CHAPTER 10 COMMUNITY DISASTER PREVENTION ACTIVITY

10.1 Existing Community Studies in Soacha

Many external organizations carry in Soacha Municipality social, economic, educational and cultural activities in the most vulnerable areas, producing a number of social studies and assessments about the conditions and needs that the inhabitants have to face. One of the in depth qualitative study regarding the people in the Study Area is the publication *"Territorio y Desplazamiento. El Caso de Altos de Cazucá",* by Manuel E. Pérez Martinez, a case study which carefully explains the rationale behind the social and historical composition of this area and peoples lives and livelihood.

This study explores carefully the possible venues to regain cohesiveness and rootedness for those groups of people, families and individuals which have been forced to migrate, leaving behind their territorial ties, assets, relatives and their life skills, to become new comers in a very different environment, and particularly in an area characterized by being of high risk, not only physically but also socially.

International agencies have contributed to document the people's conditions in Soacha, particularly those located in the most vulnerable areas. Most studies focus on Altos de Cazuca, the hill where the majority of displaced population lives and continue to arrive in a daily basis. One study is the "Diagnóstico de Género de la Población de Soacha com Énfasis en las Mujeres Desplazadas" from UNIFEM United Nations Development Fund For Women (2005) which provided specific and updated analysis of social (education, health) and economic conditions (occupation, unemployment) by age group (youth, elders, adults) as well as infrastructure resources, assets and needs (such as water, sewerage, etc.). The organization Doctors without Borders also made a study ("Altos de Cazucá: Hasta Cuando el Olvido") describing the situation of the inhabitants, with particular emphasis on the health conditions of displaced people and their serious limitations to have access to social services, mainly being the SISBEN program (System of Identification and Classification of Potential Beneficiaries of Social Programs).

With respect to the topics of disasters, the studies about disaster prevention activities involving communities are quite limited. Practically, no Community-Based Disaster Prevention activities was found in these areas. Excepting trainings of CLOPAD members done by the OFDA methodology, the communities had not participated in any part of the Disaster study or Plan. In this sense, it is fair to state that one of the preliminary studies of community conditions from the perspective of disaster prevention was the Community Survey on Disaster Prevention, completed by JICA Study Team.

10.2 Community Survey and Discussion by Focus Groups

10.2.1 Community Survey

During September 2006 the Community Survey Field Work in Soacha took place. A total of 24 barrios mainly in commune 2, 4 and 6 (only one survey occurred in a barrio of commune 5) were surveyed. Also in the rural areas, in five Veredas, thirty one surveys were applied. Three hundred sixty three was the total number of Surveys completed in the period of September 19th to September 29, 2006. A few days earlier, a trial of one hundred forty five experimental survey was done, to detect inconsistencies, most of them corrected. A team of four surveyors, two research assistants and a field work coordinator accomplished successfully the field work. Table 10 - 1 summarizes the distribution of the surveys in Soacha's Territory.

Table 10-1 Distribution of Surveys in Soacha's Territory

Commune	Location	N°. surveys	%
Commune 2	Downstream River Soacha	46	13%
Commune 5	South of Cazuca	8	2%
Commune 4	Altos Cazuca & Terreros Area	174	48%
Commune 6	River Soacha middle flood plain	104	29%
Veredas	Upstream (& lowest stream River Soacha	31	9%
TOTAL		363	100%

Table 10-2 Community Survey Summary Results

Theme	Responses
1. Location (Commune number; location code; center or rural; address)	• 8 % of homes did not have cadastral registration number • 48 % of surveys in Altos de Cazuca • 51 % in Rio Soacha watershed (including 8% in Divino Niño)
2. Profile of respondents, their households and housing conditions. Including gender; literacy; age; years living in Soacha; household members; with physical limitations; who remains most at home)	• 72% women respondents; 22% over 65 years old • 70% living in Soacha only 12 years or less • 53% households composed of 4 to 6 members • 67% mother stays at home most of time • 65% working, but only 3.3% does not generate income • 24% incomplete primary school, 8.5% illiterate • 12% some type of physical limitation • 89% home use only, 9% some type of business
3. Experience and Perception of Disasters	• 78% have experienced some kind of emergency: (94% have experienced flood and 73% landslides) • 98% could be affected by a disaster where they live • 94% have not received disaster training or information, 53% capable to address some disaster related tasks • 58% home or home items partially affected during May 2006; 9% injured and 8% evacuated • 63% believe JACs should address disaster activities at the community level
4. Self Help and Community Organization	• 44% would no t know where to go, or would not leave their home • 59% do not have relatives nearby in case of disaster • 23 % have relatives in the same neighborhood
5. Active Participation and Involvement	• 67% willing to voluntarily participate in emergency prevention. The interest was higher in activities such as being part of a community –based committee, supporting youngsters in disaster monitoring, and administering goods for and during emergencies. • Adults, rather elders are best for disaster prevention activities • availability for volunteering was 42% on a daily basis and 14% weekly • 82% not involved in other community projects • 32% new someone that could be interested in being involved in disaster prevention activities

The Community Survey contents addressed five topics: Location, Respondent and Housing Characteristics; Experience in Disasters and Risk Perception; Self help and Community organization in Disaster Prevention; Involvement and Active participation, all these distributed in seventy one questions.

