty	a Reduction of muddy area on dwelling surroundings and road b. Reduction of damage progress c. No causality	a. Record of hodograph b. Record of landslide monitoring c. Annual record of community	Community members participation
Output a. Concept plan of landslide management and infrastructure development b. Inter community road drainage c. Establishment of landslide monitoring and alarm system d. Establishment of organization of project proposal preparation and search and attraction of donor organizations e. Establishment of organization of community infrastructure maintenance	a. Plan itself b. Length of road drainage c. System itself d. Organization itself (based on the core of Working Commission, already established in the village)	a. Plan and it's making record b. c Record of simple counter measure works d. Record of system activity e. Record of organization activity	Community member's voluntary acts "The concept plan of landslide management and infrastructure development" has to be created through participation of the inhabitants of the community, representing the predominant inhabitants' wishes.
Activities **JICA Study tam** Hazard mapping Advisory activity **MoUD** Technical advice **Joint activity** Risk resource evaluation **Activity of Martuni village** Working commission activities Concept planning of landslide management and infrastructure development Labor for road drainage and interceptor duct	**Input from JICA** Man power Working commission member Study team members 1−2 persons Study team assistant 1 person Machine Landslide monitoring equipment Local subcontract work expense Topographic survey Geotechnical investigation Installation of landslide monitoring Materials, construction machines and other support for simple countermeasure work **Input from RA** **MoUD** Advisory committee Geomorphologic investigation (subcontract expense) **Martuni Villager** Risk resource mapping Simple counter measures labor（AMD 1200/day）		**Preconditions** Villager's will of self-help effort

Table 3.1.4 Project Design Matrix (PDM) for Kapan Harutyunyan Street Landslide

Narrative Summary	Objectively Verifiable Indicators	Verification Methods	Important Assumptions
Overall Goal a. Safe and comfortable traffic of the Harutyunyan street b. Improvement of spectacle by recovery of vegetation	a. Soil flow will not reach the Harutyunyan street. b. Ratio on bare ground	Record of district Photograph	Government and other donor's support for community initiative activity
Project Purposes The measures policy is settled on.	Decision existence of measures policy	Presence of measures policy	The measures policy is discussed by the person's related to Kapan city participation.
Outputs a. Concept plan of landslide management and infrastructure development b. Establishment of landslide monitoring and alarm system c. Establishment of organization of community infrastructure maintenance	a. plane itself b. system itself c. Repair and cleaning length of the existing drain worker etc.	a. Plan and it's making record b. Record of system activity c. Record of organization activity	Community member's voluntary acts
Activities **By JICA** Hazard mapping **By MoUD** Satellite image analysis, GPS point monitoring **By Kapan city** Landslide monitoring by Kapan City or related organization Working commission activities Concept planning of landslide management and infrastructure development	**Inputs from JICA** Landslide specialist **Machineries and Materials:** (Boring machine) **Subcontract costs** Topographic survey Geotechnical investigation (survey boring, electric prospecting, monitoring device installation and so on) **Inputs from Armenian side** **From MoUD:** **Subcontract costs** Satellite image analysis, GPS point monitoring **From Kapan city:** Risk resource mapping		**Preconditions** Concerns person's participation to the pilot project.

Table 3.1.5 Project Design Matrix (PDM) for Nubarashen Cemetery Landslide

Narrative Summary	Objectively Verifiable Indicators	Verification Methods	Important Assumptions
Overall Goal The knowledge and appropriate technologies for the similar type of landslides are reflected in urban/ regional development plane.	Applied number of this study's outputs to the similar landslides	Plan for urban/ regional development plan in Yerevan city, Kotayk and Ararat Marz.	No big changes of organization of Yerevan City
Project Purposes Formulating knowledge management about the technology for the similar type of landslides of Yerevan City's south-east are among concerned organization and engineer.	Recognition level for information on appropriate technology for the similar types of landslides. (Publishing technology magazines, news letters, seminars)	Answer to questioner of the technical magazine, news letter, and seminar.	The information service is done to parties concerned of the Yereban City and others.
Outputs A: Results of topographical and geological survey B: Monitoring technology transfer C: Technology materials related to the mechanism and technology for this type of landslides	Making existence of outputs of the left cell	Reports of this study Technical magazine, news letter, seminar material and record	Ditto to above cell
Activities **By JICA** Report on analysis of mechanism and countermeasures for the landslides **By MoUD** Satellite image analysis, GPS point monitoring **By Yerevan city** Landslide monitoring by Yerevan City bureau for citizens special services Creation of "Yerevan City master plan "that uses geotechnical investigation result of this pilot project. Maintenance planning of "Nubarashen cemetery" that uses geotechnical investigation result of this pilot project	**Inputs from JICA** Landslide specialist **Machineries and Materials:** (Boring machine) **Subcontract costs** Topographic survey Ground investigation (survey boring, electric prospecting, monitoring device installation and so on) **Inputs from Armenian side** **From MoUD:** **Subcontract costs** Satellite image analysis, GPS point monitoring **From Yerevan city:** Engineers in charge of landslide monitoring		**Preconditions** Concerns person's participation to the pilot project.

3.2 Promotion Method of Community Initiative

3.2.1 Community Initiative Activity and There Support System

Figure 3.2.1 shows flow chart of pilot project to which community initiative is esteemed

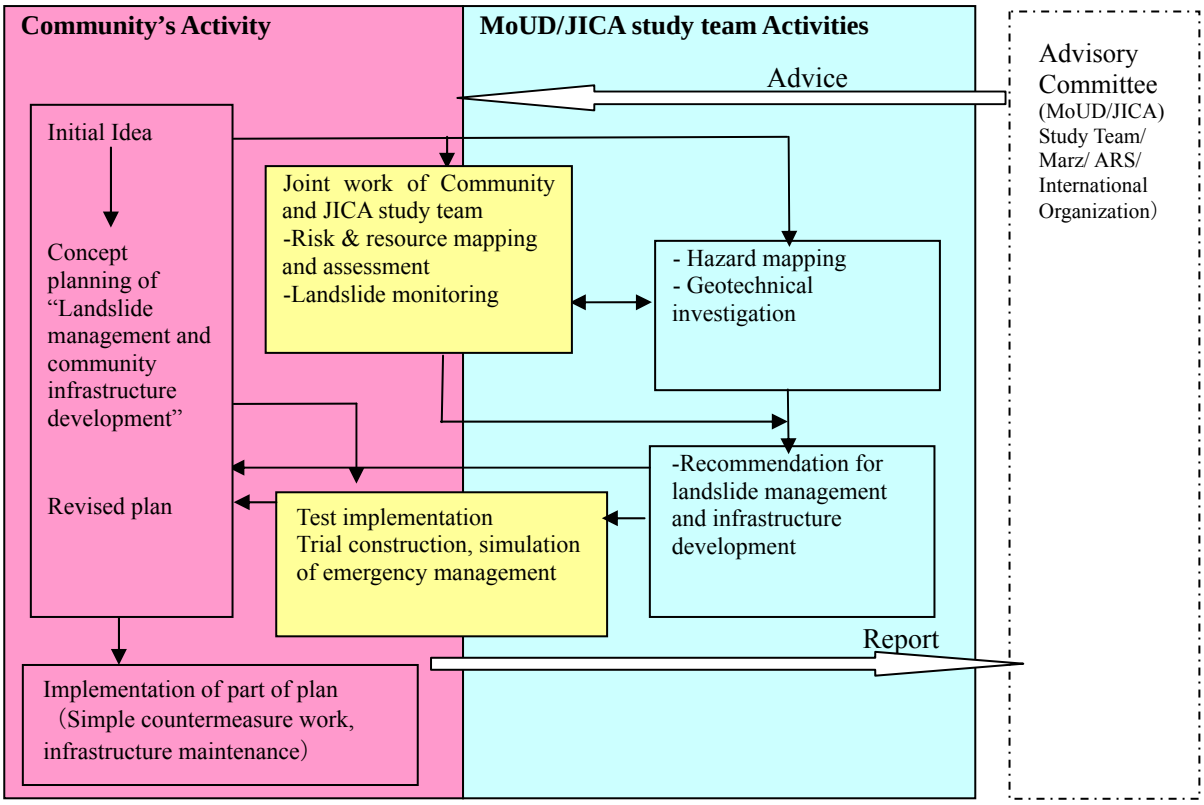


Figure 3.2.1 Flow Chart of Pilot Project to Which Community Initiative is Esteemed

3.2.2 Community Social Structure Survey

Community social structure survey was executed for the execution of the pilot project according to a social situation of community. The content of the survey is the following.

-Situation of organization

-Economy condition

-Culture

-Interpersonal relationship

-Needs of community member

3.2.3 Formation of organizations for Pilot Projects

(1) Execution organization (working commission)

Working commission was organized as a system that the pilot project executed.

(a) Working commission for village type（Gosh village, Martuni village）
Chief of village was not including of the working commission member. The aim of it is to make environment that various opinions come out easily.

Selection procedure of working commission was follows;

Study team made interview to the villagers and extracted persons who have consciousness of landslide and village development as a tentative working commission member.

At the general assembly (meting of chiefs of houses), tentative working commission ask other voluntary members and approval of working commission members.

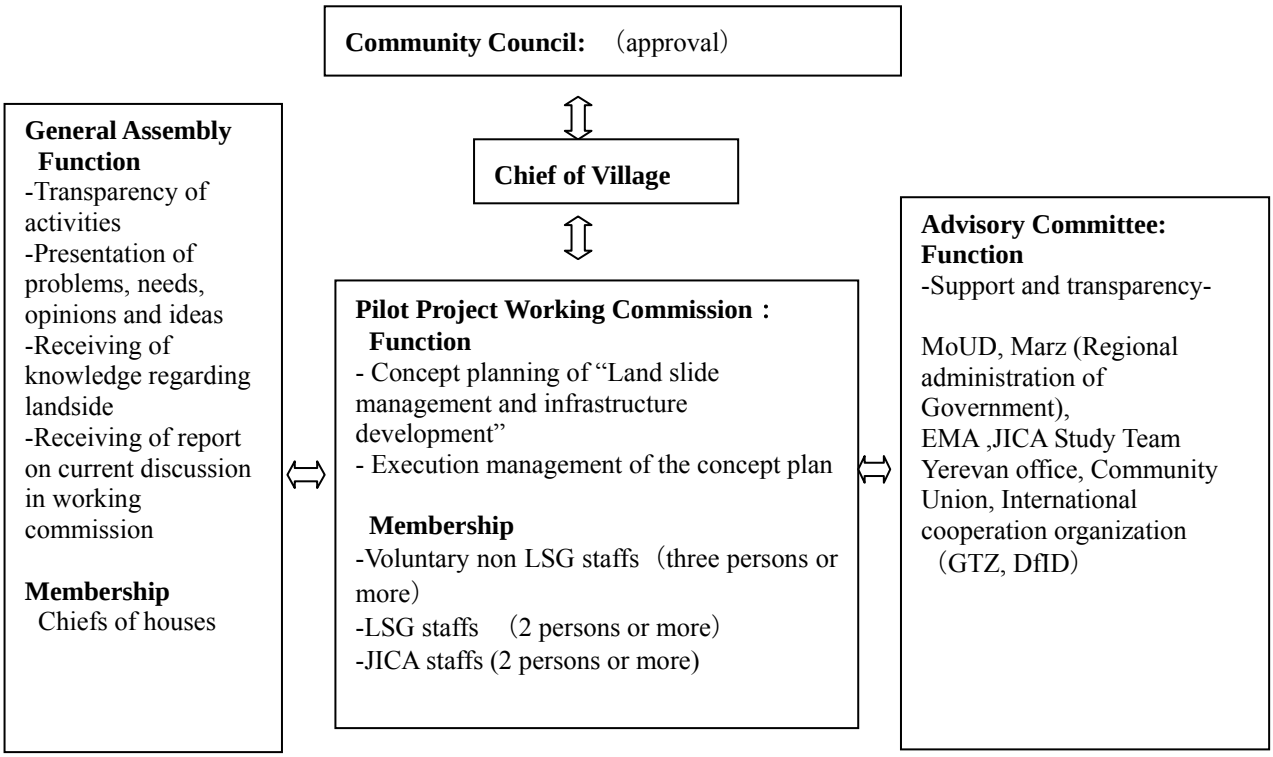


Figure 3.2.2 Execution Chart of Village type Pilot Projects (Gosh & Martuni Village)

(b) Working commission for city type（Kapan City）

The working commission members are composing of city hole, representatives of districts and Kapan community union members.

The purposes of it are

To gather various opinions

To show the pilot project experience to other districts in the Kapan City and vicinity villages.

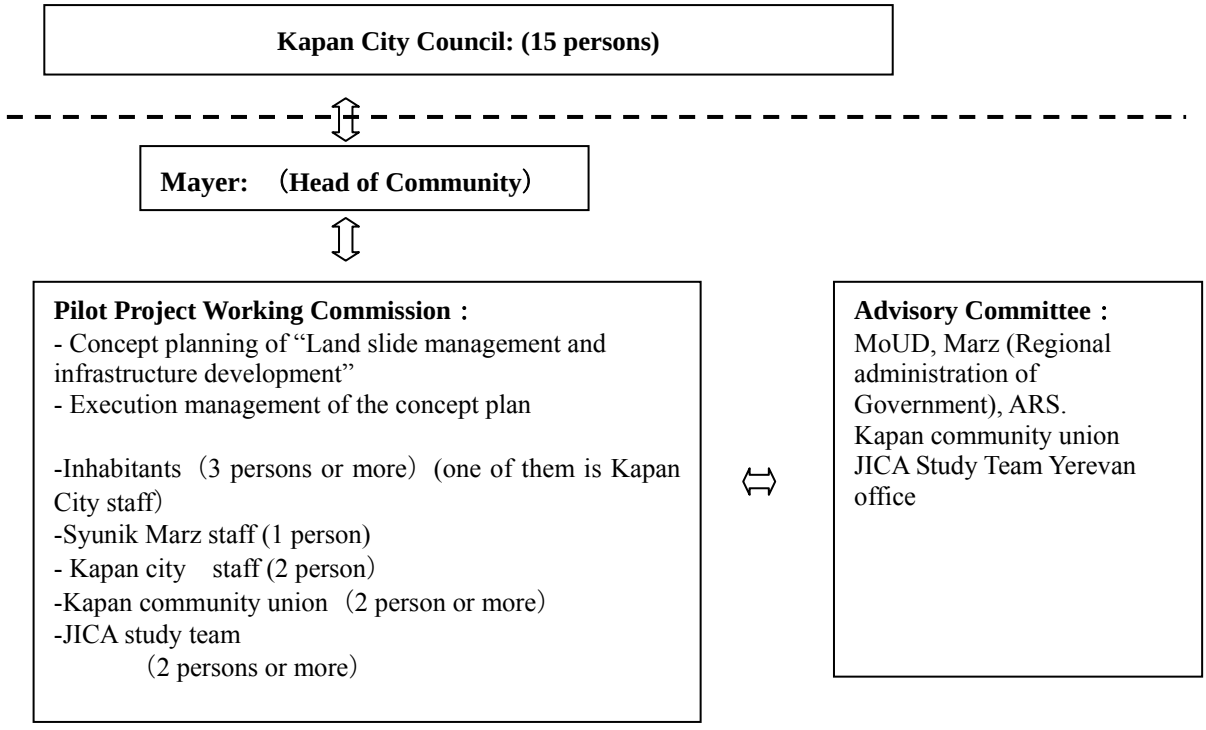


Figure 3.2.3 Execution Chart of City Type Pilot Projects (Kapan City)

(4) Advisory Committee

Advisory committee was formulated for each pilot projects to advice of project execution. Advisory committees also have function of transparency of the project execution. At first and Second advisory committees, project out line and purposes are confirmed and advised in advisory committee.

3.3 Concept Planning of Landslide Management and Infrastructure Development

3.3.1 Purpose of Plan Making by Community Members

Continuous approach is necessary to deduct landslide risk completely. The simple countermeasure works in pilot project is only a start. The sustainability, that are community's will and conditions for continuous approach are necessary.

The planning work by communities should improve the recognition of the necessity of projects and their self help efforts.

3.3.2 Planning Procedure

(1) General

Figure 3.3.1 shows flow chart of "concept planning of landslide management and community infrastructure development". It is necessary to do mainly working commission to this work. It is important to obtain the entire resident's consensus to secure the sustainability of the concept plan execution.

Procedure of the concept plan making is shown as follows.

(2) Procedure of Concept Plan Making

(a) Input from preliminary geotechnical study

Hazard map is imputed from specialist. The specialist are JICA study team members and there assistants in these pilot projects.

When other communities do the plan-making, the specialists will be persons who have specialty of community, Marz or CU, or community, Marz or CU will employ private consultant's specialist since next year. When the input by the specialist is impossible, the hazard map of the inventory survey of JICA in 2004 can be used.

(b) Realization of risk and Resource

Risk & resource mapping/ assessment by community is now progressing with specialist supporting

The following recognition is being formed because of risk & resource mapping.

The greater part of community situated on landslides-land either active or dormant, and

has risk. However, landslide-land is enriched, for example, fertile soil and abundant water.

(c) Consensus Making about Policy of Land Use and Target Industrial Field

First of all, following policies are discussed.
- Division of land that should be abandoned or be used
-Target of industrial field for community economic development (Economic development is necessary for landslide mitigation as financial resource and it is also ultimate goal of the project.)

(d) Resettlement / Change to Appropriate Land Use
For land to be abundant, it is necessary change to appropriate land use. Communities should support the resettlements.

(e) Co-existing with landslides
For land should be used, it is necessary to examine the following items.
1). Civil engineering works that contributes to not only landslide mitigation but also improve life-circumstance & industrial infrastructure for economic development.