Table 10-2 provides a quick summary of the results. People in high vulnerability have been only recently living in Soacha (12 years). The majority of respondents were women and elders.

Households contain large and extended families with unstable income and high illiteracy rates. The absolute majority of surveyed people had experienced emergencies or disasters, and expressed being fully aware of their exposure at the locations where they live. Self help and network ties appeared insufficient, and access to information or training on disaster prevention was recognized as neglected. Willingness to get involved in prevention and preparedness activities appeared high, being higher the

interest of adults rather than youth. Time availability to voluntarily participate in CBDM was found to be high, particularly in a daily basis.

10.2.2 Focus Groups

Focus groups in the participatory research methods were used for the analysis, a complementary research method of the Community Survey. The attendants were set to discuss their views on topics about community-based disaster management. The purpose of the Focus Groups was to expand knowledge on qualitative information difficult to gather through other means, such as the quantitative survey. Also it served for the purpose to understand the relations among issues (emergencies and disaster, development, and resources), and to create a scenario in which the participants could set their own vision of priorities, actions and actors in disaster management activities. In focus groups settings, the added value is the combination of opinions. The output produced is qualitatively deeper, allowing for a comprehensive understanding rather than generalizations obtained from numerous individual opinions.

The criteria chosen for the communities to participate in the Focus Groups, was to have two Focus Groups in the topic of landslide, one on each key landslide sector: Divino Niño and Altos de Cazuca. For the flood component, while initially three Focus groups were considered, logistically two events were implemented: one in the area of Tibanica River (Terreros Dam) and the other one in Río Soacha, including people coming from the upper stream as well as those directly affected by this May's inundation season.

Invitations were delivered to a pre-determined number of participants attempting to keep under fifteen participants, but mostly between 8 to 12 persons were present per event. Known JAC leaders helped supporting the selection of attendees to which the invitations were directed in each one of the four locations selected. Each Focus Group was accomplished successfully delaying o more than two hours each session.

Each session started with an explanation about what is a Focus Group. A simplified definition was provided: A Focus Group is a qualitative research method, used in collective settings rather than on a individual basis. Questions and topics address attempt focusing on the variety of experiences, opinions and values brought by the participants. The concept of "Focus", is explained since it concentrates or "focuses" the attention and interest in one (or two) specific topics of interest, in this case about community perceptions on disaster preparedness for the study. Finally Focus Groups take place in a short period of time. Two questions were addressed in all four events. What are the priority actions to be addressed in the area with respect to community based disaster prevention, and second, who are the most likely agents to be involved in the topic of preparedness. A third topic was posed by the facilitators, as a free topic. The concept behind is, leaders have their own questions and topics to discuss, which tend to stem out from collective discussions. In each session, the last half an hour was devoted to an "emerging" topic, which proved to be convenient in rounding up some of the ideas that were talked about during the session.

(1) Summary ideas of the Focus Groups:

The communities – based on the opinions of their representatives attending the events, appeared to know and be fully aware of their risks and their reality. They understood quite well the need to organize themselves to improve their living conditions and their surrounding environment. At the same time they visualized larger -rather than partial- solutions as acceptable. They preferred physical works rather than software measures only. They considered practical training as needed rather than the information and awareness that is only reinforced.

Agreement was found on the need to visually demark the areas of high, middle and low risk. This task is key as an initial task on community based disaster prevention work. Ease to understand explanatory messages located in public visual places in the risky areas was regarded as highly necessary. Following this boundary delimitation, public works were needed to take place: sanitary pipes

channeling the sewerage effluents from the neighborhood, separately from the river flow, in case of flood disasters; and safety recovery works in slope areas abandoned by former mining practices.

Community members explained and strongly requested for the urgency of resolving the vicious circle (cause-effect) of investment in high risk slope areas, and the people's exposure to the risk itself. The lack of infrastructure works to channel fluids drains over the top of the hilltops is one of the most important problems to solve in order to stop the hazard created by these types of water. The exposure of communities to landslides is caused by the lack of infrastructure works controlling the spontaneous drainage and infiltration of the sewerage, grey waters and rain runoff.

The attendees envisioned the population at risk to be resettled in a different safe place, permanently rather than temporarily. With respect to the collaborative efforts, the community members understood and were willing to organize the inhabitants, but they requested for proper promotion and facilitation tools to be, accompanied by the willingness of the municipal authorities to address the issues above mentioned.

The final idea was that collaborative efforts between neighboring barrios are possible. Coordination was regarded as highly necessary. Collaborative settings would lead community leaders and municipal authorities to work side by side. This framework would allow building trust amongst each other, setting a consensus-based agenda and advancing on the improvement of the hazardous conditions in a organized manner, again, under clear communication settings between all stakeholders.

10.3 Community Based Disaster Management (CBDM) Activities

10.3.1 Planning Process

During the third and fourth field works of the Study, a set of activities were done to advance the Community Based Disaster Management Plan in the pilot area of Soacha River Basin.

The activities were mainly done in the area where the greater affectation took place during the last emergency, the flood disaster which happened in May 2006. At that time the water overflow affected eight neighborhoods, all located at the left side of the Soacha river. A rough estimation of the population in this affected area is of five thousand inhabitants. The neighborhoods affected were El Cipres, Florida II, Cohabitar, Cien Familias, Pradera I, Pradera II, Florida I, Llano Grande and El Cardal.

Needed to be mentioned is, during the May 2006 flood emergency, other areas were also affected. For example communities located on the downstream of the Soacha rive, north side of the Autopista Sur were subject to inundations. Parque de las Flores, Ciudad Satélite, El Silo, El Tabacal, Portalegre and others neighborhoods reported serious trouble. Nevertheless, considering the dimensions of the area affected and the population size, the Pilot Project concentrated attention and actions in the south section of the Autopista Sur.

During the execution of the CBDM activities, the most responsive communities were Florida II, Cohabitar, Cien Familias, Pradera II, Florida I, Llano Grande and El Cardal. In some sessions leaders from Pradera I, Panamá Neighborhood and El Cipres attended the activities, as well as downstream leaders. Nevertheless, the most constant group of leaders came from the neighborhoods mentioned above.

These activities were mainly community based workshops, building community informational and resources map for disaster prevention; field visits to confirm the existing situation or to learn about the upper stream conditions of the watershed; community based monitoring trainings, interagency coordination meetings, and self prepared neighborhood meetings.

At the same time community activities (meetings, field inspections and workshops mainly) took place with respect to landslide issues, both in El Divino Niño and Altos de Cazuca locations.

The most constant activities were the set of community workshops, an iterative process where most of the leaders of the neighborhood associations (JACS: Juntas de Acción Comunal) built collaboratively the contents of their Community Disaster Prevention Plans. The leaders initiated in February the identification of the hazard condition, the flood scenario and their exposure during the May 2006 emergency. They went through the remembering what happened, how did they act, what were the types of affectation. This information was reflected in Community Maps by neighborhoods.

During the following activities, the Community Map would be improved until reflecting best the current status of the neighborhoods, in disaster prevention matter.

During the month of May and June the leaders started building and setting up their prevention strategies and the actions to be taken in order to avoid experiencing again the regretful situation and consequences suffered during May 2006. The process of workshops allowed creating an environment where capacity was strengthened and confidence was gained.

The community members and leaders established themselves responsibilities on prevention activities. Whether monitoring the river bed, monitoring of the rain gauges installed, setting and testing the communication equipment, learning the procedures of formal communication between stations and with the Fire Station. Also getting acquainted between neighbors, through informal means about how to raise awareness into the family members of each one the neighborhood streets. Through the radio communication system the leaders were able to inform themselves, and inform the Firefighters' Station about the conditions of the river.

The leaders of the neighborhoods experienced, during the workshops, settings where each person was exposed to the possibility to learn from all the rest of the participants. Knowledge was collaboratively constructed, whether coming from community members, firefighter, Red Cross volunteers, JAC leaders or CLOPAD/Alcaldía officers. A sense of wide cooperation was gained over time during the month of June. This consequently lead the community leaders to commit to prepare and execute community meetings during the month of July on their own. Six meetings took place in El Cardal, Llano Grande, Florida I Sector, Florida II Sector and Barrio Panamá. All the spatial information collected and created during the workshops was consistently added to the set of neighborhood maps, and used during the community meetings. At the same time, handouts were given out to members to each one of the neighborhoods, with specific data such as contact persons and phone numbers of leaders on their area. The handouts contained also a photo of the map of their area, and simple key messages explaining how to be prepared.