2). Formation of necessary community organization for
- Landslide monitoring and warning
- Infrastructure maintenance organization

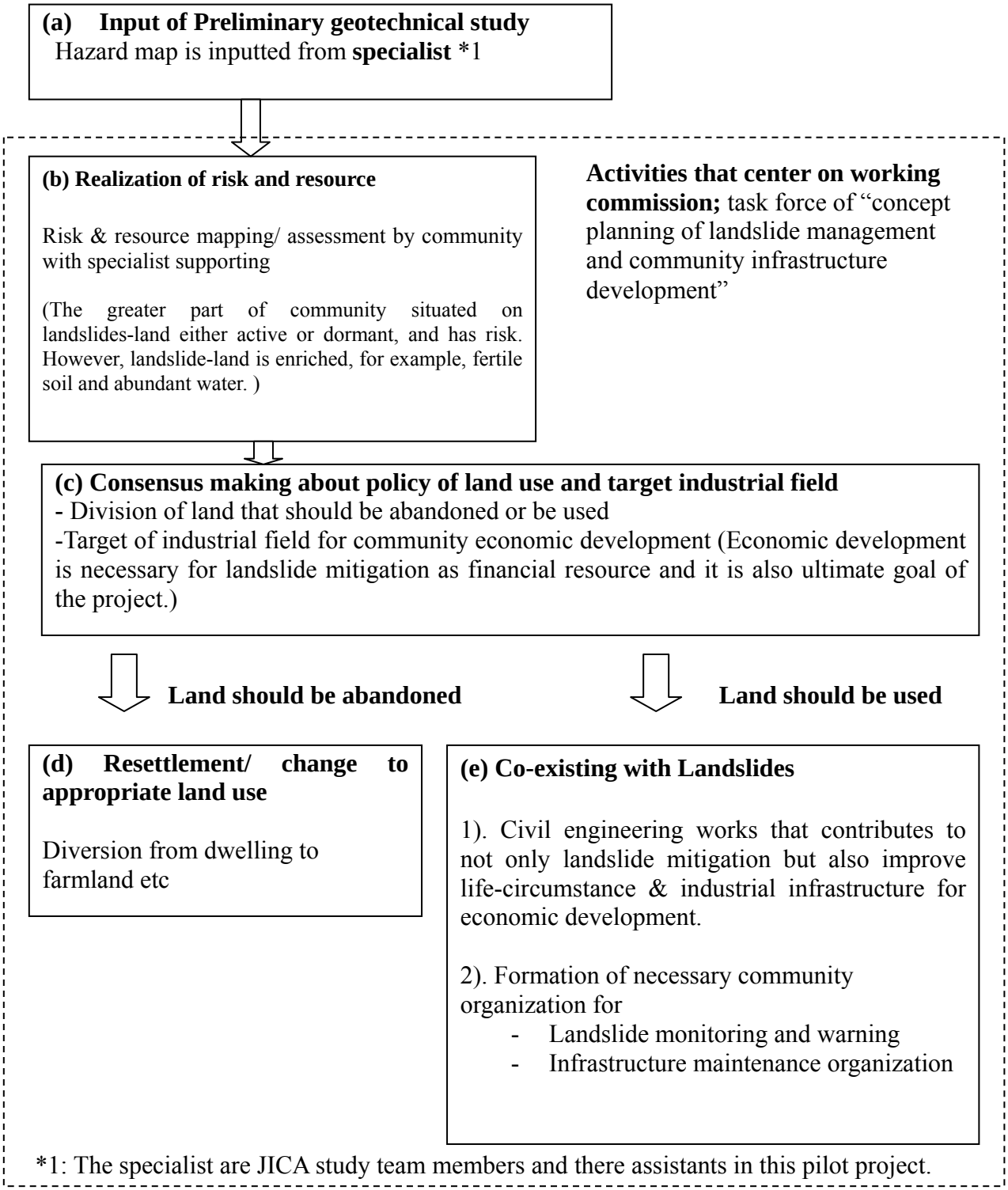


Figure 3.3.1 Flow Chart of Making of "Concept plan of Landslide Management and Community Infrastructure Development"

3.4 Execution Results of Pilot Projects

3.4.1 Execution Outlines

Execution content and achievement level of each Pilot Project is outlined in Table 3.4.1 to Table 3.4.4

Table 3.4.1 Execution Outline of the Pilot Projects

Project Name	Execution	Purpose	Achievement
Kapan City Harutyunyan Street Landslide	-Geotechnical investigation and risk assessment (by MoUD/ JICA Study Team) -Formulation of landslide Management Plan	Overall goal: Development of Kapan City	-Project effects were confirmed among the stakeholders. This project secured an alternative route for the M-2 highway. (Kapan tunnel is bottleneck for trucks). -Landslide monitoring team was organized. Early warning system was formulated.
		Project purposes: -Securing of two-lane traffic of Harutyunyan Street -Bare land landscape improvement -Avoidance of casualties	
		Output: -Risk assessment -Landslide management plan	-Risk assessment was done and landslide management plan was formulated.
Gosh & Martuni Village Landslide	-Geotechnical investigation and risk assessment (by MoUD/ JICA Study Team) -Formulation of landslide management and community infrastructure development plan, - Conduction of simple countermeasure works	Overall goal: -Community development, income generation	-Landslide management and community infrastructure development plan and community development plan were formulated.
		Project purposes: -Improvement of life and industry basis -Landslide risk reduction - Avoidance of casualties	-Project purpose was achieved by simple countermeasure works and landslide monitoring and early warning systems.
		Outputs: -Landslide management and community infrastructure development -Community roads drainage -Community infrastructure maintenance system -Landslide monitoring and early warning system	- Output was achieved.
Yerevan City Cemetery Landslide	-Geotechnical investigation and risk assessment (by MoUD/ JICA Study Team)	Ultimate goal: -Landslide technology of this type is used for urban/ regional development plans	-New findings about the landslides were disseminated by technical bulletins. -Methods of geotechnical investigation and monitoring were transferred to a private company related to National Science Academy through contracted work.
		Project purposes: -Information sharing of technology of this type of landslides	
		Outputs: -Technologies for landslide investigation and monitoring -Geotechnical investigation results (Issue of technical bulletin)	
Information Services	Newsletters	Dissemination of landslide-related information （related government organizations, international organizations, community inhabitants）	Publication four times
	Technical bulletins		Publication of volume one in December 2005. It included landslide distribution map, landslide inventory of this Study.
	Others		-Landslide physical model and experiment video -Brusher of landslide management -Manual of landslide management and early warning -Technical transfer, experience sharing seminar（Yerevan） -Experience sharing seminar in Ijevan and Gavar Cities -Study tour to Martuni Village

Table 3.4.2 (1/2) Execution Outline of the Pilot Projects System and Planning

Projects Name	Working Commission	General Assembly	Advisory Committee	Landslide management and community infrastructure development plan
Gosh	- 9 session was executed - At first, there was little remark from the committee member - The committee of non-community office staff was elected a chairman after the end of August to secure the villager's ownership. - Temporary participation of the non regular member who wanted to declare was admitted. - The much opinion from the committee is obtained as a result.	- Two session was executed - Participation has in about 20 persons though it calls widely. (General assemblies were first experience in the Gosh village)	-First session (22 th July),Confirmation of implementation system （ Deputy head of Marz request to secure transparency of project） - Second session （16th August） : Confirmation of content of simple countermeasure works and inputs by community. - Third session （25th November）: Confirmation of project continuation plan and its environmental assessment	1. A landslide monitoring team was formulated 2. System of maintenance of drainage which installed by the project was planed by voluntary works of inhabitants 3. Main items of community development plan - Tourism (tourist home, new tourists home will be constructed by income of previous tourist home - Animal husbandry development - Juice factory construction 4. The draft plan of the simple counter measure works formulated by the Study Team based on risk resource and need assessment. And the draft plan was discussed at the working commission
Martuni	- Eight session was executed - Main discussions were risk assessment and simple countermeasure works. - There is not deepening of the discussion about the resource assessment and the community development plan - Discussion is active centering of the one of the committee（science teacher）	- Third session was conducted -Participants are 25-32 -Main opinions were obtained	-First session (21st July), DfID expressed the experience sharing is important - Second session （16th August） : Confirmation of content of simple countermeasure works and inputs by community. - Third session （5th December）: Confirmation of project continuation plan and its environmental assessment	1. A landslide monitoring team was formulated 2. The villager charter was formulated 3. Simple countermeasure works were conducted at main road which access to pasture only church and cemetery. 4. The draft plan of the simple counter measure works formulated by the Study Team based on risk resource and needs priority which was voted among inhabitants 5. Community development plan was itemized (dairy product, meet processing, wheat gristmill etc.)

Table 3.4.2 (2/2) Execution Outline of the Pilot Projects System and Planning

Projects Name	Working Committee	Advisory Committee	Landslide management and community infrastructure development plan
Kapan	- 7 session was executed (action policy and community infrastructure development) - 4 session of secretariat of conference (Kapan community union and the Study Team) was held. - One technical transfer work shop was conducted (know-how of landslide and landslide situation of the Harutyunyan street landslide) - Drainage sediment cleaning work was conducted by Honorarium system (AMD 1200/ day is paid as public subsidy) - The committee of non-community office staff was elected a chairman after the end of August to secure the villager's ownership. - Temporary participation of the non regular member who wanted to declare was admitted. - The much opinion from the committee is obtained as a result.	-First session (6 th July), discussion and confirmation of implementation plan of the Pilot Project, agreement about working commission system -Second session（15th August）: Discussion about project in the feature and cost/capital plan -Third session (11th November) Discussion about countermeasure project of Harutyunyan street landslide project in the feature and cost/capital plan	As countermeasure of Harutyunyan landslide, "plan for recovery of 2 lane traffic by earth removal and drainage" was adapted Cost for the woks are approximately AMD 96 million, USD 210 thousand, The capital plan was talked about, 10% of Kapan city, 10% of a mine company in Kapan, 80% of it will be requested to the central government and donor. Expert of earth works. is also necessary
Yerevan		-First session (22 th July), discussion and confirmation of implementation plan of the Pilot Project, situation of the master planning of Yerevan City was explained from Yerevan City. -Second session (18 th August),	-It was confirmed that result of the study will be used for the cemetery maintenance project including pavement of road and water supply(AMD 90 million in 2006) -Study results are provided to use the development plan of the Yerevan City -Because similar type landslides are widely developed around Yerevan City, Kotayk Marz, Ararat Marz, the Study results was informed by technical bulletin

Table 3.4.3 Outline of 1st Advisory Committee

Item	Tavush region Gosh village pilot project	Gegharkunik region Martuni village pilot project	Kapan City Harutyunyan Street landslide pilot project	Yerevan City Nubarashen (Arinberd) Cemetery landslide pilot projects
Execution date	June 22, 2005	June 22, 2005	July 6, 2005	June 23, 2005
Participant (Execution body)	- Chief of Gosh Village -JICA study team Gosh village office（2 person） （total three persons）	- Chief of Martuni Village - JICA study team Martuni village office（2 person） （total three persons）	- Kapan City（1 person） - Representative of Inhabitants （2 persons） ・JICA Kapan office（2 persons） （total 5 persons）	-Yerevan city（3 persons） -Erebuni Community (1 person) - JICA members who take charge of Yerevan Pilot project （1 person） (total 5 persons)
Participant (Advisory)	- Ministry of Urban development (person) - Tavush Marz (2 persons) - EMA Tavush regional office (1 person) - Dilijan community union (1 person) -DFID (1 person) -GTZ (2 persons) -JICA study team Yerevan Office（3 persons）	-Ministry of Urban development (person) - Gegharkunik Marz （1person） -EMA Gegharkunik regional office (1person) -DFID (1 person) -JICA study team Yerevan office（3 persons）	-Ministry of Urban development（absence） -Syunik Marz（1 person） - EMA Syunik Marz regional office (1 person） - Kapan community union（1 person） - JICA study team Yerevan Office(2 persons）	-Ministry of Urban development（2 persons） -JICA study team Yerevan office（2 persons） -Yerevan Project Closed Joint Stock Company the “Master plan” workshop（2 persons）
Content of confirmation	-Target and execution content of pilot projects （Presentation from Community） -Role of advisory committee and execution schedule for the future -Role and inputs by communities, MoUD, JICA Study Team			
Outline of advice to communities and discussion	- The representative of community should act as pioneer of such kind of project.（MoUD） →Chief of village says that he has consciousness of pioneer. -Transparency is important for material procurement (Marz）	- Such kind of project is first trial in Gegharkunik Marz. Advices from MoUD and JICA and frequent holding of advisory committee are expected. （Marz） -Inter community structure would provides the function of technical transfer （DFID）.	- Harutyunyan landslide is important issue at Kapan City. - Clarification of management method is expected. Only specialist can evaluated the risk of the landslide be. (Marz)	-The result of the study should be reflected in the mater plan of Yereban City. - The minute was signed. And it was reported to Mayer.
Remarks			Local television station, radio station coverage, and report	

Table 3.4.4 Outline of 2nd Advisory Committee

Item	Tavush region Gosh village pilot project	Gegharkunik region Martuni village pilot project	Kapan City Harutyunyan Street landslide pilot project	Yerevan City Nubarashen (Arinberd) Cemetery landslide pilot projects
Execution date	August 16, 2005	August 12, 2005	August 15, 2005	August 17, 2005
Participant (Execution body)	- Chief of Gosh Village -JICA study team Gosh village office（2 person） （total three person）	- Chief of Martuni Village - JICA study team Martuni village office（3 persons （total four person）	- Kapan City（1 person） - Representative of Inhabitants （2 persons） ・JICA Kapan office（2 person） （total 6 persons）	-Yerevan city（6 persons） -Erebuni Community (1 person) - JICA members who take charge of Yerevan Pilot project （2 persons） (total 5 persons)
Participant (Advisory)	- Ministry of Urban development (1 person) - Tavush Marz (2 persons) - EMA Tavush regional office (1 person) - Dilijan community union (1 person) -DfID (1 person) -GTZ (2 persons) -JICA study team Yerevan Office（1 persons）	-Ministry of Urban development (1 person) - Gegharkunik Marz （5 persons） -Martuni Village Administration (1 person) -EMA Gegharkunik regional office (1 person) -DfID (1 person) - JICA study team Yerevan office（2 persons）	-Ministry of Urban development（1 person） -Syunik Marz（1 person） - EMA Syunik Marz regional office (2 person） - Kapan community union（3 person） - JICA study team Yerevan Office(2 persons）	-Ministry of Urban development（2 persons） -JICA study team Yerevan office（2 persons）
Content of confirmation	Interim report of project. Confirmation of items and quantities and responsibility demarcation about simple countermeasure works		Progress report of project and confirmation of needs and issues	
Outline of advice to communities and discussion	-Progress report of geotechnical investigation -Priority landslide area -Countermeasure work contents from chief of village -Contents of self-help from village -Planting on landslide area	- Progress report of Hazard Map and Countermeasure Plan for Martuni village landslide management - Agreement upon implementation of simple countermeasure works in Martuni village, their scope and implementation details - Confirmation of landslide monitoring technology transfer and continuous monitoring by nearby communities damaged by landslide	-Progress report of geotechnical investigation -Confirmation of technology transfer of landslide monitoring and continuous monitoring by local community and application to other landslides -Formulation of precaution system by rainfall observation	-Progress report of geotechnical investigation -Site confirmation of planning drilling sites -Confirmation of execution organization of landslide monitoring
Remarks		Marz television station coverage and report	Local television station, radio station coverage, and report	

3.4.2 Social and Organization Outcomes and Issues of Pilot Projects

'Landslide management and community infrastructure development plane' and 'community development plan' were formulated by the discussion that centers on the Working Commissions. An open ditch with conduit along the community road was constructed by inhabitants and a horizontal drainage boring by Japanese input (contract with an Armenian Company) were completed. Landslide monitoring teams and early warning system were established. Method of maintenance of community infrastructure was discussed. And the systems were started to operate. Inhabitants planed cleaning activity of tourism resources for the comminuted development.

Inhabitants recognize that these simple countermeasures can mitigate landslide activities through the activity of landslide monitoring by the inhabitants participation. This resulted in an improved life and industrial base, such as a dry community road. The inhabitants came to recognize these effect and necessity.

It was confirmed that these activities (planning and implementation by themselves, consensus building about priority projects, and sharing of issues among inhabitants) can enhance self reliance efforts of the community.

Social and organizational outcomes and issues are summarized in Table 3.4.5.

Table 3.4.5 Outline of the Pilot Projects Outcomes and Issues

Item	Outcomes	Issues
Working Commission (WkC)	-WkC was formulated for 3 pilot projects (Gosh, Martuni, Kapan), with the role of plan making. -For obtaining various needs, the head of community was not a proper member and non-community staff members participated in the WkC. - In WkC, various opinions were obtained step by step.	-For the project continuance, the WkC should not be dissolved. -For continuous implementation of the project, public and international assistance (technical and financial) is necessary. Application for assistance should be made by the WkC.
General Assembly	- General assembly was called at Gosh and Martuni villages as required. - The purposes were to secure project transparency and to compile various opinions. In general assembly, WkC members were recruited and approved. -Participants were less than 30 people. Remarks were not active in the Gosh village; it did not seem to carry out its functions.	-This is necessary to avoid overemphasis of the plan on some stakeholders. -To be practical, its functions, bulletin boards and neighboring circulars should be used.
Advisory Committee	-MoUD chaired the advisory committee. -The purpose was to support the Pilot Projects and to secure their transparency. -Agreement of responsibilities and roles for the Pilot Projects was made by signed document. -Advisory committee carried out the function of stakeholders committee for the environmental assessment.	-MoUD should support the holding of advisory committee.
Geotechnical investigation and risk resource assessment	-Geotechnical investigation was done by JICA Study Team and MoUD with local contractors. -House damage investigation was done by Armenian specialists. -Installment of landslide monitoring equipment was done by local contractor. - Landslide monitoring was undertaken by landslide monitoring team with the support from the Study Team. - For the resource assessment only itemization was done by WkC.	-Carrying on the investigation (by the contractor) by MoUD is indispensable.
Simple countermeasure works	-At Gosh village, the active landslide block was minimized by drainage and horizontal drainage boring. Due to this effect, motivation was improved. -In Gosh and Martuni villages, muddy road was improved. -In Gosh village and Chambarik City, which neighbors Martuni village, there were experimental civil engineers who performed the role of construction supervision.	- To provide materials and workers' rewards public and international assistance is necessary.

3.4.3 Information Services

Table 3.4.6 shows public relations exercises that were conducted within the Pilot Projects. Through the continuation of these exercises by MoUD, it is supposed to increase the success of the Pilot Projects.

Table 3.4.6 Public Relations

Item	Content
Newsletters Technical bulletins（Publication and Web site）	-Successful cases of landslide management within the Pilot Projects
Landslide physical model	-Educational materials for schools（Reorganization of landslide activity and watering）
Brusher for landslide management	- Notes for co-existing with landslides

4. GOSH PILOT PROJECT

4.1 Socio-Economic Description

This chapter aims to provide information on socio-economic analysis of Gosh community. For this study the survey research was conducted in Gosh in September, 2005. Special self-administered questionnaire was designed to collect date about main socio-economic indicators, infrastructure conditions, social structure of community, and interrelationships among the residents. The interviews were conducted with residents of the village and municipality experts as well as content analysis were made to reveal all the above mentioned questions. Besides, long term observations were also conducted to reveal different features, lifestyles, local gatherings and parties in the community.

4.1.1. General Description of Gosh Community

Gosh administrative territory occupies 1485 ha, where plough lands occupies about 403 ha, pastures- 571 ha, private lands- 100 ha and forest cover about 411 ha. Lands were privatized in 1992. Gosh is located at l200 altitude. Two big neighboring cities are Dilijan and Ijevan (marz-center).

The population of the village consists of 1200 people (645 males and 555 females) in 2005 and 1145 (620 males/ 525 females) in 2004. Actually, population number has not been drastically changed since the collapse of the USSR, it has always amounted a little more than thousand people.

Table 4.1.1 General Description of Gosh Community

Categories	**Number**
Number of birth rate	15
0-4 years	89
5-7 years	87
School-children 8-15	136
16-63 years	290
over 64 years	49
Total	**1200**

There are four shops in the village and one gas station. There are 27 lorries and about 30 passenger cars in the village, besides there are 13 tractors 2 of which are caterpillar

tractors. There are two schools in Gosh: the smaller one is located in the lower Gosh (45 students), the bigger one is located in upper Gosh(110students). The latest was renovated in 2002 by the donor organization «Save the children». The small school was renovated in 2004.

The village has prolonged form, the distance between Lower Gosh and Upper Gosh is about four kilometers. The most population is concentrated in the Upper Gosh. The upper district of Upper Gosh is located on the landslide area.

Getik river flows along the entire village and reaches the main Dilijan-Ijevan highway where flows into Agestev river.

4.1.2 History of Gosh Village

After being ordained in Kilikia in 1160s Mkhitar Gosh goes to Kharabakh to Khachen (region), then he comes to the Monastery of Getik and becomes the Leader of the Monastery. After the strong earthquake the Getik Monastery is completely ruined (Getik Monastery was located somewhere between present Martuni and Aghavnavank villages, Gegharkunik Marz) and Mkhitar Gosh applies to atabek (head of administration) of Georgian Kingdom Ivane Zakaryan to find place and help him to construct new monastery in the same region. Ivane Zakaryan agrees to construct new monastery and Mkhitar Gosh comes to present Gosh territory (then it was called Tandzut) and "decides to construct Monastery on the hill of Tandzut"[1]

At first that monastery was constructed from wood and was called Nor Getik (New Getik) after the old Monastery name. But Mkhitar Gosh initiated the construction of stone made Monastery. Instead of concrete people used mixture of milk and eggs. Milk was sent to the Monastery from mountainous pastures by clay pipes[2] installed in the ground. After Mkhitar Gosh death in 1213 this Monastery was renamed into Goshavank after Gosh's name and the village located near the monastery was called Gosh. After Gosh's death the Monastery is constructed completely.

During Mongolian and Turk-Persian wars the Gosh village becomes abandoned. In

[1] According to expert in History Science Robert Ghazaryan

[2] Clay pipes through which milk was sent for construction of the monastery are found even now in Upper Gosh upper area

1800s seven families are resettled here who come from two villages of Noyanberiyan region: Dostvlu and Koti. These seven families has become base families of today's Gosh population. In other words based on these seven families today's Gosh population has been developed. Today Gosh people's second names are mostly originated from the first names of the heads of these seven families. Thus it is common knowledge names of four of these persons: Alo, Melik, David, Grigor**.**

The establishment of communism system in Gosh was made in 1920s. However for Gosh people of that times the communism as an antireligious system was not acceptable, since the people were very religious, because Goshavank as a famous monastery was very popular religious center. Thus it was very difficult to establish the communism especially in Gosh. The legend[3] about the leader of monastery Father Chitchyan who persuaded his smaller son to kill his elder son because his son had betrayed the Christian postulates and had become a communist party member, shows how the people resisted the communist system establishment in Gosh.

4.1.3 Economic Structure

The communist system establishment in Gosh followed by the new soviet economic policy. Village residents were forced to keep only very restricted number of cattle as their own business, all the lands were privatized and delegated to the state. Individual households (worker's property) were retained in the collective farm-kolkhozes.

The kolkhozes were established as an economic unit of Soviet village. A kolkhoz - cooperative agricultural enterprise operated on state-owned land by peasants from a number of households who belonged to the collective and who were paid as salaried employees on the basis of quality and quantity of labor contributed. Conceived as a voluntary union of peasants, the kolkhoz became the dominant form of agriculture during Soviet times.

Later the Gosh kolkhoz was reformulated into Gosh sovkhoz (soviet cooperative enterprise); however the principle of public ownership remained the same.