The following field work of the Study occurred in September 2007. The CBDM work was geared to refine and test the Plan that communities had been working on.

A First Respondent Training Course coordinated with Red Cross Trainers, an Evacuation Simulation Session, and several preparation meetings lead to the first Community Based Flood Evacuation Drill which took place in September 22nd. Six neighborhoods participated in the Drill: Florida I, Cien Familias, Florida I, Pradera II, Llano Grande and El Cardal. An approximate total count of 530 people participated in the evacuation, lead by 50 to 60 leaders. About 40 response agents actively joined the Drill, contributing with key resources such as medical aid and firefighter's vehicles. But mostly, they both partnered and modeled the exercise, which was intended to be lead by the civil leaders, and not by the response entities. It is known that response agents hardly are in time in the emergency site. Therefore the leaders took the role of Community First Respondents, during the planning process, and consequently during the Exercise Drill.

After the Drill an evaluation session revealed both the satisfaction for the growth experience, and the desire to improve key aspects, in light of a real emergency flood situation. More community involvement, improved encouragement strategies towards the public, better coordination between JAC leaders, street and meeting point coordinators, better assessment of families at the meeting points, were some aspects mentioned. The presence of the police or security persons was mentioned as a

factor that could have given confidence to families that refused to participate, to leave their homes and join the evacuation exercise.

During November 8th, 2007 a second and complete evacuation drill took place. This time, all three parts of the Early Warning System were included in the exercise. The upstream stations, properly equipped and trained; secondly, the central information location, the Fire Department; and finally the affected communities downstream. A small evaluation survey helped gather the most important lessons learned from the experience, shedding light to final recommendations for the future activities to be continued by the CLOPAD members and Community Leaders themselves.

The final activity wrapping the entire CBDM Plan was the Seminar held on November 13th at Tequendama Hotel, in Bogotá. CLOPAD members and community leaders, DPAE, OPAD and other officers attended the Seminar, and were able to listen to the contributions offered by the selected lecturers. A community observer from the upstream of Soacha River, a JAC leader from the affected downstream area, the firefighter head officer, a Civil Defense representative; all of them careful and colorfully pictured the reality lived in the Soacha Watershed, the entire experience of a Community Based capacity building process in disaster prevention. As a closure of the Seminar, all parties signed a commitment Agreement to continue the monitoring work, the improvement of the river and the inter communitarian and inter institutional coordination for disaster prevention.

10.4 Community Based Disaster Management Plan

This section addresses the eight components of the Community Based Disaster Management Plan.

(1) Rainfall, Water and River bed Level Monitoring System
(2) Information Transfer System
(3) Early Warning System
(4) Operation and Maintenance
(5) Considerations of Lead Time for Early Warning Criteria
(6) Evacuation Plan
(7) The Community Disaster Prevention Map
(8) Meeting Points and Shelters for Evacuation

As mentioned earlier, the Community Survey accomplished in September 2006 revealed that the majority of people surveyed in the pilot project area had not received training in disaster prevention. Considering this fact, the process of planning the disaster management Plan with the communities, initiated identifying the key neighborhood agents, mostly being these JAC leaders and JAC board members, as well as other active leaders (some in the past have been JAC leaders). Through the process of interaction in the field visits and the workshops, interest has developed among the community leaders and members. Also the engagement has lead to the adoption of responsibilities in the prevention and preparation activities.

In the following pages, the output in each one of the components of the plan is discussed. The information built on the plan relies in the options, possibilities and desires from the engaged community leaders and active neighbors.

(1) Rainfall and Water Level Monitoring System

Monitoring of rainfall and water level

The monitoring of the river behavior upstream implied coordination between different types of entities: the IDEAM weather station located inside the property of the ICA (an agriculture institution), both located in the highest monitoring point of the Soacha watershed. Inside the ICA, families live and work for either or both institutions. The second highest station is in Vereda Fusungá. Some homes are closely located to the river, in points relatively easy to monitor the behavior of the river.

Next monitoring point downstream is managed by the Alcaldía, the Zaragoza Prison. Three guards rotate their work shifts to cover 24 hours of surveillance. Going downstream the next point is the Ladrillera Santa Fe. Security guards at the entrance of the companies' premises are permanently at work at a check point. The last river monitoring point is in the neighborhood known as Llano Grande. This community is technically no longer on the "upstream" but mostly on the middle or downstream. It is actually in the most affected area. A monitoring station was located here in order to raise awareness of the condition of the water level, and to improve the emergency response, in case of an imminent flood. Homes in Llano Grande are built close and in the flood plain, in lower grounds than other neighborhoods. Llano Grande was one of the communities most affected during May 2006. Community leaders live next to the river at a convenient observation point.