The sovkhoz was controlled by government officials (sovkhoz chairmen) who were elected by the peasants of the Gosh commune; however such elections were not without corruption and coercion..

[3] Legend was told by the preceptor of Father Chitchyan, who lives in Gosh

The state administration system was the following: Gosh sovkhoz was under the subordination of Dilijan Rayon [4] Committee Administration. Each rayon was accountable to the Central Committee of the Communist Party of Soviet Socialistic Republic of Armenia.

After the collapse of the Soviet regime the sovkhoz system was also destroyed. The Government of the independent Republic of Armenia adopted the legislative regulations on new administrative territorial division of the Republic of Armenia. Under this system Gosh got a status of community which was managed by gyughapet (community head), who was elected by the avaganis (community council). However, in 1993 the acting system was changed and gyughapets were also elected by the community residents.

Survey Results:

Residents' revenue sources

Findings

Respondents were asked about their revenue sources (it is important to mention that the respondents were asked to mention main source of their family's income, however answers did not exclude other categories also). Most of the answers included agriculture activities (44% responses) mostly growing potato, tomato, haricot, and corn and animal husbandry development(60% responses): cow keeping, ship keeping. Seasonal work was selected as the source of revenue for 47% respondents. Villagers mostly work in Russia in Stavropol region. There are several families which moved from Gosh several years ago and running their businesses there; thus these people provide seasonal works for Gosh residents in Stavropol region. 16% of the respondents answered that they are state employees and the source of their income is state budget: 2 teachers, forestry officer, head of the local museum. 28% of the respondents said that source of income for them is pension. Two people run their own business: plaster master and driver. Two respondents said that they earn their living by bringing and cutting the dry wood from the forest.

Analysis

Thus finding show that *main income for the villagers are agriculture and animal husbandry development.* However, seasonal works are also considered as revenue source for many families, especially those families where grown up young persons are available. According to findings people in Gosh are reluctant to run their own

[4] Territorial-administrative in USSR

businesses.

Best agricultural product in the community

Findings

Respondents were asked in a separate question which agricultural product is the best in the village. 84% of the respondents agreed that potato is the best agricultural product in the village. About 64% respondents mentioned haricot with potato as the best products in the village. 20% of the respondents mentioned corn, tomato and cucumber with potato and haricot as best agricultural product.Wheat was mentioned by 16% of respondents as the best agricultural product.

Analysis

Finding show that the *best agricultural product for the village are considered potato and haricot.* However, corn, tomato and cucumber are also cultivated in the village as popular agricultural products.

Most effective agricultural product to cultivate in the future.

Findings

Separate question was given to respondents about their idea of best agricultural product to be developed in the future in Gosh. Twelve respondents said that wheat is the most effective agricultural product to cultivate in the future. Four respondents suggested to cultivate potato as the most effective product, one respondent affirmed that tobacco cultivation will be very effective to develop for the village. Meat also was proposed as a product to develop by a respondent. Two persons proposed haricot as effective product to cultivate for the future development of the village. Five respondents did not have any idea about effective product for cultivation in the future.

Analysis

Thus according to findings *the wheat is the most effective agricultural product* to cultivate in the future.

Tax collection mechanism

Actually in Gosh rate of tax collection is more than 90%.Taxes are paid according to the following fixed scheme:

Table 4.1.2 Tax collection mechanism in Gosh Village

Tax type	Tax amount	Payment schedule
land tax payment per year	733.9 AMD per household	50% of tax to be paid until October 15 50% to be paid until April 15 of the next year
property tax payment per year	764 AMD per household	100% to be paid until August 30
land fee per year	825 AMD per household	50% of tax to be paid until October 15 50% to be paid until April 15 of the next year

According to the Article. 57 of the Law on Local Self Government (LSG) the sources of formation of local government budget are the following: 1**- Tax revenues: property and land tax are completely collected by LSG**; 2- Stamp duties, 3- Non tax revenues, 4-Capital inflows, i.e. receipts on alienation of the community owned assets, 5- Allocations in the shape of official transfers, 6- Sources of financing community budget deficit.

Administration Staff

Village head, community council member and chief accountant in a separate question were asked about formulation of village administration staff. All the three respondents said that local municipality staff is appointed by village head. Staff structure is also formulated by village head but according to Chief –accountant in the community with more than thousand residents the wage scale is determined as 5:1 where 1 relates to village head and 5 is allocated among staff members. Thus the head of community with more than thousand population should formulate the staff based on the above-mentioned scale. Chief-accountant added that after the staff structure is ready head of the community submits the structure to the Community Council (CC) for approval.

According to Article 28 of the Law on LSG

".The Chief of Community, at his own discretion and responsibility, shall carry out human resources policies and form the staff of the Chief of Community....., through his submissions and in agreement with the Community Council"

The Chief of a Community, not later than one month after he accepts his office, shall submit the structure of his Staff, as well as the structure and staff-lists.....to the Community Council for approval"

Figure 4.1.1 presents the organizational structure of the Gosh community administration:

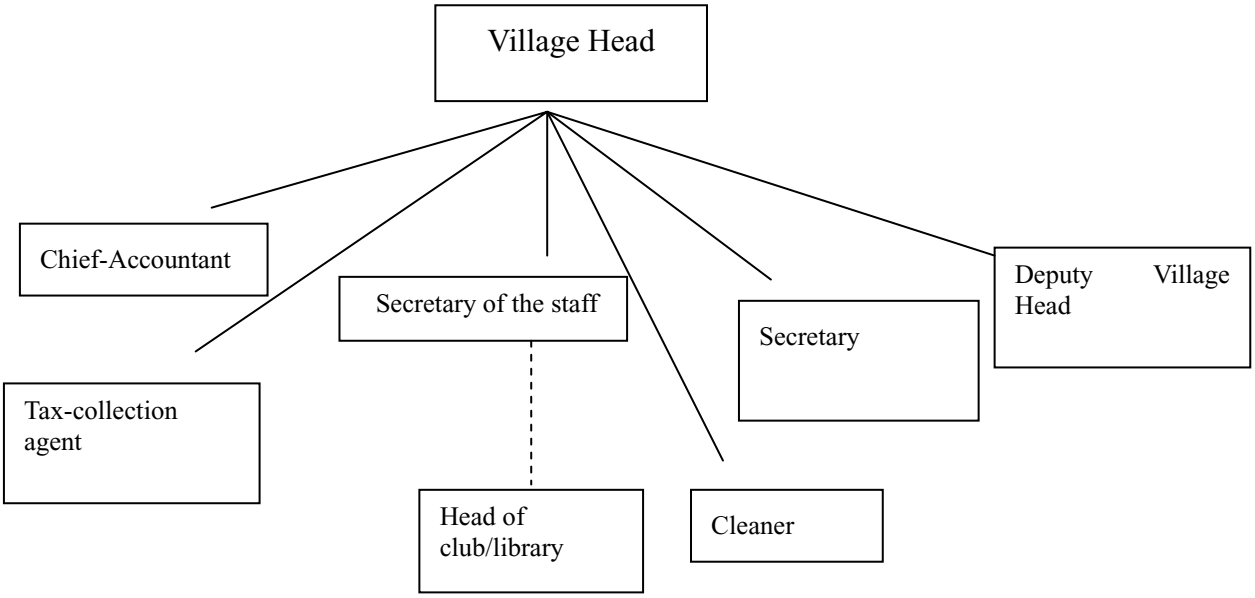


Figure 4.1.1 Organization Structure of Gosh Community Administration

Staff remuneration is made based on the following scheme

Table 4.1.3 Remuneration of Gosh Village Stuff

Village head	70000 AMD per month
Deputy Head	52500AMD per month
Chief accountant	49000AMD per month
Secretary of staff	35000 AMD per month
Tax collection agent	21000 AMD per month
Secretary	14000 AMD per month
Head of club/library	11000 AMD per month
Cleaner	11000 AMD per month

The municipality do not have auditor. According to the Community Chief– accountant it is permitted not to admit auditor in small communities.

Community Budget

The budgets for 2001 and 2002 were with positive balance: 2001 budget balance amounted 224,200 AMD and 2002 budget balance amounted 684,200AMD. However in 2004 the balance was negative and amounted -416,720AMD. It is important to mention that the revenues from alienation of the reserved lands were received in 2004. In 2001 and 2002 budgets this type of revenue was not allocated. Big differences between budget trends of 2001, 2002 and 2004 are not noticed.

Community Infrastructures

Regulation of **public transportation** of the village residents is under the jurisdiction of local municipality (gyughapetaran). Service bus works five days per week: two days to Dilijan and three days to Ijevan. Transportation fee is 300 AMD. However the gyughapetaran plans to exploit another mini bus for transportation to Yerevan.

About 200 households have **telephone connection** in the community; however it does not work properly, since the cables have not been changed for a long time and telephone stations are in improper conditions. Telephone connection fixed fee is 180 AMD per month. Mr. Ashot Davdyan (Gosh resident), an employee of "Armentel" CJSC Ijevan branch is responsible for telephone connection in Gosh.

Energy station center which is in charge of electrical energy supply for Gosh is located

in Dilijan, however there is representative of this organization in Gosh village John Arzumanyan who is in charge of controlling payment process of energy fee, fixing cables and other issues relating to electricity. Energy fee is amounted 25 AMD per 1 kilowatt.

Drinking and irrigation water supply conditions are different in Lower and Upper Gosh. In the Upper Gosh water pipeline system is installed and three water sources are connected to this system. However upper part of this system does not work properly because this area is located on landslide territory and possibly could be damaged by landslide movement. It is important to mention that the water flows permanently during all the seasons from the taps which are mostly located in the gardens and yards of the residents. During the summer season people leave the water flow for irrigation, and in the winter the water tap is open to avoid freezing of the pipes.

On the other hand, there is a scarcity of water supply in the Lower Gosh. Thus only respondents from the Lower Gosh said that because of the scarcity of the water they do not cultivate agriculture products. Gyughapetaran (Local Government) plans to conduct irrigation system installation project in cooperation with donor organizations. Gyughapetaran has already submitted the proposal of irrigation system installment for the community to IFAD organization.

Central road of the village was reconstructed in 2004 according to the decree of the President of the Republic of Armenia. However, other local roads are in poor conditions. Municipality in cooperation with donor organizations GTZ (German Technical Cooperation), UN Food Program and World Bank has conducted several projects on reconstruction of local and mountainous roads in 2004, 2005.

However the sustainable maintenance of the main drainage, installed along the main road is not conducted properly. Citizens say that the construction company is responsible for drainage maintenance for a fixed period of time, but the representatives of Construction Company has not appeared in Gosh for a long time.

Sewerage system does not exist in the community what first of all disastrous from the viewpoint of environmental protection since all the waste matters is thrown into the river Getik. On the other hand sewerage water is also poured into the gardens in the upper area of the Upper Gosh since the river does not flow through the upper district; in

this way the water is penetrating into the underground in the landslide territory, what is very dangerous from the viewpoint of landslide activity.

4.1.4 Social Structure

The basis of today's Gosh population as it was mentioned mostly consists of about ten families[5]. Almost all the villagers are in some extend close or farther relatives to each other. It is very unique society from this viewpoint. However, the close kinship among the residents does not always consider the strong ties in the society.

Beginning from 1980s to 1999 about 30% of Gosh population left for Russia for permanent residence. At present, these Gosh residents stay mostly in the Stavropol and Rostov regions (Southern part of Russia). There are about 10-15 prosperous families from Gosh who have their own businesses, or occupy high ranked positions in the Stavropol Regional Administration. After the collapse of the USSR Armenia was experiencing economic blockade and these families helped Gosh people very much by sending flour, sugar, domestic animals. Today also these people help their co villagers by providing seasonable works in Stavropol region.

There is a big conflict in Gosh society which has existed for several years. This conflict has even divided the community into two main camps. The origin of the conflict has begun from 2000 when the acting village head was elected. The society was divided into two groups: those who supported the previous head of village and those who supported the new head of village. There was a case when even two brothers appeared in two different camps.

2005 Local Government Elections in Gosh

The conflict has been reactivated from October, 2005 when pre electoral campaign of 2005 local self government elections was launched. During the pre-electoral campaign the tensions have been very high. On October 16, 2005 Local Government elections were run in Gosh Community. There were two candidates for the post of the Head of Community: Hovsep Veranyan-acting Head of Community and Rafik Zakaryan – forestry officer, who was supported by the previous gyughapet; as well as eleven[6] candidates for the Community Council member posts. The elections were conducted in

[5] See appendix on social tree of Gosh Community

[6] Seven candidates out of eleven shall be elected for Community Council member positions

two election sites: in the Lower Gosh at the small school and in the Upper Gosh at the big school. In each election sites corresponding election committees were responsible for election procedure. The election committees consisted of 7 members, chairman and deputy chairman. Besides election committee entrusted persons of each candidate were present at the election site. At 20:00 both of election sites were closed and election committee members began to count number of votes for each candidate. The winner is considered a candidate who gathered a maximum number of votes for the Head of Community. For community Council members the winners are considered the seven candidates who gathered the maximum number of votes. The voters shall elect a Community Head and one Community Council members from the provided list and insert the election bulletin into the ballot box. According to the Electoral Code of the RoA only Election committee members as well as entrusted persons for each candidate shall be present at the election site after the election site doors are closed. Official results of election were provided on October 17, 2005.

The results of Local–Self Government elections in Gosh community were allocated according to the following Table 4.1.4:

Table 4.1.4 List of the candidates for local government election

Names of candidates for the post of Community Head	**Number of votes received in Lower Gosh**	**Number of votes received in Upper Gosh**	**Total**	**Percentage %**
Hovsep Veranyan	133	231	364	69.3
Rafik Zakaryan	47	114	161	30.7
Names of candidates for the post of Community Council members	**Number of votes received in Lower Gosh**	**Number of votes received in Upper Gosh**	**Total**	**Percentage %**
Garik Mehrabyan	88	10	98	18.7
Suren Grigoryan	12	49	61	11.6
Rafik Vardanyan	5	52	57	10.9
Zhora Sargsyan	13	44	57	10.9
Gevorg Amirkhanyan	7	49	56	10.7
Andranik Davdyan	29	21	50	9.5
Garnik Arzumanyan	7	42	49	9.3
Levon Amiryan	10	36	46	8.8
Srapion Babinyan	7	22	29	5.5
Pavel Amirkhanyan	5	11	16	3.0
Emma Markaryan	2	12	14	2.7
TOTAL number of votes	**525**			

Survey results

Will to stay in the community

Findings

Respondents were asked about the points which they like in the village. Mostly people referred to the beautiful nature and motherland, thus 64% of the respondents said that they like the nature of their village very much, and 44% respondents said that this is their motherland and they are tied to it. 16% of the respondents substantiated their families as the cause of stay in the village; two persons said they especially like the Goshavank Monastery in the village.

Respondents were asked in a separate question what they do not like in the village and would like to change. Most of the answers-60% said that they would like new working positions to be opened in the village, and 24% of respondents referred to the landslide disaster. Three respondents said that they would like agricultural machines to be provided for agricultural activities. Three respondents said that there is a big problem regarding the school children, so some of schoolchildren go to school every day from the Lower Gosh to Upper Gosh (distance about 4 km).Other two respondents said that they do not like in Gosh the separation of society into two groups one group supports the present head of the village and the second group supports the previous one, who is going to participate in the coming local government elections. Two respondents said that they do not like the situation of the water supply in Lower Gosh and would like to change it.

The respondents were asked to tell what action they would like to take if their house is somehow damaged by the landslide. 67% of the respondents will move to another house in the village, 25% will renovate their house and only 2 respondents said that they will move away from the village. 3 families out of those who agreed to move to another house in the village have been already resettled to other houses in the Lower Gosh.

Analysis

Findings show that first of all respondents emphasize the nature of their village, and secondly this village is their motherland so they are tied with this place. The family is also considered as one of the main causes of their attachment to the village. On the other hand people do not have work and cannot support their families, so they are very interested in opening new jobs in the village.

The second problem for the villagers is the landslide, since landslide has a negative

influence not only on the people who live on that territory but also on the people who live in other districts. Most of these people go to their pastures, plough-lands through this landslide area.

Although only two respondents said there is a split among the population of the community: part of the residents supported the present head of village and the other part supported the previous head of village, it was important to draw the attention on that issue since local government elections were going to be run at that time and the tensions increased in this regard.

According to findings people of the village were much tied with their motherland, thus 92% decides to stay in the village even though their house is damaged. It demonstrates the high level of willingness of the villagers to stay in the community in spite of the landslide.

Observations

During the pilot project it became more obvious that village residents are very much attached to their village, even to their districts. For example, in some cases residents of the same district of community have been even more close to each other than to their relatives. District neighborhood is very strong unit in the society of community. Gosh residents are very proud of Gosh Lake, which is located about 2 km far from the village. It is important to mention that the road to Gosh is in very poor situation, and it is possible to get there only by Soviet truck , which is called sixty six, and soviet UAZ and UAZ Russian small jeep

Landslide knowledge and action

Finding

Respondents were asked about their opinions of mechanism and origination of the landslide. Most of the respondents (40% of people) said that the landslide emerges from the water, namely the water flows into the underground, makes the soil loose what causes the creeping of the soil. 20% of respondents specified that this water is caused by the rain and snow melting, and two respondents said the sewerage and waste water which permanently flows in the residents gardens penetrates into the ground and causes landslide. 2 respondents said that the landslide is caused by the Spitak earthquake of 1988, thus big cracks appeared on the soil and water was penetrating there making

erosion of the land. Eroded land is very weak so it begins sliding. Three persons did not have any idea about either origination or the mechanism of the landslide.

Analysis

Thus finding show that most of the residents think that the main cause of the landslide is the water which penetrates into the ground makes the underground soil weak and loose and it begins to creep. According to the villagers this water is mostly originated form the rain, snow melting and residents' waste water. It is important to mention that even though residents from different districts were interviewed there were not big differences in opinions. What about stones in the upper area.

Observations

During the pilot project the residents more clearly understood the mechanism of landslide. It is important to point out that the workers who were engaged in the landslide countermeasure works, monitoring experts, who are responsible for landslide activity date collection and input could themselves estimate how the underground and surface water influences the velocity of the landslide. Beginning from the late October the landslide mitigation has been noticed on the most active landslide area. And since this information was disseminated among the population of the village by their villagers (workers, monitoring experts are village residents) the villagers trusted this information.

Need assessment

Finding

Respondents were asked to evaluate (to score from 1 to 12) presented statements[7] on different needs where 1 is the highest priority need and 12 is the lowest priority need for the respondent's family. Thus for the assessment of the needs responses which got scores from 1-3 are considered as high priority, and those which got 11, 12 scores are considered as low priority scores. Hence for the 80% of the respondents the highest priority need was job opportunity in the village, 40% of the respondents evaluated availability of doctors in the village as the high priority need. Good telephone connection is also determined as high priority need for the villagers- 16% of respondents gave high scores to this need.

On the other hand availability of shops in the village was determined as the lowest

[7] Matrix of needs was provided to respondents to score according to priority

priority need by 40% of the respondents. Although 16% of the respondents prioritized school teachers need for the school, 28% of the respondents gave lower score to the need of the teachers. Entertainment places were low priority needs for the villagers – 24% of respondents scored low for this need, sewerage system was also considered as low priority need for the village, 32% of the respondents scored low for sewerage system availability. Agricultural market availability is not important need for the villagers: 28% of respondents gave low priority to this need.

Analysis

Based on the date of the finding it is reasonable to assert that for the people of Gosh village the most basic and important need is the availability of job in the village. The next important need for the residents is the availability of the local doctor in the village. Good telephone connection condition is also prioritized by the residents of the village, since telephone cables are very old and it is very difficult to connect even with neighboring cities and villages.

Nevertheless, village people do not concern about availability of shops in the village, since there are four shops in the village. Regarding school teachers availability although some of the respondents think that it is very important need for their families most of the respondents do not prioritize this need. Entertainment places are not considered important issues for the village residents. Sewerage system and agricultural market availability are not important needs for the villagers according to the findings.

Input of the villagers

Findings

Respondents were asked to say personally respondent and his family what kind of actions they can take to help coping the landslide in this project and in the future maintenance. 48% of respondents said that they can assist physically and by provision simple instruments like hammers, crow-bars. 20 % said they are skilled persons and ready to help by professional assistance: tractor operator, driver, and constructor.

Almost all the people 92% are ready to monitor, protect and maintain the constructions in the future.

The respondents were asked to tell would they like to be trained for further maintenance of landslide equipment and countermeasure actions in the future for free. 28 % did not

know the answer, 48 % said they will agree to be trained. And 24% said that they do not want to be trained.

Analysis

Findings showed that people were ready and willing to bring their inputs for landslide prevention measures by different means: their knowledge, force or instruments. Most of the people also agreed to conduct maintenance of the construction and equipment for free. Namely people were willing to bring their help and assistance for JICA Study Team countermeasure works.

Observations

About 10-12 workers have been involved in the landslide prevention small scale civil works and one person was supervising the construction works, three residents compose the landslide monitoring team. It is important to mention that the workers payment amounted 1200AMD per day. It can be considered as a contribution from the workers' side since this is small amount of payment for Armenia. Actually the input contributed from the community was more than it was expected by the results of the survey. Working instruments and materials were provided by approximately each worker, the householders of the construction site provided the basements of their houses for construction materials storage, there were several cases when the dump tracks which were provided by subcontractor got out of order and the residents provided their 66-tracks at free. The workers themselves manually unloaded the gravel from the 66-track, what was very difficult task. Welding equipment was also provided at free by the villagers. The contribution was also provided from the side of municipality and local NGOs. The skilled workers who lived in Dilijan City were transported by the cars of municipality.

Observation of public events:

Funeral ceremonies

JICA Study Team members participated in the funeral ceremony of an old resident of the village. According to the traditions of the village all the village residents (at least representative from each family) shall participate in the funeral ceremony. Usually the funeral is conducted in the afternoon at 13:00, 14:00 and the funeral procession moves to the cemetery. In Gosh there are three cemeteries. Two of these cemeteries are old and closed; the new recently open cemetery is located in the north-western part of the village. After the funeral the relatives bring the food and beverage to the cemetery and

ask everybody to drink for the memory of a dead person. Then everybody are invited to the house of a dead person and given a traditional dinner. During the dinner the villagers are proposing the toasts for a memory of a dead person. On the seventh day after the death the relatives shall go to the cemetery and burn incense. After it the relatives visit the cemetery each Saturday until the fourth day after the death. Armenians also visit the cemetery on the second Sunday of September which is a Memorial Day of all the dead people.

Vardevar

Vardevar is a traditional festival which was originated from the pagan times. This festival is usually celebrated in July[8] throughout all the Armenia, however in Gosh it is celebrated very actively and both children and grown up people are participating in this event. On that day people are pouring water on each other, and in the evening they have big parties, making khorovats (Armenian barbecue) and inviting their neighbors tot their homes.

4.2 Formulating a Mechanism for Community Initiative

4.2.1 General

Working commission which consists of village residences and JICA Study Team members has been established in order to conduct the pilot project with community initiative. The working commission has taken the lead to discuss about issues of the pilot project. It is important to mention that all the important questions regarding Pilot Project progress were discussed on the WC meetings. In parallel with establishment of the working commission, advisory committee has been established to backup the pilot project. The advisory committee consists of deputy governor of Tavush Marz (region), Chief architect of Tavush marz, representatives of German Technical Cooperation donor organization and British Regional Development Agency, Dilijan Community Union's Director, as well as representative of MoUD who chaired the Advisory Committee meetings.

The main obstacles for establishment of a mechanism for community initiative

According to observations the main population of the community was working in state organizations during Soviet times. About 70 people were working in Gosh affiliate of

[8] the hottest month in Armenia

Dilijan factory of radio equipments (headquarter in Moscow), about 20 people were occupying different positions in Sand mining organization near Gosh. Most of the people were working in Dilijan City, Ijevan City surrounding villages and areas; village residents were also working in local sovkhoz as machine operators, agricultural specialists, animal husbandry specialists, other area specialists. Regular everyday bus transportations of the people to surrounding cities and villages were organized by the village and state administration. The employment rate of that times was very high, namely every person who wanted to work could find appropriate job.

It is worthy to mention that the state organizations, which were managed by the assigned directors, belonged to state; hence nobody took care about the efficiency, quality of the production. It was very famous expression *"carriers"* which was applied during those times. The meaning of that expression was that in any state organizations most of the productions or semi-productions, details, instruments were just stolen by the workers themselves and were carried to their homes for their needs. For example, most of the people who were working in Gosh affiliate of Dilijan Radio-equipments factory even now use the instruments they got from the factory.

Another issue to be pointed out was the working regulations and rules on the working site. Nobody obey the rules and regulations on the working site. In most of the organizations workers, specialists could go on their businesses at any time they wanted, could be late for the work, and NOT use the working hours effectively. However they were receiving their salaries in a proper manner.

Gosh people were also living in the same conditions and behaving in the same way. During the seventy years of this system people used to work without putting any efforts, not paying attention on the quality of the works, maintenance of the equipments because the result would be the same. So during the long time this people were losing motivation for the works **considering only the salary as a benefit of their works**. After the collapse of the Soviet System the peoples mind is remained the same. Actually people of the post soviet area are willing to find the "easy" work even nowadays, work which was provided to them during soviet era.

So at the beginning of the pilot project it was difficult to explain the importance of maintenance and sustainable development of the project to the people who have not considered about it for a long time.

Moreover, it was very difficult to establish a community initiation mechanism in the society, where all the works, efforts have been put to get the “pocket of money” by any means.

4.2.2 How were the members nominated and selected

At the beginning of pilot project member of the working commission has been selected based on the discussion of head of the village, the village office staff and JICA Study Team. First meeting of WC was held on June 30, 2005 in Gosh Municipality building. Actually the participating members were formally recognized active people who were representing mostly one generation of the village society. Although at that time it was not possible to identify the real key persons of the community, most of the people participated the first meeting were active community residents: Lena Arzumanyan LSG Accountant, head of “Mkhitar Gosh” NGO, Founder of “Aghstev Shin” Construction Company, Grigoryan Suren is the Executive Director of “Gosh Foundation” NGO which is charge of tourism development in the community. With the initiative of this NGO several micro projects such as small market establishment in the central square of the village, needle-work trainings for the children. Boris Grigoryan was occupying the high positions in the village administration during the Communism times. Table 4.2.1 shows the member of the working commission.

After the first General Assembly, where actually all the layers of the society were represented, it became obvious that it was ***necessary to involve other generation representatives*** into WC to make it more effective since all the members of the WC were representing one generation from 35 years old to 45 years old (only Boris Grigoryan belonged to the higher generation). These issues were discussed on the W/C meeting and beginning from the fifth WC session Mr.Artsruni Hovsepyan and later Mr. Anton Sargsyan and Mr. Robert Ghazaryan began to participate in the WC sessions as representatives of older and younger generations of the village society.

However, as the pilot project continued it became clear that the ***involvement of the informal leaders of the society into the WC*** was necessary. In each society some informal leaders are available. This people are respected by the population for different causes. The main characteristic of this people is that they can lead and influence some groups or strata of people. Thus the positive step in this regard was the participation of Mr. Anton Sargsyan on the WC sessions, which is very much respected by the most of

the population because "he helps each family of the village"[9]. Mr. Sargsyans participation gave a positive incentive for the positive development of the progress of W/C. His contribution was also big for the preparation of community development draft plan, due to his experience in civil construction.

Table 4.2.1 Working Commission Member List

Name	Position	Occupation
Ghazaryan Armen	Chair of W/C	Constructor
Grigoryan Boris	Core member	School teacher
Hosepyan Artsruni	Sub-member	Head of Goshavank Historical Complex
Grigoryan Suren	Core member	Director of "Gosh" Foundation (NGO)
Arzumanyan Lena	Core member	Gosh Municipality accountant
Grigoryan Shushanik	Core member	Gosh Municipality staff secretary
Sargsyan Anton	Sub-member	Constructor
Ghazaryan Robert	Sub-member	In charge of Landslide Monitoring
Veranyan Hovsep	Observer	Head of village
Choginyan Gregory	Core member	JICA Study Team
Hara Takashi	Core member	JICA Study Team

4.2.3 How the W/Cs were held

The working commission meeting has been held twice a month basically. In case of necessity, the meeting held depending on the situation of project progress. Working commission discusses the actual issues based on progress of the project and discussion issues are provided by JICA Study Team in the meeting. Basically, the meeting has been held by working commission members. According to the contents of discussion issues, other residences who have relation with the issues to be discussed have presented as sub-members of the working commission.

4.2.4 How were the issues proposed or agreed

The style of a member's free discussion among the WkC members has been taken during the meetings. About the deliberation subject for discussion, it provided from the

[9] According to villagers of Gosh

JICA Study Team. The result of the discussion has been reported to the head of the village. The information offer to residents was made from the working commission member.

General assembly had been held twice. In early stages of the project, residents' interest was not so big, and during the first general assembly, not many residents gathered to participate on the meeting. During the second general assembly more residents participated. The main issue of discussion was the selection of priority site for landslide countermeasure works. Although participants agreed to conduct prevention measures on the selected site, it was clear that they do not believe this works may bring some contribution. Although many residents gathered at the meeting at which it is the second time, some residents left or told about other issues in the middle of a meeting.

During the project, the JICA Study Team spoke to as many residents as possible, explained the project, and collected the opinions of residents. Moreover, JICA Study Team gave explanation to some key persons who respected by residents in the village, and ask the communication of information from a key person to residents.

4.2.5 Observations and Evaluations

It seems that a working commission member and residents had distrust to the investigation and construction of landslide countermeasure which the JICA Study Team is planning at the beginning of a pilot project. However, a discussion in the working commission meeting became active as the project advanced. It is considered that the residents could feel a real possibility since the residents itself actually join the project. Although head of the village was attending the meeting as an observer at the beginning, head of the village's presence has had a large influence and there were few remarks from the working commission members side. When head of the village was requested to refrain from attendance to a meeting, the active opinion of members came to be obtained. Moreover, maintenance activity of the village institution resources by the residents who considered the working commission member and head of the village as initiative also came to be performed. This is considered that the pilot project became one cause.

At the beginning of the pilot project it was obvious that residents were very skeptical about importance of the small scale landslide countermeasures proposed by JICA

Study Team in the effect of to landslide mitigation, first of all because they were not be familiar with the drainage system[10] and could not imagine the possible effects of that. Moreover, there was the opinion that the budget spent on the countermeasure construction to the landslide mitigation should be transfer for relocation of families, suffered by the landslide activity.

However, during the progress of pilot project it was obvious that residents could visually estimate and believe in the effect of the small scale countermeasures. The degree of interest and degree of the input of the villagers increased.

After actually starting construction, a result came to be a foregone conclusion gradually and it was thought that residents' degree of interest and degree of comprehension went up. However, all residents did not become so.

4.3 Forming the Conceptual Community Development Plan

4.3.1 Proposals regarding Community development plan

The community development conceptual plan which is considered as a basis of a pilot project was prepared based on the opinions of the working commission members. At first W/C members selected the priority areas of development:

1. Infrastructure development
2. Agriculture development
3. Industry development
4. Natural protection development
5. Public Health development
6. Education development
7. Tourism development

The table was prepared with blank cells to be filled in according to each field and distributed among the W/C members. The working commission members proposed their ideas about the community development according to each category of each field. Those ideas were classified according to the category by the JICA Study Team. During the

[10] Basically during the Soviet Era the drainage systems were not installed in most of the rural areas

next meetings working commission have specified priority categories of each area: discussed details of what will be needed for the future development plan as well as available resources of the village.

4.3.2 Resulting outputs from the Working Commission

(1) Infrastructure development conceptual plan

The high priority issue for the village is considered the infrastructure development according to the W/C members. The following table shows the infrastructure categories according to the priorities: the highest priority infrastructure category is landslide area road reconstruction. There are causes of this decision:

First of all the upper area roads are is in very bad situation comparing with other areas local roads. Although it was able to pass by the heavy-duty truck on the local roads of that area in past time, there is a case that passing of these trucks is impossible since especially a road suffered. The residents themselves recognize this situation as serious problem. The road situation of this area gets worse remarkably at the time of a heavy rain or snow melting season since the ground is soft clayey and drainage system is deficient.

Secondly, the upper area was the most attractive area for the tourists, since both monasteries are located here, the natural background is more beautiful from the upper site as well as the central square is located here.

Considering all the above mentioned factors, working commission has developed infrastructure development conceptual plan, which is shown in Table 4.3.1.

Table 4.3.1 Infrastructure Development Conceptual Plan

Categories	Problem definition	Necessary steps to be made	Community Input (10-15% of Project Cost)	External assistance	Priority
Local Roads Reconstruction	Some of the local roads are in very poor situation (for example upper area roads)	The pavement works on the roads	1.labor 2.instruments 3. 66-tracks+operators (will work at free for 7-10days) 4. tractor + operator 5. rocks / gravel 6. store for construction materials 7.welding equipment+ operator	1.fuel 2.cement 3.payments 4.excavator+operator 5.welding die	**I** Highest priority
Sewerage system	sewerage system is not available	installment of sewerage system	1.labor 2.instruments 3.welding equipment+ operator 4. store for construction materials 5. 66-tracks+operators (will work at free for 7-10days)	1.pipes 2.cement 3.excavator +operator 4.payments 5. welding die 6. fuel	**II** High priority
Irrigation system	irrigation system is not available in Gosh	To install irrigation system in Gosh	1.labor 2.instruments 3.welding equipment+ operator 4. store for construction materials 5. 66-tracks+operators (will work at free for 7-10days)	1.pipes 2.cement 3.excavator + operator 4.payments 5. welding die	**III** High priority
Drinking water system	drinking water system is not available in some houses	To install drinking water system supply in Lower Gosh	1.labor 2.instruments 3.welding equipment+ operator 4.66-tracks+operators 5.fuel 6.pipes 7.cement	No external assistance is needed	**IV** High priority
Road to Gosh lake	road is in very poor condition	To cover the road with the sand	1.labor 2.instruments 3.66-tracks+operators (will work at free for 7-10days) 4. tractor +operator 5. rocks / gravel	1.fuel 2.cement 3.excavator+ operator 4.payments	**V** middle priority

(2) Tourism development conceptual plan

Gosh village has tourist attractions, such as Goshavank, Gosh Lake, beautiful mountainous and forestry areas and village people are interested to tourism

development very much. Therefore, the conceptual community development plan was planned within the scope of tourism development as much as possible. These activities are supported by the establishment of "Gosh" Foundation [11], construction of information[12] center for tourists, establishment of souvenirs shop for tourists in the central square of the village[13]. The village's natures, mountainous areas, famous Goshavank, Gosh Lake attract tourists from all over the world. The number of tourists visiting Gosh is increasing from year to year, for example in 2004 the number of tourists visiting Gosh was about 5000-6000. Different ideas of tourism development were proposed and thoroughly discussed by the WC members. Thus according to proposed ideas of WC the tourism development strategy consists of two main approaches: **family development:** lodging is provided to tourists, they can have natural local food, and they can get familiar with local traditions and **eco tourism**: tourists get the opportunity to travel to the attractive sites either by donkeys, horses or by foot. Tourism development conceptual plan prepared by working commission based on these factors is shown in Table4.3.2

Table 4.3.2 Tourism Development Conceptual Plan

Categories	Purpose	Community Input	External assistance
Family Tourism	Lodging	1.private houses 2. natural food	1. Internal repair 2. Sewerage system installation 3. Hot water supply system
Eco tourism	Trips by animals, walk	1.Traveling to the attractive sites: Gosh lake, mountainous areas, collecting the herbs 2. Transporting animals	

(3) Agriculture development conceptual plan

During the Soviet Era very intensive breeding of large-scale livestock had been carried out in the village. The livestock was kept in state farms which were under the sovkhoz. Each household was permitted to breed up to three cows as a private business. After the collapse of the Soviet Union, each resident carries out small-scale livestock breeding. Although there are many residents who specialize in breeding of livestock in a village, it

[11] The local NGO which is in charge of touri

[12] The project is financed by the World Bank and coordinated by "Gosh" Foundation

[13] The micro projects conducted by "Gosh" Foundation

is difficult to expand a business and perform individually. The WC discussed several categories of agriculture development but the highest priority categories were given to large-scale stock raising industry managed by the village, since there is a high demand on the high quality raw meat and milk in Armenia, especially in Yerevan, where the restaurant and fast food businesses become very popular and prevalent in a recent time. It is important to mention that the village has rich pastures for cattle grazing. According to the villagers themselves"in Gosh the cattle is kept in the cow house only for two months, and the rest of the time animals are de-pastured". Namely, since the animals in this region get fresh grass all the year the quality of the meat and milk becomes higher as well as the administrative costs are lower than in other regions. It is important to mention that different villagers run the animal husbandry farming separately. On of the ideas of Working Commission was the union of the separate farmers to establish meat and milk processing factory. Since this factory will provide processing and packaging of the meat and milk produced in the village by different farmers. Uniting of separate farmers it is feasible for the community to solve the problem of packaging and processing of the production and getting the access into the market. The animal statistics of Gosh is presented in Table4.3.3

Table 4.3.3 Animal Statistics of Gosh Village

CATTLE					
Total number of cattle	Cows	Un spermatic female cows (1- 2 years)	Spermatic female cows (more 2 years)	Un spermatic female cows (more2 years)	number of bulls
455	220	67	24	133	11

PIGS			SHEEP	GOATS	HORSES	
Total number of pigs	Mother pigs more than 9 months	Female pigs 4-9 months	Total number of sheep	Total number of goats	Total number of horses	Females more than 3 years old
205	49	156	148	62	23	23

DONKEYS	BEES FAMILIES	BIRDS
6	83	523

Agriculture development conceptual plan prepared by working commission based on the above mentioned factors is shown in Table 4.3.4

Table 4.3.4 Agriculture Development Conceptual Plan

Categories	Purpose	Community Input	External assistance	Priority
Meat production	To establish meat processing production	1.farms for cattle keeping 2. pastures for cattle 3.labor	1.technology for meat processing 2. medicine for cattle	high priority
Milk production	To establish milk processing production	1.farms for cattle keeping 2. pastures for cattle 3. labor	1. technology for meat processing 2. medicine for cattle	high priority

(4) Industry development conceptual plan

Regarding the industrial development, the ideas of development of abandoned quarry, located in the northern part of the village, and the fresh juice production using the abundance of fruit harvested in the village were proposed. Although these ideas had been argued in the village in the past, these plans are not carried out so far because of financial problems. However it is important to stress that according to WC members' opinions both fields have good opportunities to be developed. Rock mining was exploited in the early 1990s by the local entrepreneur, however due to economic instable situation and absence of market was closed. According to WC members today these two main obstacles are not so problematic, because at present the economy is more stable in comparison with that of 1990s, and the demand for the production is higher, moreover the people's solvency rate is slowly increasing.

Fresh juice production is very popular idea in the entire village, since all the villagers can use this opportunity of income generation (almost all the villagers raise different fruits in their gardens). Village favorable conditions are very conductive for an abundance of different types of fruits and vegetables. According to WC members and villagers during tourism season there is a high demand for fruits and it is possible to formulate the potential market for the fresh fruit juice and fruits production within the village with the increase of the number of tourists. The following types of tourists are growing in the village: pear, apple, strawberry, plum, hips.

Industry development conceptual plan made by working commission based on these situations is shown in Table 4.3.5.

Table 4.3.5 Industry Development Conceptual Plan

Categories	Purpose	Community Input	External assistance	Priority
Rock mine	1. to develop community industry 2. to open new working positions	labor documents (license) rock processing place	rock cutting machine	middle priority
natural juice productio n	1. to develop community industry 2. to open new working positions	1.fruits 2.labor 3.natural spring water 4.corresponding place 5.fruit processing machine	market	middle priority

(5) Natural protection development

Although the problem of natural protection very much refers to tourism development field it requires more attention to be paid. Regarding the problem of natural protection the WC members pointed out the problem of cleaning of Gosh Lake. In this regard it is important to mention that the grass and moss covering the bottom of Gosh Lake have become an actual problem recently, thus WC members have stressed the issue of cleaning the bottom of Gosh Lake, however to make the cleaning works the community shall get the permission from the Ministry of Natural Protection.

Natural protection development plan made by working commission based on these situations is shown in Table 4.3.6.

Table 4.3.6 Natural Protection Development Conceptual Plan

Categories	Purpose	Necessary steps to be made	Community Input	External assistance	Priority
Cleaning Gosh Lake	To make Gosh lake attractive place for tourists	To make special instrument to clean Gosh Lake from plants and moss	1.labor 2.instruments 3.66-tracks+operators (will work at free for 7-10days) 4. tractor + operator 5. rocks / gravel	Permission from Ministry of Natural Protection	high priority

(6) The problem of absence of English teacher in the village school was also stressed by the WC members. The Local Government applied to the Regional Government Agency to appoint an English teacher for two schools of Gosh.

(7) As an idea for an improvement of residents' living environment the idea of distribution of medical facilities was mentioned. Although maintenance of the medical facility and a periodic medical checkup is performed by NOVA[14] organization funded by USAID, it is still not enough. The main problem is the absence of the doctor in the village. This problem was also mentioned in the survey conducted in September.

4.3.3 Observations and Evaluations

Although the residents had the idea for community development before the pilot project started, study to make systematization and implementation had not been carried out about these plans. It seems that these plans is materialized and clarified more by the working commission meeting, and residents recognized what should be made in the future for village development and prosperity. Therefore, on the occasion of implementation of the village development plan, the residents can make an action efficiently when they get required materials and funds.