All these observation points will have a person which will communicate regularly with the Fire Department of Soacha, to inform three times a day on a regular basis about the condition of the river. The role of the observers is to permanently look, write down and inform the readings. In each point equipment has been installed, whether rain gauges or water level gauges, telemetric or manual. Through the workshop meetings, the community leaders along with the institutional officials and private enterprise supervisors (from Ladrillera Santa Fe) selected the main persons in charge of the monitoring tasks. The names are shown in Table 10-3.

Regarding the Firefighter's Station, the main responsible is the head of Soacha's Fire Department. Nevertheless all staff (eight) firefighters in Soacha will have the same task, monitoring the rain gauge daily, as well as being receptive on the data that every one of the monitoring locations -up and down stream- provide. The situation for the Ladrillera Santa Fe employees is similar, if the main responsible person will not be in the post, other security employees will take this task. The Prison of Zaragoza also rotates its staff among three Alcaldía employees.

Table 10-3 Water Level Monitoring: Water Level Gauge, Rain Gauge, and Radio Communication

Location	Main Responsible	First replacement	Second Replacement	Type of entity
Firefighters Soacha (central monitoring point)	Ivan Riobueno 782 7983 316 6083132 Autop Sur No 37-40	Raúl Ríobueno, Oscar Rico, Alexander Mosquera, Henry Mosquera, Carlos Diaz, Julio Cesar Perez.	Raúl Ríobueno, Oscar Rico, Alexander Mosquera, Henry Mosquera, Carlos Diaz, Julio Cesar Perez.	Alcaldía
Llano Grande y El Cardal (water level gauge)	María del Carmen Muete 781 4380	Ana de Ospina 578 6343 Ana Isabel Molano 721 2673	Dagoberto Silva 722 7114	Community
Ladrillera Santa Fe (telemetric & panel)	Israel Barreto 721 1010	Jorge Infante 721 1010	Pablo Abel Peña 721 1010	Private business
Cárcel Zaragoza-Alcaldía (water level gauge/alarm)	Guillermo Pérez, 732 2859, Cra 71 C Sur No 5-13 Bta Urb. Las Quintas	Pedro Moreno, 300 768 0458	José Erasmo Ramírez. 310-262 3433 Vda Hungría	Alcaldía
Fusungá (water level gauge)	Flor María Ramírez, 315 3521626, Vda Fusungá Km 9	Diana Milena Ramirez (hija) Vda Fusungá Km 9	Aracely Montoya 781 6800 Vda Fusungá	Community
Estación San Jorge (rain gauge)	Stella Devia	Joaquin Morales	Elias Lopez	Institution

For the two community monitoring sites, Fusungá and Llano Grande, in both cases, women have accepted the responsibility of monitoring the water level gauge installed in the Pilot Project of this study. Also in both cases, the main responsible persons live next to the river. Each one of the river point persons will use the provided radio communicator to report to the Firefighter's base.

Monitoring the river bed

In order to check the sedimentation behavior of the river, five points were identified in the downstream affected area of the pilot area, in order to establish a record, through direct observation about the changes of the river sedimentation.

In five Bridges: Carrera 2A, Carrera 2Este, Carrera 4 Este, Carrera 7 Este, Carrera 9 Este, community leaders committed to take measurements, each two weeks. A field's training took place on March 2nd and the monitoring activity has continued each two weeks by these five community members. These five people have agreed to continue to monitor the river, although they requested support from other neighbors and leaders to take part of the observing and recording group. These observers belong to different barrios of the study area (Florida II, Florida I and Llano Grande).

The photos in the following page present the activities of river bed monitoring.

Preparing the monitoring pole, carving an edge, each 10 cm. The pole is 3 m long.

White carved lines are located each 10 cm. A red carved line indicates 1 m distance in the pole.

Above: the length is written down in the register sheet. For example, in March 2nd the left side of the bridge located in Cien Familias measured 2 meters and 85 cm.

Left: They now take their chanced to measure and write down the figures of the distance between the bottom of the river and the edge of the bridge marked in orange paint.

The first bridge is in Florida II Sector. People observe at first, while the exact point of monitoring is defined.

Photo 10-1 River Bed Monitoring Activity

In La Florida II currently there is a community system used by the neighborhood association for announcing events or topics of community interest. This is the only barrio that has this kind of devices. The alarm system is broken. The speakers present distortions at 80 mts of distance which does not allow fully understand the message, due to its limited capacity.