The flow chart of the conceptual community development plan prepared by the working commission meeting is shown in Figure 4.3.1.

[14] Aid post was estabished

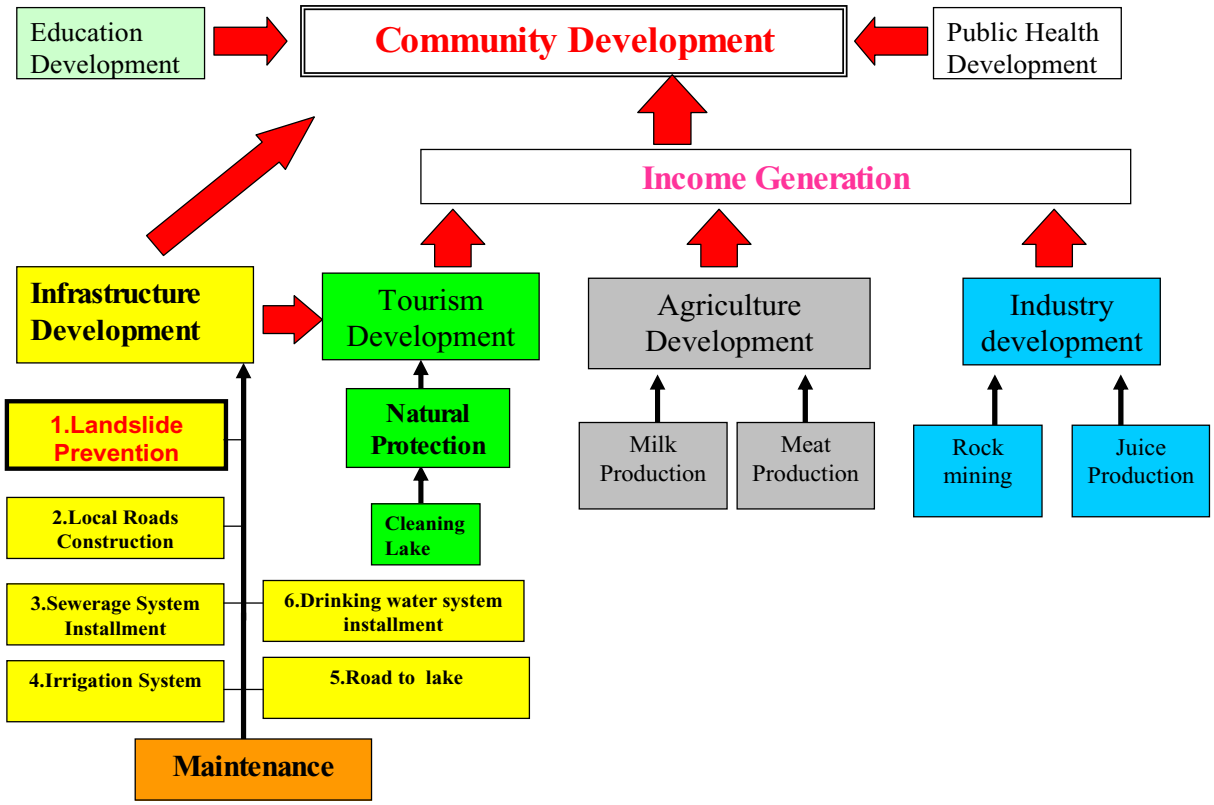


Figure 4.3.1 Flow Chart of Conceptual Community Development Plan

It is important to mention that the Community Development Conceptual Plan have been developed step by step prioritizing the important fields of development. After the elaboration and discussion of all the feasible fields the WC have given the highest priority to the continuation of installation of drainage system throughout all the upper area of Gosh according to the general plan prepared by JICA the Study Team. However, during the implementation of the pilot project the working team has faced with some difficulties of transportation of construction materials and gravel material to the construction site, besides it was difficult to work in clay site for the villagers. If the road pavement is conducted it will be more feasible and effective to conduct drainage installation throughout all the upper landslide area. Thus based on the above mentioned indicators the WC has come to conclusion to implement the project of **pavement of the roads in parallel with drainage system installation**. This project is considered as the highest priority project of the village development plan and is going to be conducted in 2006.

For this purpose the upper landslide area was divided into A, B, C, D, F zones and was prioritized according to the importance, and the cost-estimation for each zone was prepared by the WkC construction specialists.

During the pilot project the landslide monitoring team was formed in Gosh. The landslide monitoring has been conducted in Gosh since December 2004. On the landslide territory of Gosh village ten extensometers, pipe strain gauge, inclinometer and 14 nuki-itas (movable beams) have been installed to monitor landslide activity. Beginning from September 2005 the landslide team was formed which was responsible for landslide monitoring date collection and reduction. The landslide team members are: Andranik Davdyan, Robert Ghazaryan, Razmik Grigoryan. Andranik Davdyan is responsible for monitoring equipment maintenance, Robert Ghazaryan is responsible for extensometers, inclinometer and water level date collection and reduction; as well as analysis of the raw date, Razmik Grigoryan is responsible for nuki-ita date collection. The monitoring date collection shall be continued and the obtained and analyzed date shall be submitted to the MoUD and Marzpetaran.

During the pilot project a big attention was paid to the establishment of landslide management system in the community. After the discussions and elaboration of this issue WC members have formulated this system according to the realities and situation of Gosh community. The landslide management system is presented in the Fig.2. According to this system in case of normal situation the landslide monitoring team submits the monitoring date to the WkC and WkC informs about the activity of the landslide to the residents. However, in case of emergency situation landslide monitoring team gives evacuation advice to the residents and informs about the situation to the village head. Village head shall give the evacuation order to the residents and at the same time shall inform about the emergency situation to the Marzpetaran and ARS.

Maintenance of the infrastructure facilities as well as landslide prevention facilities is very important from the viewpoint of community sustainable development. Gosh community has an experience in this regard. Thus in 2004 Gosh Foundation in cooperation with “Burg” NGO have installed several signboards on the lakeside of Gosh Lake. The central square of the village is everyday swept by the assigned person. Anton Sargsyan was elected as a coordinator of landslide prevention constructions by the WkC members. According to the maintenance system of landslide prevention facilities 3-5

families will be selected each month from the upper area that will be responsible for the maintenance of landslide constructions. All the maintenance process will be coordinated by Anton Sargsyan.

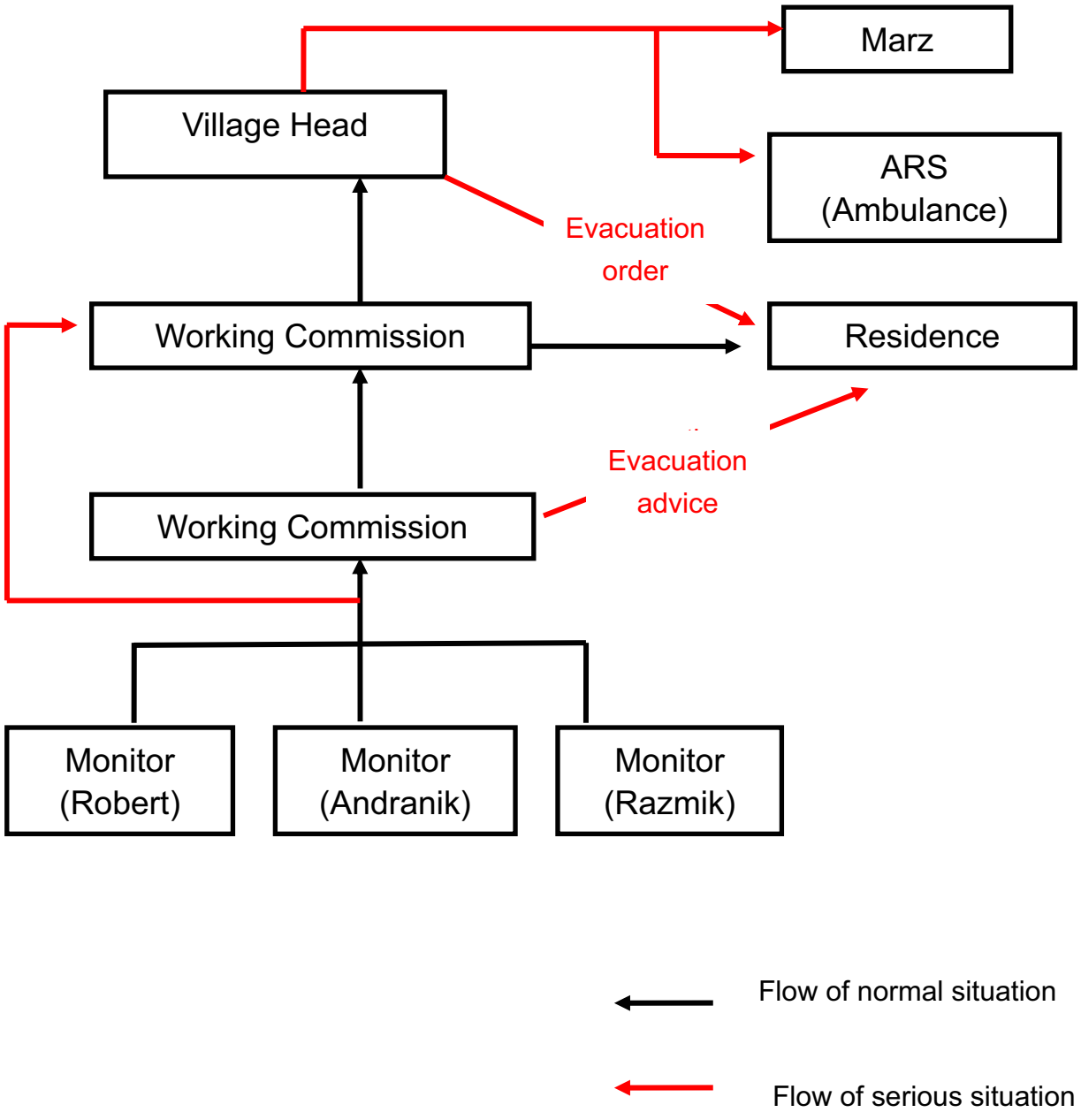


Figure 4.3.2 Evacuation System in Gosh Village

4.4 Landslide Management within the Framework of Community Development Plan

4.4.1 Risk and Resource Assessment

(1) Hazard Map

Hazard Map that is a basic map has been prepared in the project. The map is prepared based on interpretation of aerial photograph/ topographical map and result of geological reconnaissance by JICA Study Team. On the map, estimated landslide block, estimated hazard area by landslide activity, topographic and geological information, location of geotechnical investigation and landslide monitoring instruments are shown. The contents of items that are shown on the Hazard map are shown on Table 4.4.1.

Table 4.4.1 Contents of Hazard Map

Item	Information
Landslide Block	Area, Estimated moving direction
Estimated Damaged Area	Deposit area, Water reserved area, Flood area
Topographic Information	Knick line, Crack, Depression zone, Scarp, Gully
Geological Information	Outcrop, Dip-strike, Boundary, Fault
Geotechnical Investigation	Borehole, Dynamic Cone Test, Cross Section
Monitoring	Extensometer, Nuki-Ita, Rain gauge, Alarm Unit
Water Condition	Surface water, Spring,
Other	Deformed Tree, Swamp

Hazard map based on 1/1,000 scale topographical map is prepared Auto CAD format. The area of the hazard map is the upper Gosh village.

Result of interview to residents and geotechnical investigations are used to preparation of a draft hazard map. Final version of the hazard map is prepared with working commission using the draft version map. Figure 4.4.1 shows the final version hazard map.

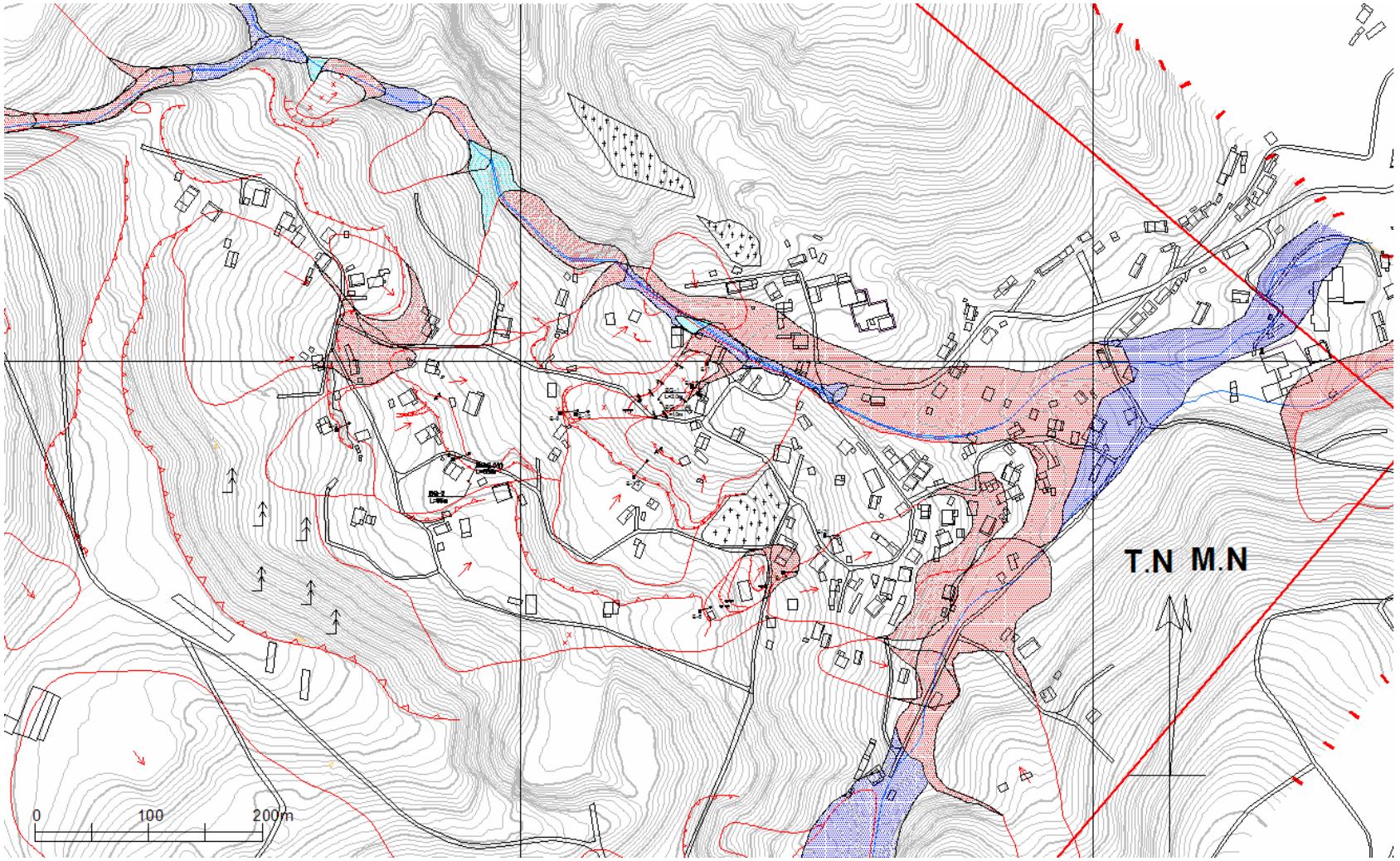


Figure 4.4.1 Hazard Map of Gosh Village

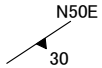
LEGEND

<Geological Map>

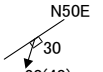
Dip and Strike — Bedding

Joint

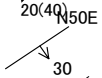
Schistosity



Scarp (Striae)

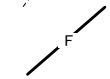


Fault



Geological Boundary

Fault Line



Outcrop

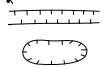
Crack

Gully

Scarp — New

Old

Depression Zone



Knickline

Water Spring

Surface Water

Deformed Tree

Cross Section

Borehole — No Monitoring

Strain Gauge

Water Level

Inclinometer

Dinamic Cone Penetration Test

Monitoring — Nuki-ita Movable Beam

Extensometer

GPS Point

Rain Gauge

Alarm Unit

<Hazard Map/Risk Resource Map>

Landslide Block

Assumed Affected Area

Assumed Reservoir Zone of Landslide Dam

Assumed Flood Zone by Collapse of Landslide Dam

Direction of landslide Movement

Evacuation Place

Drainage

Horizontal Drilling

Landslide Management Office

Telephone

Disaster Prevention Resources

House Damage Category Code

		No damage at all
I		Buildings in good technical condition; inessential damages, which can be eliminated by current restoration works
II		Buildings in satisfactory technical condition; damages can be eliminated by restoration-reconstruction works
III		Buildings in unsatisfactory technical condition; damages can be eliminated by strengthening and reconstruction works
IV		Buildings in emergency condition; dangerous for further use – the habitants must be resettled
V		Buildings partially or completely ruined; habitants resettled

Estimated natural disasters and damages based on the hazard map are shown the following table.

Table 4.4.2 List of Estimated Natural Disaster in Gosh Village

Disaster	Risk	Estimated Damage
Landslide	Damage to buildings Damage to infrastructure Damage to field	Houses: more than 100 Monastery: 1 Culture center: 1 Hospital: 1 School: 1 Shop: 1 Cow house: 80 Village road: 3300m^2 Drinking water pipe line:4000m Drainage system:420m River: 3100m Electricity: 3800m Telephone line: 380m Grazing land: 8.5ha Cultivate field: 2.25ha
Flood from river that is dammed up by landslide deposit	Prejudice to human life Damage to buildings Damage to infrastructure Damage to field	Resident: 500 persons Houses: more than 80 Village road: 3300m^2
Debris flow	Disturbance of traffic	Main road: 500m
Rock fall	Disturbance of traffic Vehicles Pedestrian	Main road: 100m

(2) Risk Resource Map

Risk resource map is prepared by working commission and JICA Study Team based on the hazard map. The information of village resource that is proposed by working commission is put on the map. The resource of the village is confirmed by the working commission member on the site. Risk objects of the area are identified by working commission based on the hazard map. The Risk resource map of the upper village is prepared based on the hazard map which scale is 1/1,000, whole village one is prepared 1/10,000 scale topographical map that is prepared Armenian geodetic institute. In the project, the house damage inspection is carried out by engineers of Tavush municipality office. The result reflected to the risk resource map.

The contents of items that are put on the risk resource map are shown on table 4.4.3.

Table 4.4.3 Contents of Risk Resource Map

Item	Information
Risk	Landslide, Debris flow, Slope collapse, Rock fall
House Damage	Category based on the official criteria
Resource	Disaster prevention material, Monastery, Natural resource, Evacuation place
Public Facility	Village office, School, Cemetery, etc

Many pictures are used on the risk resource map of whole village to easy to understand by all village residents.

Resources in Gosh village are shown on the following table.

Table 4.4.4 List of Resources in Gosh Village

Resource	Type of resource	Remarks
Monastery	Tourism	Goshavank, St. Gevorg monastery
Sand mine	Village development	
Rock mine	Village development	
Square	Tourism, Disaster prevention	Car park Evacuation place
Museum	Tourism	
Lake	Tourism	
Water resource	Infrastructure	3 water resources
Water supply system	Infrastructure	
Telephone to out of village	Disaster prevention	In Village office
Telephone network inside village	Infrastructure	
Tractor	Disaster prevention Village development	2 tractors
Truck	Disaster prevention Village development	4 tracks
Internet connection	Tourism Village development	To be planned by village
School	Infrastructure	
Pasture	Village development Tourism	
Motel	Tourism	
Tourism information center	Tourism	To be planned by World Bank
Gasoline stand	Village development	Lower village
Water spring	Infrastructure	
Animal husbandry facility	Infrastructure Village development	

The risk resource maps are shown on Figure 4.4.2 and Figure 4.4.3.

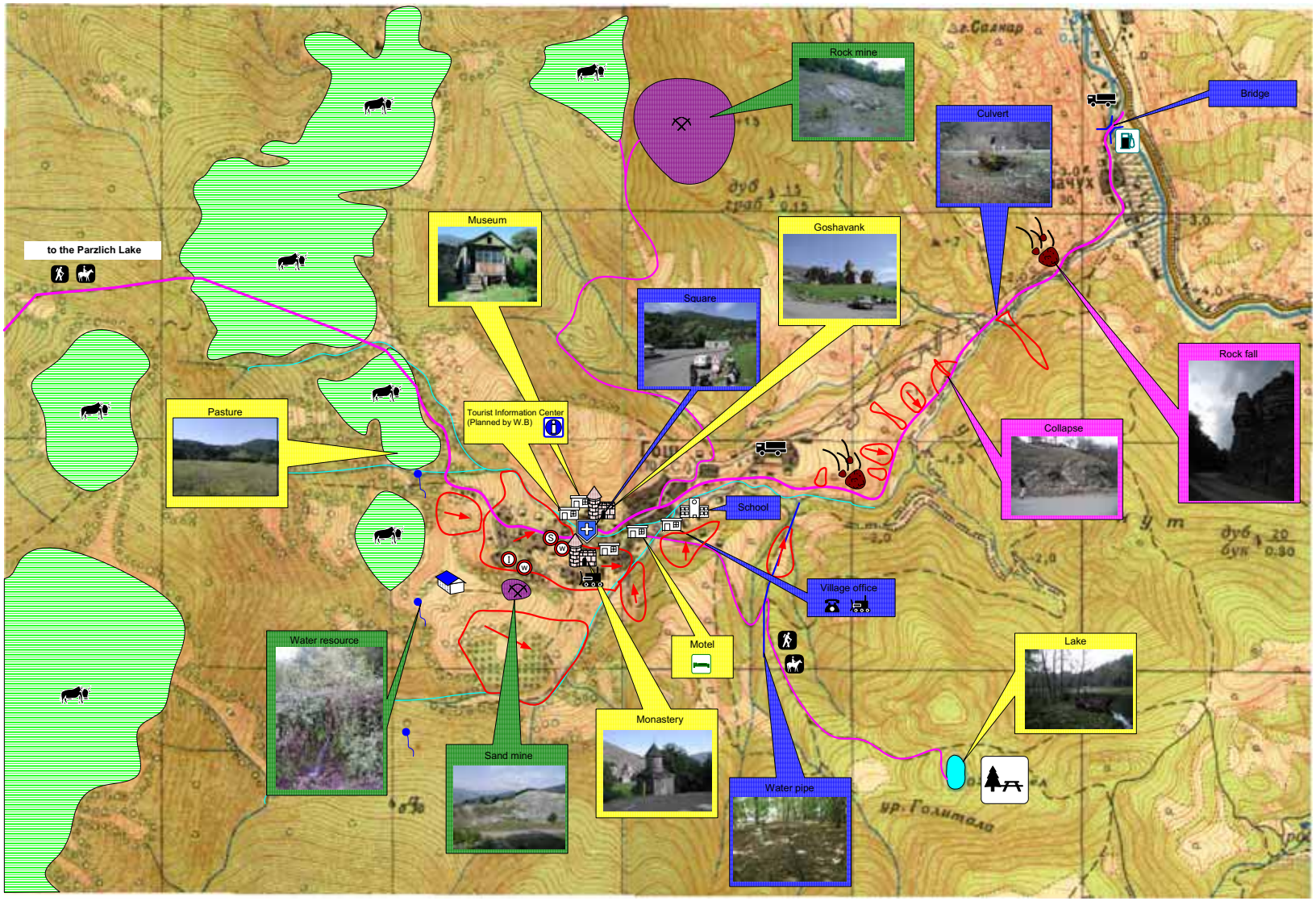


Figure 4.4.2 Resource Map of Gosh Village

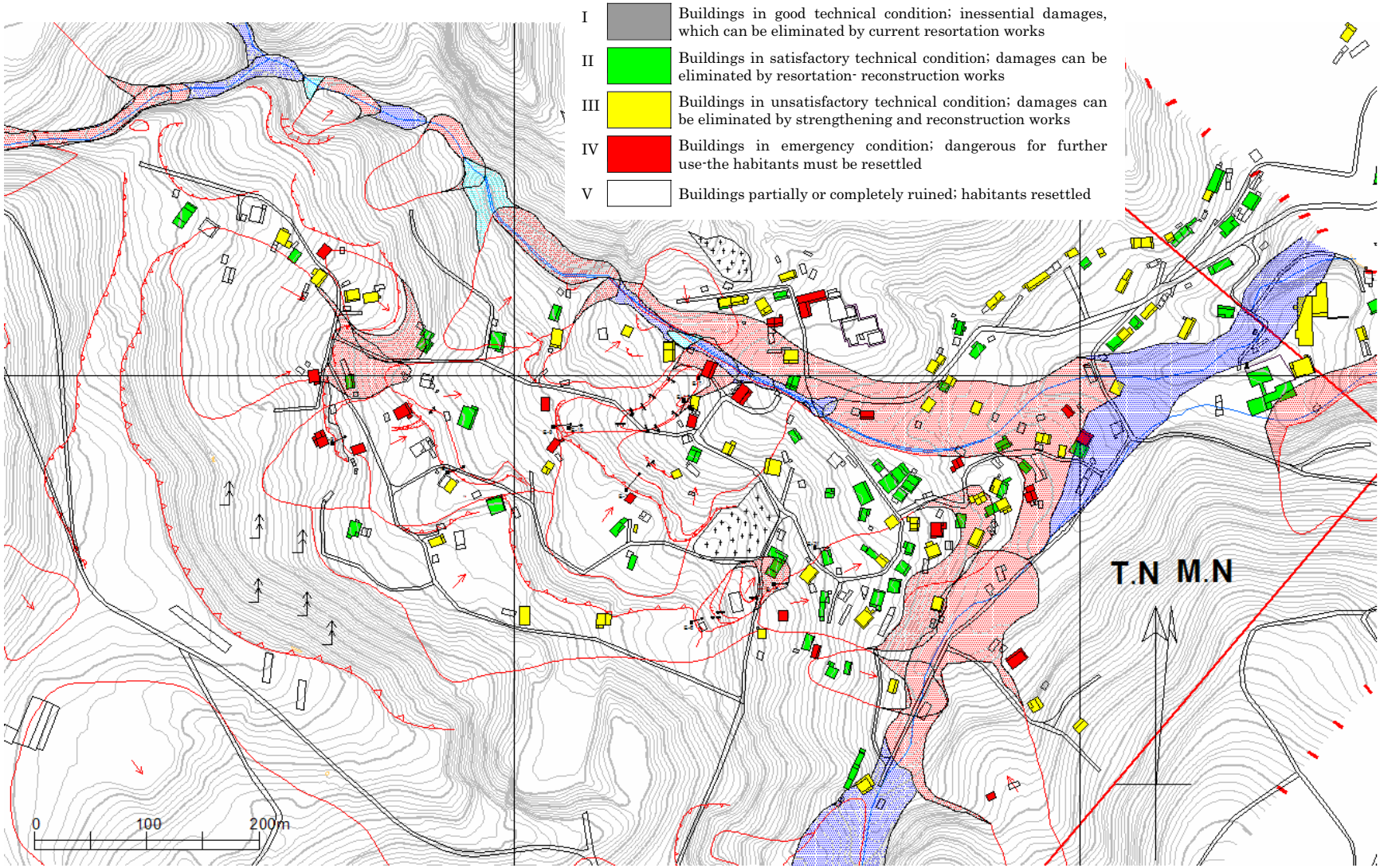


Figure 4.4.3 House Damage Category Map of Gosh Village

(3) Observations and Evaluations

The some village residents have some idea of resource for the community development and understand a situation of these resources of the village. Therefore, the risk resource map is prepared without any problem. The residents did not have the method of utilizing a resource in the village to the village development. However, by creating a risk resource map in this time, the risk resource in the village became clear. This result will be help to them when they carried out other community development activities. These maps are put on PC in the village office. Therefore, any residents who are interested in can find these maps.

4.4.2 Geotechnical Investigation

(1) Implement organization

Table 4.4.5 shows implement organizations for geotechnical investigation.

Table 4.4.5 Role Allocation of Geotechnical Investigation

Subject of Investigation	Work Contents	Organization in charge
Drilling	All core boring, Non-core boring	Artegia (Private section) Assist from community
Standard Penetration Test	Each 1m in borehole	Artegia (Private section)
Dynamic Cone Penetration Test	10 points	GeoRisk (Private section)
Groundwater Prospecting	2 boreholes	GeoRisk (Private section)
Geo-electrical Prospecting	5 measurement lines (total:2,179m)	GeoRisk (Private section)
Laboratory Test	Physical Laboratory Test Laboratory Soil Test	GeoRisk (Private section)
Installation of Monitoring equipment	Pipe strain gauge, Inclinometer, Extensometer, Rain gauge, Groundwater level sensor Nuki-Ita, GPS point measurement	Artegia (Private section) Community
Monitoring	Pipe strain gauge, Inclinometer, Extensometer, Nuki-Ita, Ground water level, Rain gauge	JICA Study Team Community
	GPS point measurement	GeoRisk (Private section)
Topographical Survey	Scale 1/1,000 survey on the site Scale 1/5,000 Digital Elevation Data	GeoRisk (Private section)
Geological Reconnaissance		JICA Study Team

(2) Result of the Investigation

Table 4.4.6 List of the Geotechnical Survey in Gosh Village

Item			Quantity	Description
Survey	Drilling (Vertical)	All core	2 holes	L=30m, L=55m
		Non core	2 holes	L=12m, L=38m
	Standard Penetration Test (SPT)		50 Tests	
	Geo-electrical Prospecting		4 lines	L=2170m
	Dynamic Cone Penetration Test		10 Points	
	Groundwater Prospecting		2 holes	
	Soil Laboratory Test		7 samples	
	Topographical Survey		870m* 600m	1/1,000scale, 1/5,000scale
	Geological Reconnaissance		870m* 600m	
Monitoring	Inclinometer		1 point	L=50m
	Pipe Strain Gauge		1 point	L=35m
	Groundwater Level Observation		2 point	L=10m, L=38m
	Extensometer		10 point	
	Precipitation Observation		1 point	
	Nuki-Ita (Movable Beam)		12 point	

The location of the surveys are shown on Figure 4.4.4

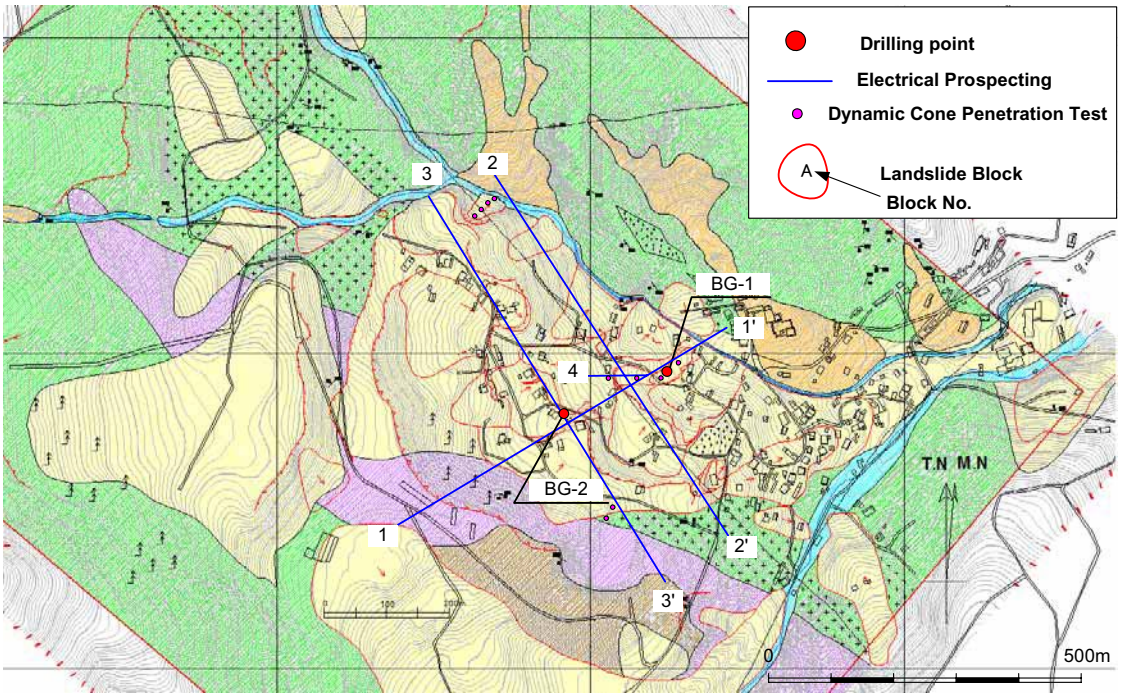


Figure 4.4.4 Location Map of the Geotechnical Survey

(a) General Geology

Generally, Palaeogene volcanic rock and volcanic sedimentary rock are widely distributed. In the area, basaltic tuff breccia is distributed as baserock and gabbro-porphyrite is found in the basement rock as intrusive rock.

Gabbros is found in the south-west of the upper village. The gabbro can be observed in old sand mine on the upper village. The gabbro is distributed in the N60W direction. The geological structure of this area shows N40W - 70W. This structure is parallel with Sevan fault that runs through north of the Sevan Lake. Landslide deposit that consists of silt sand with 0.5m to 1m boulder covers the basement rock. The rock in the range of 500m from boundary of the gabbro and the tuff breccia is received hydro thermal alteration. The rock in the zone becomes clayey rock or crystalline rock by the metamorphic alteration. According to the result of the geological study and aerial photograph interpretation, it is considered that big scale landslide (1,000m wide * 500 length) activity had been happened on the hydro thermal metamorphic zone in past time. After this, secondary landslides had been happened in the big scale landslide block. Almost houses of the upper village are located on the big scale landslide block, and are damaged by land subsidence.

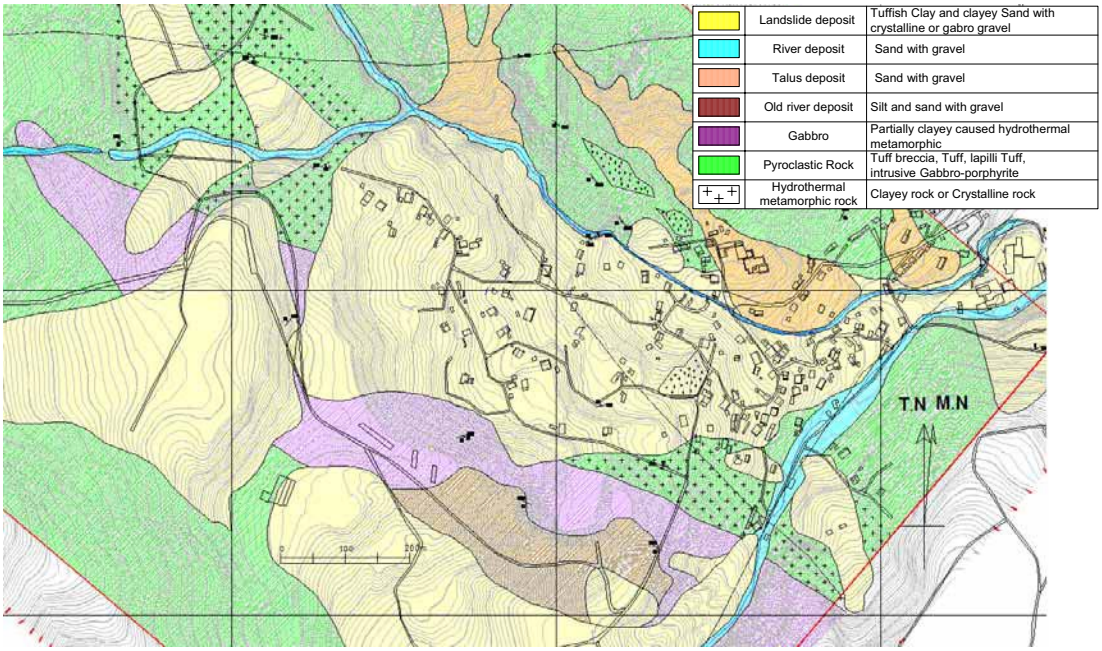


Figure 4.4.5 Civil Geological Map

(b) Drilling Survey

Drilling surveys were conducted on 2 sites that are shown on the Fig 6.3.1. On each drilling site, there are 2 boreholes, one borehole is all coring drilling to know geological condition, and another borehole is non-coring drilling to install groundwater level observation pipe.

1) BG-1

This drilling site is located on center of landslide block which is the most active in this area. Summary of geological condition is described hereunder.

Depth (GL -m)	Geology	Description
0.00 - 3.25	deposited Soil	Clayey-sand with gravel that is 1-3cm diameter. This soil is became a soft soil when the soil has some moisture.
3.25 - 4.80	Clay	The clay is transformed from original rock by hydrothermal metamorphic influence. The landslide surface is formed in this layer.
4.80 - 8.70	Tuff	Generally this section is fragmentized. There are few parts that are found original rock structure.
8.70 - 9.70	Tuff	This section has heavy - medium weathered. Original rock structure is hard to identify.
9.70- 16.90	Tuff	This section has medium weathered. Original rock structure is remained. From GL-12.5m, quartz vain is found in the rock core sample. There is no trace of water influence in this section.
16.90 - 17.10	Tuff Braccia	This section is fragmentized compare with upper section.
17.10 - 30.00	Tuff Braccia	This section has medium weathered. Original rock structure is remained. There are not some traces of deformation in this section.

As the result of core sample observation, slip surface of the landslide is considered at GL-3.25m to GL-4.80m and GL-8.70m to GL-9.70m. During the drilling work, groundwater level was observed everyday.

As the result of the observation, groundwater was GL-6m when the borehole was got on GL-6.8m. After that, the groundwater level was increased until GL-3.1m when the borehole was got on GL-15.25m. Therefore, groundwater is considered to confine. When the borehole was got on GL-35.00m, groundwater level is about GL-5m. Pipe strain gauge was installed in this borehole.

Non-coring drilling was conducted on point that is 2m away from the all-coring drilling point. Standard penetration test (SPT) was conducted in this borehole at each 1m depth. The purpose of the test is to know firmness (N-value) of the ground. The result of the test is shown on Fig 4.4.6.

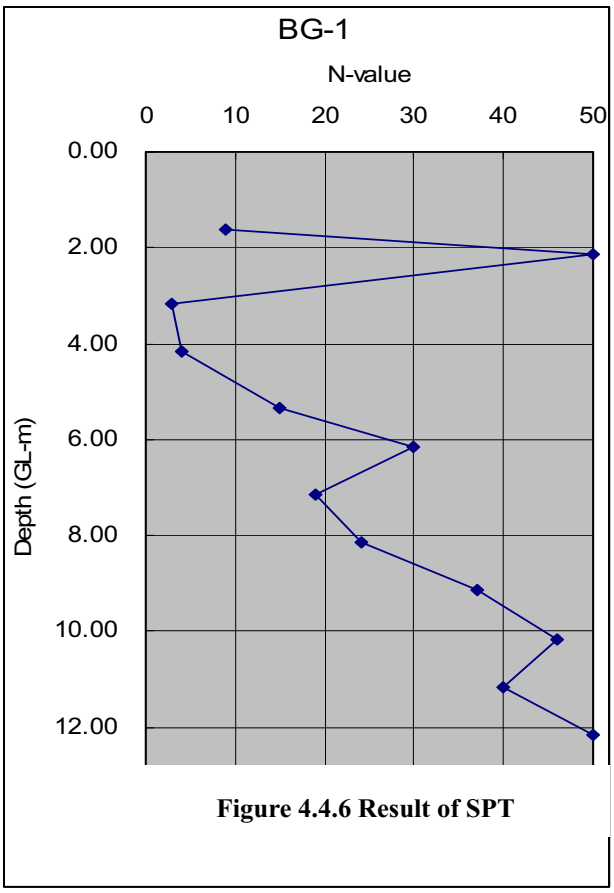


Figure 4.4.6 Result of SPT

The result shows that N-value of GL-2m is over 50. This is considered to get some hard gravel at the depth. N-value of GL-3m to GL-4m where is estimated to become clayey material due to hydrothermal metamorphic influence shows less than 5. N-value of GL-7m to -8m where is fragmentized zone shows lower number than upper one. The result, however, shows that N-value would be increased depend on weathering degree.

This borehole that had been conducted SPT was installed perforated pipe to used for groundwater level observation hole. The depth of the borehole is 12m based on the result of groundwater observation on all coring drilling. After drilling until 12m, it was sealed by bentonite until GL-10m. The length of groundwater observation section is 10m.

2) BG-2

The location of this drilling site was decided to know slip surface of the biggest estimated landslide block and geological conditions. Summary of geological condition is described hereunder.

Depth (GL -m)	Geology	Description
0.00 – 2.70	Tuffish sand with gravel(2nd deposit)	Tuffish sand with carbonatite gravel. Some plant roots are found in the matrix.
2.70 – 32.70	Tuffish sand with gravel(2nd deposit)	Tuffish sand with carbonatite and welded tuff gravel. Sediment structure of this section is disturbed due to landslide activity. Almost all core samples show very fine sand. This material is become to clay when it has some moisture. The material shows red to light grey color. The gravels which is found in this section are hard, and diameter of the gravels are 5 to 10cm.
32.70 - 38.00	Tuff	Heavy weathered tuff. There are some parts of the core sample that is found rock structure. From GL-38.45m to -38.00m, the core sample shows reddish brown color clayey sand, and no rock structure.
38.00 – 44.20	Tuff	Almost all core samples show as rock fragment. These cores are become soft due to medium weathered. In some part of the section, about 10cm hard core samples are found. Form GL-44.0m to 44.2m, the core sample shows as find sand with soft gravel. The core sample shows brownish grey color.
44.20- 48.50	Lapilli Tuff	This section has medium weathered and hydrothermal influence. The core sample is become soft, but is found original rock structure. Some part of the core show hard rock fragment about 1 to 20mm diameter.
48.50 – 55.00	Tuff Braccia	Generally, core sample of this section show as rock fragment. There is clayey sand in some of the section. These clayey sand part is considered that it cause by hydrothermal influence.