Photo 10-2 Present Speaker System

(2) Information Transfer System

Regarding the existing communication system in communities in the flood area, the study team members made an assessment of the current conditions in the Study Area affected by flood in order to determine the settings for alarms and a community-based communication system for flood warning. An early field inspection (February 26, 2007) along the communities located on the river side of the affected area, showed that most of the communities did not have a collective alarm system installed. Those at place were not working properly: either the sirens were broke or had limited coverage. The observations were triangulated with another assessment with key leaders during June 2007.

Some barrios had a speaker system, by which they communicated internally within the adjacent streets. The type of messages they use to deliver through their existing system are about community activities such as calling to neighborhood meetings or relevant information that require all people's attention for the betterment of their neighborhood. The findings are summarized in the Table 10-4.

Table 10-4 Existing Alarms or Sirens in the Pilot Project Area

Barrio	Conditions before June 2007	Conditions since pilot project
Cohabitar	A community alarm is used for security topics and community news. Located in the middle of the barrio,atr Ramiro Tibacuy's home, Treasurer of JAC.	Same as previous. Nevertheless, the new devices installed in Florida II provide coverage to this neighborhood
Florida II	An alarm or security siren. The speakers are broken. One panel is located in the middle of the block in Cra. 9. The second panel is in the middle of the block Cra 2.	A new sound and alarm system was installed by the Study Team with greater volume and quality capacities
Cien Familias	The community alarm is broke. Located in the house of Adela, she Works with the Health Committee. One possible communication mean are the use of whistles.	Same as previous. The parish has agreed to join the warning communication system, contributing with their own speakers and sirens.
La Pradera I	No alarms	n/d
La Pradera II	There is a community alarm. One panel is working and it has 10 alarms. The other is broke.	Leaders agreed to join the warnings. Firefighters will call by phone key leaders, which would activate the sirens.
Florida I	No alarms nor speakers	A new sound and alarm system was installed by the Study Team,
Llano Grande	Alarm system broke. They only use the megaphone for announcements.	A new sound and alarm system was installed by the Study Team.
El Cardal	Alarm used by the President of the JAC.	A new sound and alarm system was installed by the Study Team
TOTAL	Most barrios do not have. The alarm devices are broke or working limitedly.	New sound and siren system installed in four neighborhoods, the remaining now have direct phone contact with Soacha's Firefighters Department.

(3) Early Warning System

Considering the community based flood early warning system, close relationship and collaboration work between upstream community and downstream community has been strongly stimulated. Community leaders living upstream were part of the workshops, providing input and support in building the Plan.

The leaders from Vereda Panamá, located between Fusungá and El Cardal, in the middle catchment of Rio Soacha, attended the workshops of June 23 and 27, expressing concern and interest in being part of the monitoring and early warning system. The members of Vereda Panamá had a meeting during July where it became clear their situation, specifically how could they be part of the warning system and the prevention plan. After June, their involvement decreased due to time and logistics limitations, but their interest kept being present.

To complete the early warning system in the community, further discussions and trainings were necessary. Trainings were carried out using the monitoring and radio equipments for early warning which was installed in late August and September 2007.

Community leaders from areas prone to affectation by flooding of the Soacha river attended the workshops and expressed concern about their situation, and interest to become part of the pilot project as well. Community members from El Cipres and Prado de las Flores attended one workshop. Leaders from Portalegre and El Silo, from downstream also were part of the discussions. They expressed willingness to coordinate a meeting with the Comuna 2 board and representatives, and requested that Alcaldía staff could be at this event.

Tibanica watershed community leaders were invited to attend the June events, and two young leaders were able to be present during one of the workshops. They were invited to be observers of the planning process held in Soacha river, as a way to stimulate some initiatives in their own communities,

since Soacha river CBDM plan is only a pilot project, a starting point for the Alcaldía and the community members to increase and expand their disaster preparedness work with local stakeholders. Through the existing channels of communication with the UNDP project coordinators, invitations were delivered to attend the workshops and subsequent drills. The UNDP office located in Altos de Cazuca is a shared building with other UN institutions such as OCHA. UNDP has a Local Development Management project in the high vulnerable area of Altos de Cazuca.

(4) Operation and Maintenance

The maintenance of the equipment installed has been discussed with Alcaldía representatives with IDEAM assuming that Soacha city and IDEAM will make an agreement. Particularly important is the proper maintenance and battery replacements of the radios. The rain gauges and the monitoring pole are part of the equipment to be used by the community leaders. Some leaders expressed interest in setting more staff gauges –each 100 mts ideally- in order to monitor best the behavior of the river, since in some places the cavity is deep and on other sections it is very shallow.