As the result of the observation, the deepest slip surface of landslide of the area is estimated as GL-32.7m. There should be other slip surfaces at more shallow part, but it is hard identifying from core sample observation. During the drilling work also, groundwater level measurement had been conducted. Until GL-32m, groundwater was found in the borehole. After through GL-32m, groundwater appeared at GL-32.7m. Then until GL-55m, groundwater level is stable as GL-32.7m. After drilling, inclinometer casing was installed in the borehole.

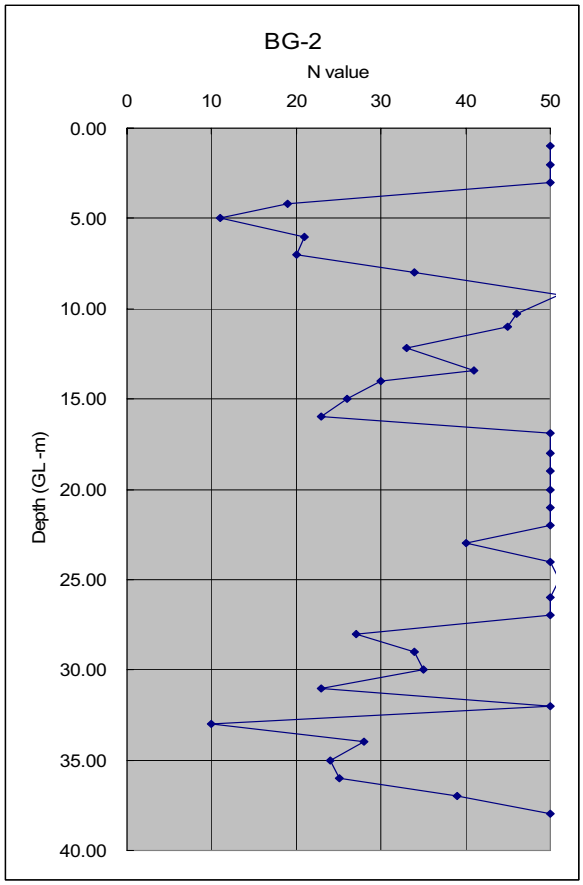


Figure 4.4.7 Result of SPT

Same as BG-1 site, Non-coring drilling was conducted on point where is 2m away from the all-coring drilling point. Standard penetration test (SPT) was conducted in this borehole at each 1m depth. The purpose of the test is to know firmness (N-value) of the ground. The result of the test is shown on Fig 4.4.7.

The implementation section of SPT is pyroclasitic rock zone that is including many hard rock blocks. Therefore, there are many parts that show more than 50. The parts that show 10 to 30 N-values are estimated as matrix part of the zone. The matrix part consist tuffish clayey material that was under influence of hydrothermal metamorphism according as observation of penetrated samples by SPT.

Same as BG-1 site, this borehole that had been conducted SPT was installed perforated pipe to used for groundwater level observation hole. The depth of the borehole is 38m based on the result of groundwater observation on all coring drilling.

As the result of the drilling survey, the landslide blocks are considered as follows;

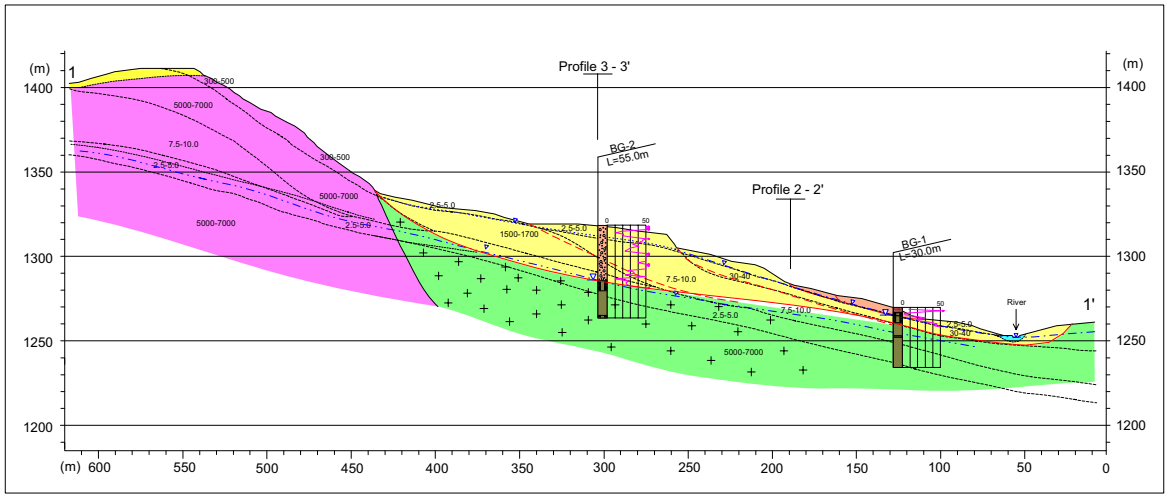


Figure 4.4.8 Profile of Main Survey Line

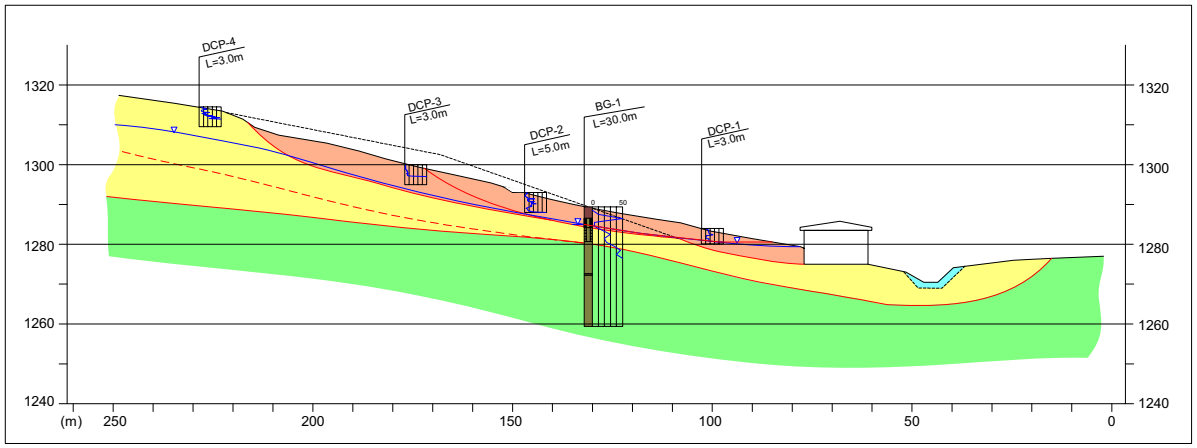


Figure 4.4.9 Profile of H Block Survey Line

(c) Groundwater prospecting

The groundwater prospecting was conducted at borehole that is for groundwater level observation. The purpose of the prospecting is to know the depth groundwater flows. The result should be helped for consideration of the depth of slip surface of landslide.

(i) BG-1

The groundwater prospecting was conducted at borehole installed pipe groundwater level in the borehole for groundwater level observation is GL-7m that is lower than estimated landslide slip surface.

The measurement section is about 17m which is from GL-4.95m to GL-22.00m. The measurement was conducted after making of a constant electric resistance of groundwater in the borehole by infusion of salt solution. As the result of the prospecting, major water inflow was not found. Therefore, it could be estimated that groundwater that should affects to landslide activity is increased in rainy day tentative, and the groundwater does not inflow generally. The result of the prospecting shows on Fig 4.4.10.

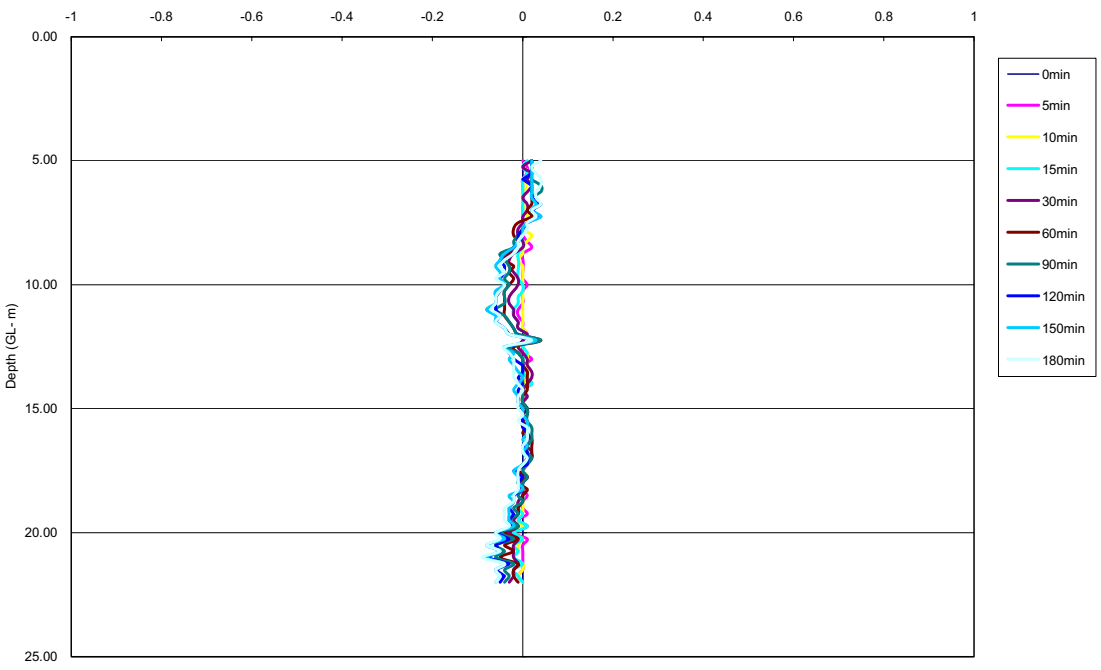


Figure 4.4.10 Result of Groundwater Prospecting in BG-1

2) BG-2

The groundwater prospecting was conducted at borehole installed perforated pipe for groundwater level observation. The groundwater level was GL-33.00m on that time. The measurement section is from GL-33m to GL-37.75m

As the result, groundwater flow was found at GL-33m near the groundwater surface. Therefore, slip surface of landslide would be near surface of the groundwater. And gentle water flow was found from GL-34.50m to GL-34.75m.

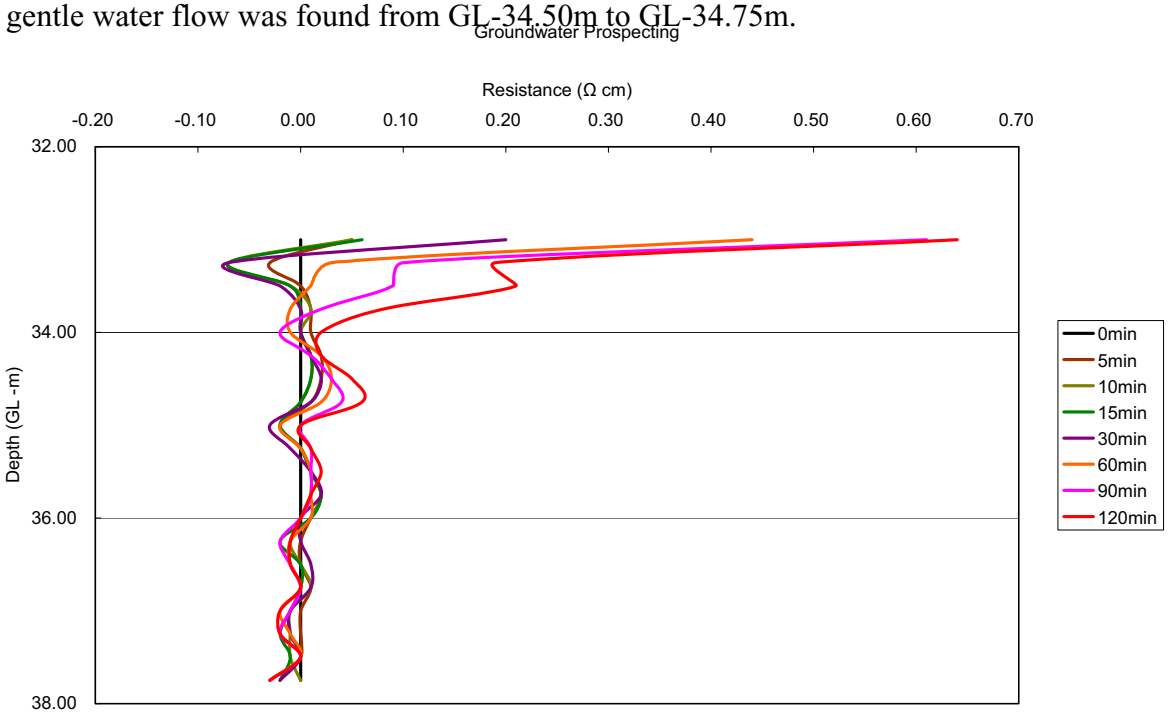


Figure 4.4.11 Result of Groundwater Prospecting in BG-2

(d) Simple Dynamic Cone Penetration Test (DCP)

Simple dynamic cone penetration test (DCP) was conducted on the estimated landslide blocks that are considered to have shallow slip surface since a limited test depth is 5m. The purpose of the test is known the firmness (N-value) of the ground by penetration of the rod with cone. Target landslide blocks are H block, L block and O block. The result of the test is shown on Fig 4.4.12.

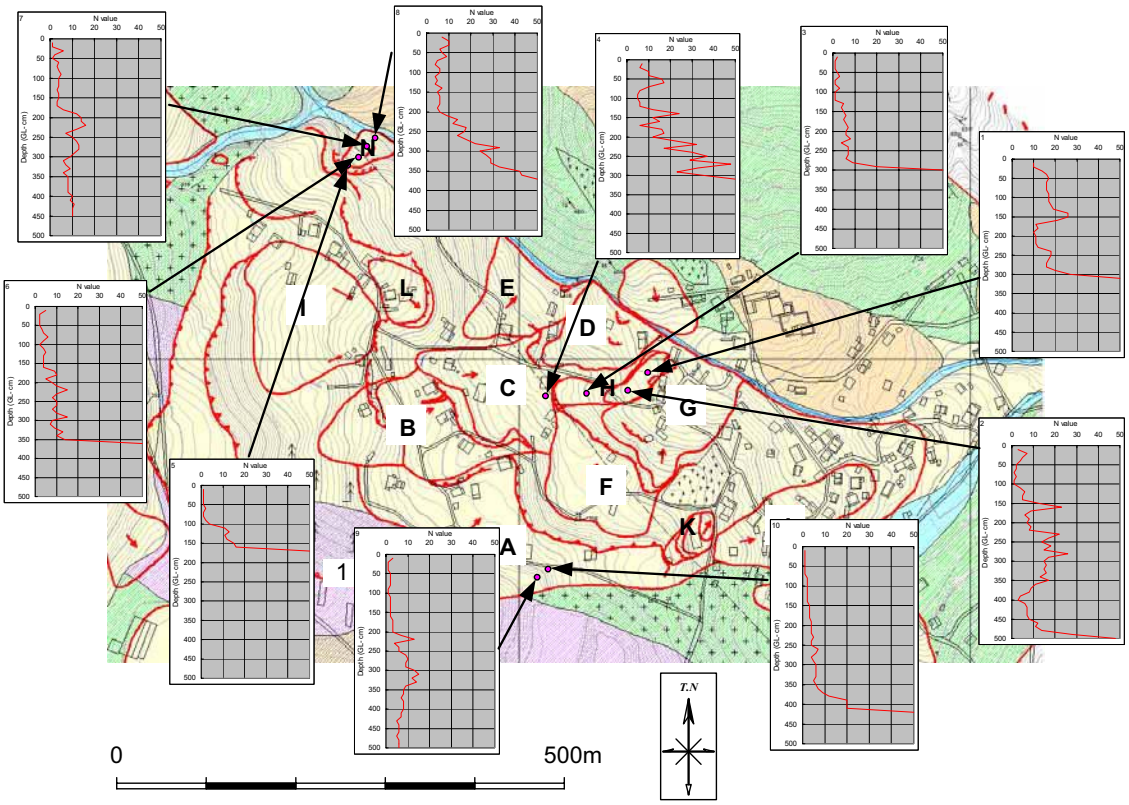


Figure 4.4.12 Result of Simple Dynamic Cone Penetration Test

H block: Generally, the soft layer that shows less than 10 N-values are distributed from ground surface to GL-3m. From GL-3m shows more than 50 N-values. Disturbance of N-value is found near the scarp of landslide. It is considered that the part is with hard rock blocks compared with center or bottom parts of landslide block.

Minor block in A block: The landslide block is located on slope beside village road. This block shows swelling of the bottom part and fresh scarp. Generally, the block is thick as more than 5m at head part and 4m at bottom part.

N block: This block is one of the most active landslides. As the result of the DCP,

thickness of the head part of the landslide block is estimated 2m, and thickness of center and bottom part of the landslide are estimated 3 to 4m.

(e) Geo-electrical Prospecting

The geo-electrical prospecting was conducted to know distribution of groundwater in study area (refer to Fig 4.4.4). The prospecting was conducted on one main survey line, two sub survey lines which cross at right angles and a survey line which run through on upper part of H landslide block. Interval of the survey point is 20m.

The result of the prospecting are shown Figure 4.4.13

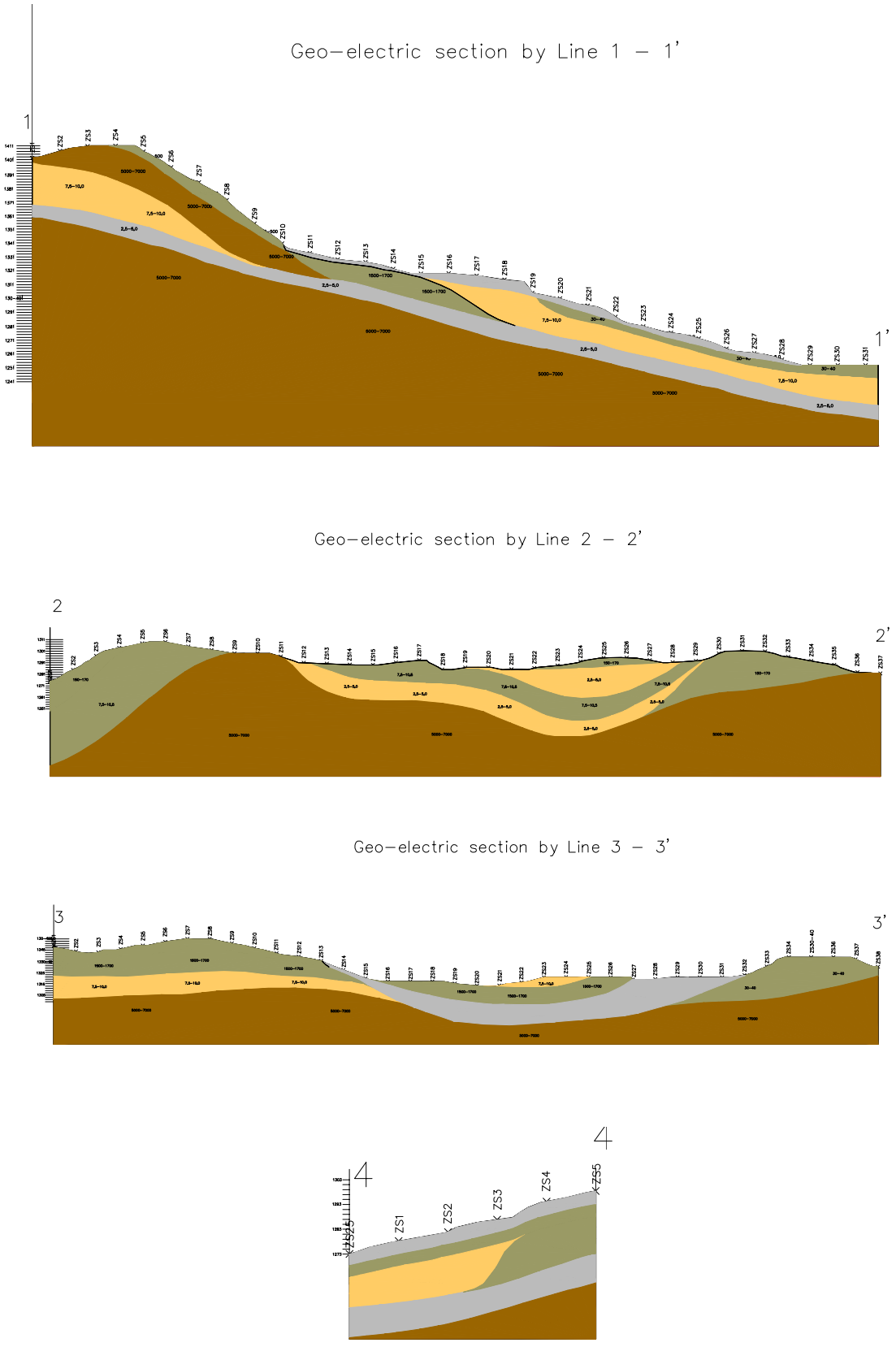


Figure 4.4.13 Result of Electrical Prospecting

As the result, low electrical resistance layer which thickness is about 5m from ground surface is distributed at center part to lower part of the slope on the main survey line. The layer shows low electrical resistance value due to high moisture contents by water flow from ground surface. Another low electrical resistance layer is distributed on a parallel with slope inclination. This layer is considered as aquifer that is found on borehole of BG-2. Therefore, there are two aquifers in this area. These aquifers are located near slip surface of the landslides, and fluctuation of groundwater level in the aquifers influence landslide activity.

(f) Soil Laboratory Test

Physical soil laboratory tests are conducted to know character of soil that is consist of landslide block using coring sample taken from all-coring drilling. Two samples of them are conducted chemical analysis test to know that soil is available for planting. The result will be used to consider which plant should be available to the landslide area by local expert.

The result of the test is as follows;

Table 4.4.7 Result of Soil Laboratory Test

		SP-gs-01	SP-gs-02	SP-gs-03	SP-gs-04	SP-gs-05	SP-gs-06	SP-gs-07
Specific gravity		2.694	2.576	2.698	-	2.666	2.549	2.391
Moisture conts.		4.76	5.69	21.6	42.96	37.00	38.97	9.69
Atterberg Limit	LL	54.88	-	78.51	-	77.40	75.09	47.74
	PL	29.15	-	36.67	-	29.53	38.82	32.57
	PI	25.73	-	41.84	-	47.87	36.27	15.17
Chemistry Analysis	K	3.48	-	-	-	-	1.56	3.60
	Na	-	-	0.19	0.34	0.32	-	-
	N	0.10	-	-	-	-	0.08	0.31
	PO_2	0.10	-	-	-	-	0.13	0.17
	Organic Conts.	7.96	-	-	-	-	0.17	14.21

(g) Inclinometer

Aluminum casing for inclinometer was installed on borehole at BG-2 site. Measurement section is from ground surface to GL-50m. At present time, initial data and first measured data have been obtained due to taking time until stiffen the grout material in the borehole. The result of measured data is shown on Fig 4.4.14. This data is comparison with the initial data, 5th Oct. 2005 and the latest data, 18th Nov. 2005. According the result, any major landslide activity is not found. The measurement would be carried out by resident once a week.

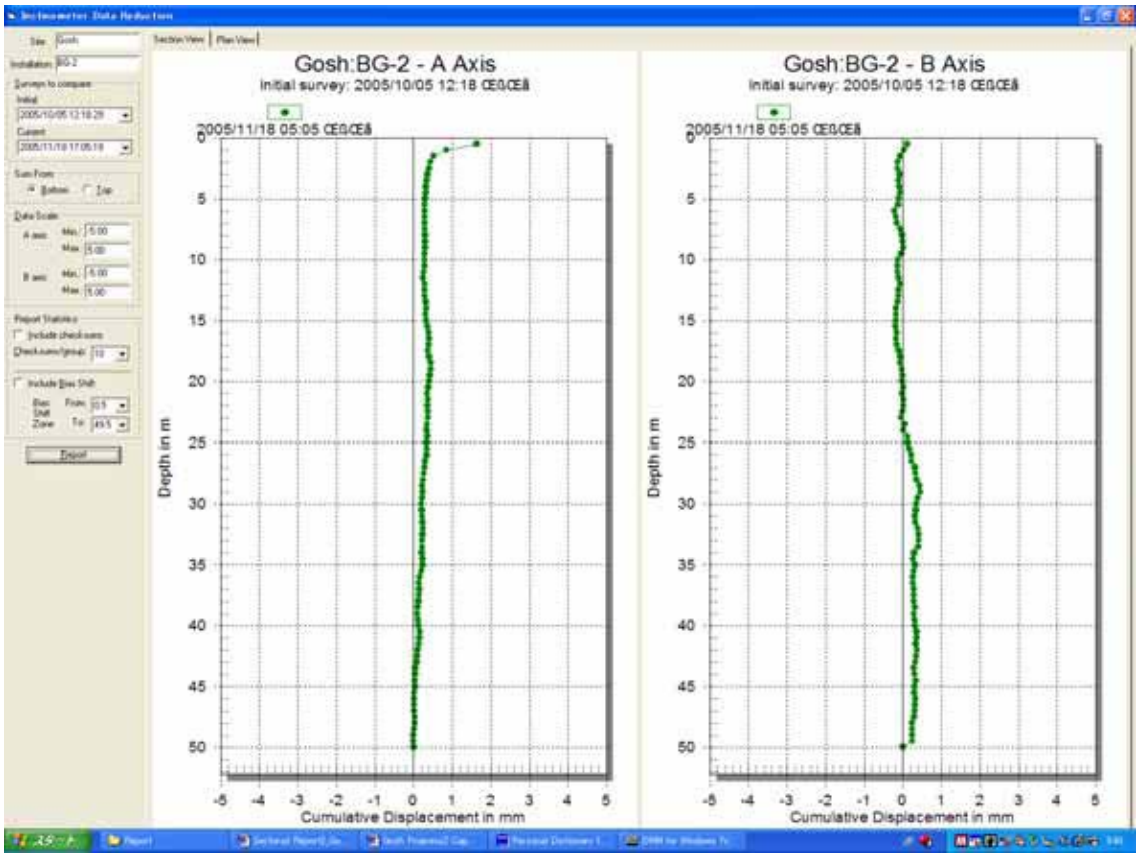


Figure 4.4.14 Comparison data of Inclinometer

(h) Pipe Strain Gauge

Pipe strain gauge was installed on borehole at BG-1 site. Measurement section is from ground surface to GL-35m. Interval of recording data was once a hour until after one week from installation day, then the interval is once a day (0:00) at present. The result of the measurement is shown on Fig 4.4.15.

As the result shown on Fig 4.4.15, data of the -5m gauge shown active movement. This movement is accumulated day by day. Data of -5m gauge on 7th September shows abrupt movement. After that, the data of 13th September could not measure any more due to over scale. The depth is considered as depth of slip surface of H Landslide block that is the most active block. Therefore, the data means the activity of H landslide block. Data of -13m and -26m gauge also shows abrupt movement on 18th September. These movements are unidentified cause by landslide or some other causes.

The monitoring of other depth gauge by pipe strain gauge is continued here after. Data collection and data reduction is carried by resident twice a week.

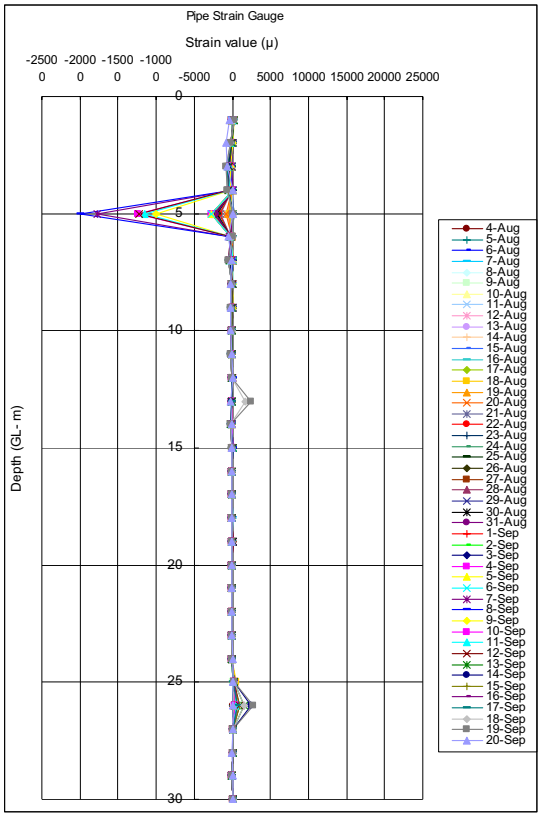


Figure 4.4.15 Pipe Strain Gauge

(i) Groundwater observation

Groundwater level observation is conducted using observation pipes that are installed on BG-1 and BG-2 sites. Data recording is carried out once a hour, then these data is accumulated in data logger. The result of groundwater observation is shown on Fig 4.4.16.

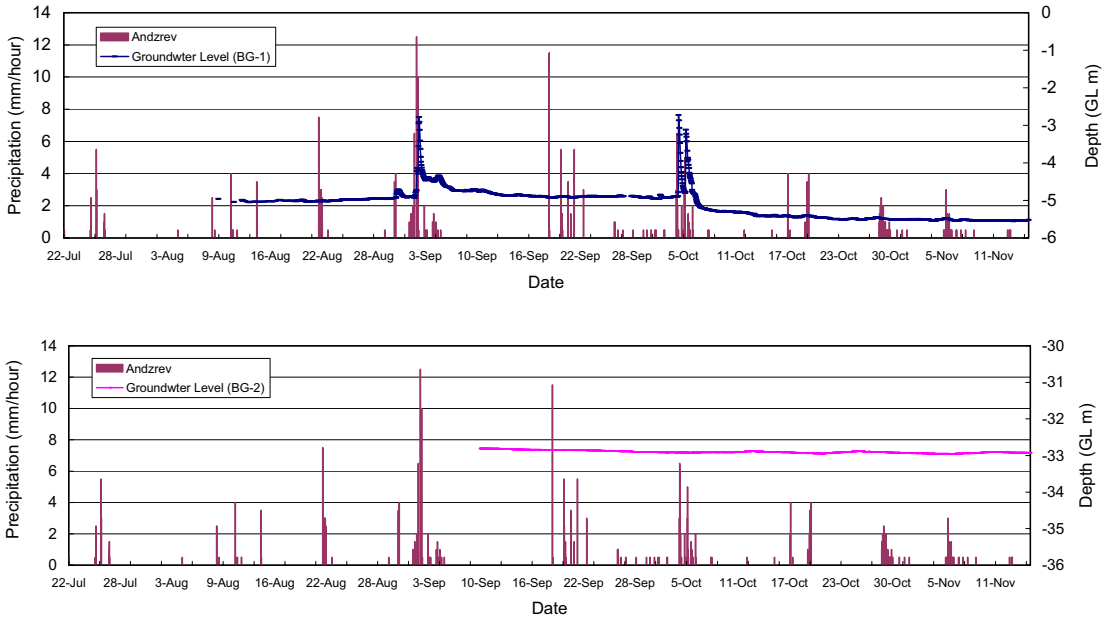


Figure 4.4.16 Groundwater Level Monitoring

As the result, the groundwater level of BG-1 site was increase from 2nd September when is recorded heavy rainfall more than 12mm per hour. After then, the groundwater level has tendency of decrease. And also the groundwater level increase rapidly after rainfall, then after that the level decrease rapidly also. After 8th October, the groundwater level is decrease comparison with then before. It is considered that little amount rainfall in the term and also effectiveness of horizontal drainage are one of the reasons.

The data of groundwater level of BG-2 shows small change due to there were not continuous rainfall from starting data of measurement.

(j) Extensometer and Nuki-Ita (Movable beam)

Landslide monitoring by extensometer and Nuki-Ita is conducted from end of December 2004. At present, 10 extensometers and 12 Nuki-Ita have been installed and measured. Two of installed extensometers have been connected with alarm unit. The alarm unit is set up as sounding alarm when extensometer records 4mm per hour movement. Up to the present, there were many cases of re-installation due to destroy by landslide movement or by animals. On each occasion, re-installation had been conducted by resident who is in charge of monitoring.

Data of extensometer is recorded once an hour automatically. Measurement of Nuki-Ita is conducted by resident twice a week.

The location of these monitoring instruments is shown on Figure 4.4.17

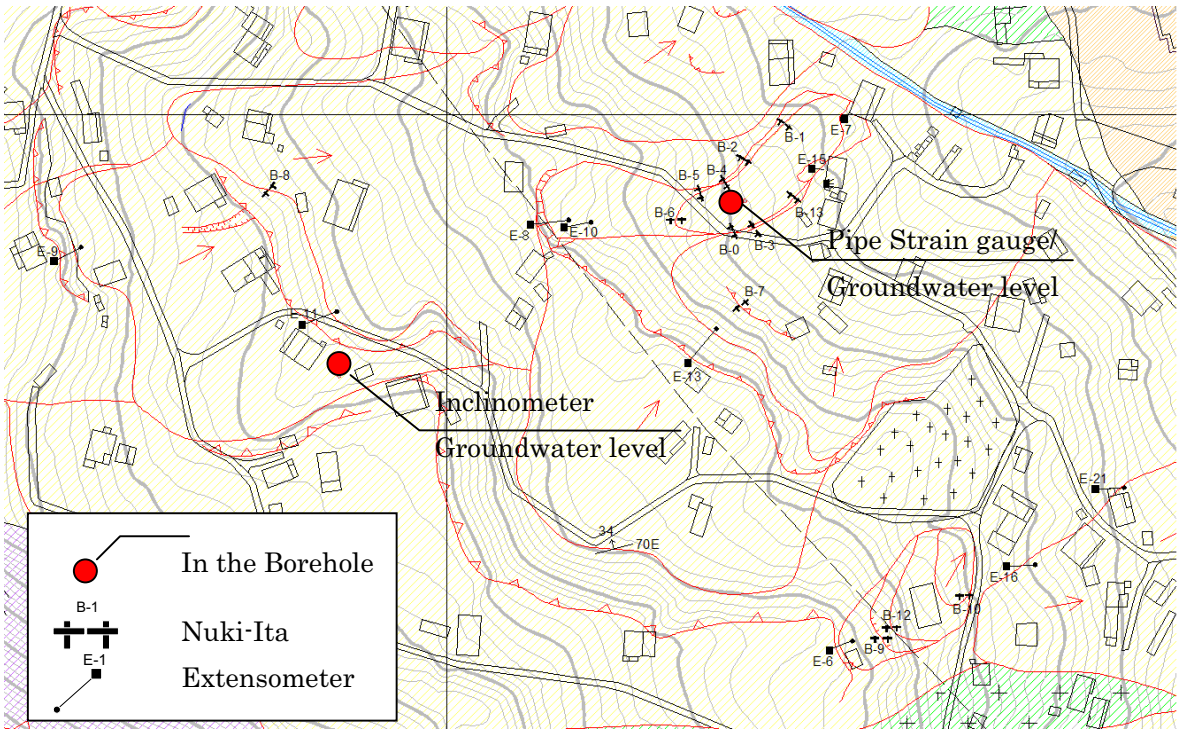


Figure 4.4.17 Location Map of Monitoring Instrument

The result of the monitoring shows on Figure 4.4.18 and Figure 4.4.19.

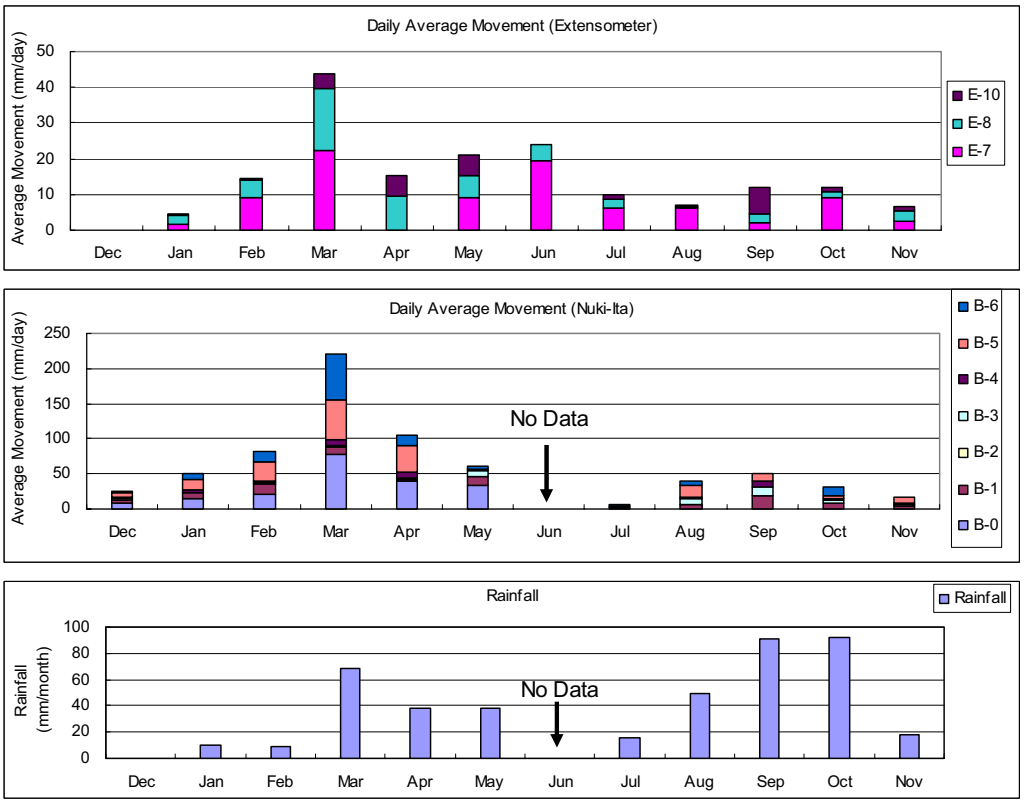


Figure 4.4.18 Result of Extensometer Monitoring on Active Landslide Block

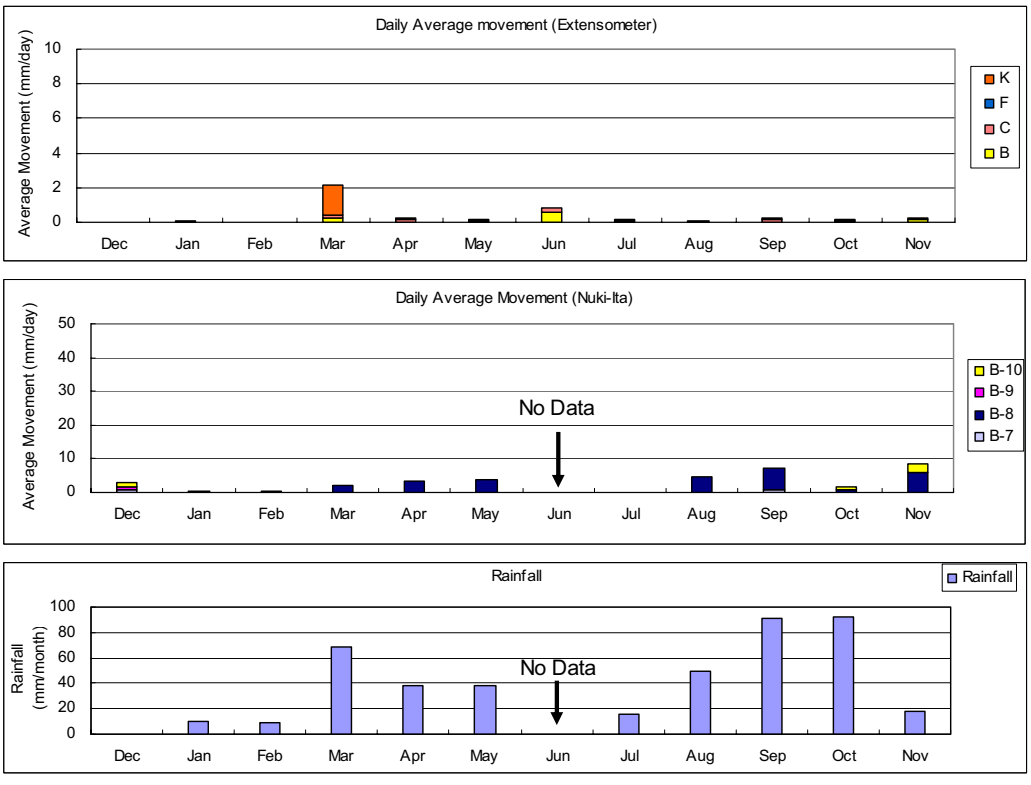


Figure 4.4.19 Result of Extensometer Monitoring on Other Landslide Blocks