(5) Considerations of Lead Time for Early Warning Criteria

As input data for the Early Warning Criteria, the community members and leaders determined how much time is needed for evacuation. Table 10-5 summarizes for five barrios of the pilot project area the time that it would take to a) inform all community members the urgency to evacuate, b) prepare individual and collectively items and actions to evacuate c) evacuating time: leaving each home, walking the streets through the evacuation routes, and gathering in the Meeting Points.

Table 10-5 Summary of Time Required by Barrios: Informing all of the Evacuation Issue, Preparing, Evacuating and Gathering in Meeting Points. Workshop June 27th, 20007

Topics	Florida II-Cohabitar Cien Familias.	Florida I	El Cardal	Llano Grande	Rural Barrio Panamá
How long would it take: To inform all the barrio? To preparation for evacuation? To go from each home to the meeting point and the shelter?	The alarm activates in 1 min. 2 min. is enough to inform all the community. 40 min. to prepare considering children, elder and sick people. Moving time 45 min. The longest distance is 150m.	15 min. for the time evacuation. Last year a drill was made taking 20 min. to evacuate 300 people. The time to Inform is between 3 to 5 min. Preparation to evacuate is 5 min. Moving towards the meeting place to the shelter takes 3 to 5 minutes.	15 minutes to go around the community. Preparation time: 30 min. Moving to the shelter 15 min.	Informing: 15 min. Preparing: 30-60 min. Evacuating: 30 min.	Evacuation time: in Barrio Panamá there is no speaker. A community alarm would help leave the place in minutes. 5 minutes for 8 families is the preparation time. Time to move to the meeting point is 30 min. because the community center is 30 minutes away, 1 km. Evacuation should happen in both directions because the river cuts the community in half. Two families need a place where to shelter.

It is clear that these times need to be fine-tuned through rehearsals, and fed with the accumulated data from the upstream monitoring stations. After the implementation of the two drills, it became clear that the calculated time in this Table, in some cases is beyond the time really used during the exercises. The safety threshold should be calculated once more.

(6) Evacuation Plan

Regarding the Evacuation plan, several sets of planning items were advanced. A preliminary estimation of population in the neighborhoods adds 5,730 persons in the pilot project area. No health

infrastructure is present in the area, and three kindergartens are located in three barrios (two kindergartens attend sixteen children each). Existing infrastructure in the area is summarized in Table 10-6.

Table 10-6 Infrastructure Profile of Communities Affected by Floods in Soacha River

Barrios	Existing Health infrastructure	Children & Adolescent infrastructure	Elderly institution	Physical disabilities institutions	Educational institutions
Cohabitar	No	No	No	No	No
Florida II	No	Two kindergardens of "Bienestar Familiar". Sixteen to twenty children in each.	No	One institution that provides attention to 10 children with physical disabilities	No
Cien Familias	No	Kindergarden of "Bienestar Familiar" Sixteen children. Parroquia Divino Niño	Policarpo Institution Provides attention to twenty elders	No	Eduardo Santos school with 150 students. Nuevo Milenio school with 60 children
La Pradera I	No	A kindergarden of "Bienestar Familiar".	No	No	No
La Pradera II	No	No	No	No	No
Florida I	No	No	No	No	La Florida School with 700 children
Llano Grande	No	No	No	No	No
El Cardal	No	No	No	No	No
TOTAL	No	In 3 barrios	In Cien Familias	In Florida II for 10 children only	910 school students

Only in Cien Familias, there is an elder's institution for twenty persons, and in Florida II one institutions to 10 children with physical disabilities. A total of 910 school students are located in Cien Familias (150 students, Nuevo Milenio with 60 kids, and La Florida with 700 students).

The two practical exercises offered concrete references in building the evacuation plan.

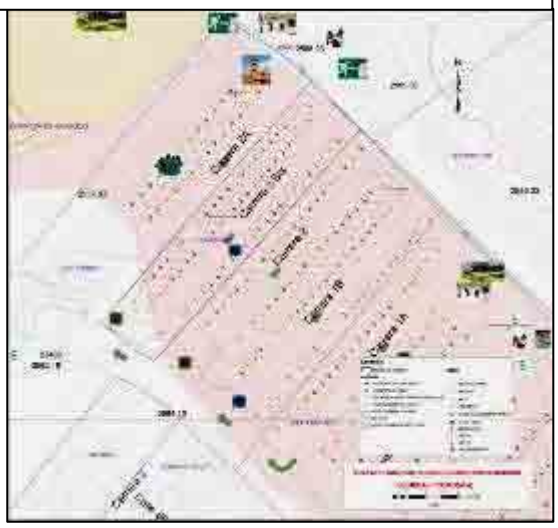
The responsibilities of the groups of leaders were sets. The warning messages were created. The Evacuation Route was defined. A Collage Illustration of all stakeholders is found in Annex 10-1.

(7) The community disaster prevention map

The neighbors and leaders collectively built the information pertinent to the prevention plan. The information they shared and agreed was written into the draft community disaster prevention map. The Study team collected and transferred this data into the GIS database, in sets of corrections during the process until completing a final map.



A walk around the streets to study the possible evacuation plan in each barrio was coordinated with Red Cross volunteers and the JAC leaders who visually explained the areas flooded during May 2006. The streets, routes and shelters were identified and inspected in Cien Familias, Florida II, Cohabitar and Florida I. Another field visit identified the number of floors and type of roof (flat with terrace or not). This data was added into the draft maps, (lower left) and later incorporated into the GIS data base for the Community Map (lower right GIS based draft map).



The Community-based Workshops were a baseline towards building better knowledge on the territory. The final version of the Community Map is found at the end of this section (Annex 10-2). Table 10-7 was prepared with data gathered provided in February 18th, 2007. In El Paraíso (additional field information captured in February 26 and 28, 2007), to visualize the type of affectation, the evacuation behavior, and the community and institutional capacity as well. The last column reflects the recommendations on disaster prevention activities and planning.

Table 10-7 Flood Emergency May 2006. Summary of Information

Group Works	Affectation	Height level of inundation	Evacuation details	The community's response	Institutional response	Lessons learned
Group 1. Autopista Sur, El Cipres, Prado de las Flores, Ciudad Salitre	Between 10 to 20 apartment buildings affected. Losses included mattresses, blankets, furniture, and appliances.	The water level was 70 cms high, in the first buildings of Cipres and y Parque de las Flores.	People went to the second floor, to await the water level to decrease. Later they took out the excess of water in pails and swept out the water.	The community helped rescuing items and supporting the evacuation of people towards safe places during the emergency. Also they called the security and rescue agencies to gain their support.	Firefighters and the police CAME but the risk was not that high, so they did not stay long. They evaluated the risk and its magnitude.	Need of prevention training, emergency management, what to do during disasters. Also periodically the river needs to be dredged and cleaned.
Group 2. Florida II, Cohabitar, Cien Familias	Fifty families in Florida II were affected. Seven houses with two or three families in Cien Familias. 10 families in the first houses near the river. In Cohabitar the losses generally speaking were beds, mattresses, clothing, personal items, tvs, furniture.	The water level was 70 cms high. In La Florida II, the water overflowed. Seventy cms in Cien Familias, but through the sewarage system. One meter in Cohabitar in the first houses closest to the river.	In the areas where no flood took place, they helped pulling the water out in pails, they climbed to the second floor and to the terrace. They swept the streets, cleaned out the water and all items to avoid loss.	The community immediately helped to pull out the water from the homes. They took the lids out of the sewerage pipes. The Ladrillera Santa Fe kindly lent an electrical water pump. Also the community organized by requesting the food aids, clothing, kitchen items, and preventing home items to become damaged.	The firefighters CAME to make a situational assessment. The Police supported the community by helping to pull the water out of the homes and streets. The Alcaldia supported donating mattresses, kitchen pts, food packages and other items.	They request training in prevention, orientation and preparation in the face of disasters. How to act during an emergency. Awareness raising for the community about the risk. Educational campaigns. Sign posting by the CAR. Clearing of the river four times a year.
Group 3. Florida I, La Pradera	In La Florida I, Sixty six persons were affected, which represent twenty six families. In La Pradera no one was affected because the homes did not flood.	In La Florida the water level was 1.20 mt in Cra 4 and Calle 8 y 9. The water backed up by the sewerage pipes in the majority of the homes. In La Pradera the water level did not	La Florida evacuated to the Community Center of La Florida Took out the water with pails, brooms. Took children, elders and people with physical limitations	Gave notice to the community through a speaker and through all communication means. Called all the rescue and emergency agencies but the communication was	The rescue and security agencies arrived: firefighters, police, Doctors without borders, the Alcaldía, the nearby high	To reach an agreement with the Major to receive training for the community leaders and the community in general on first aids, disaster prevention, risk management. Also required is peace

Group Works	Affectation	Height level of inundation	Evacuation details	The community's response	Institutional response	Lessons learned
	The loss was in furniture, TVs, beds, mattresses and objects in the first floor.	increase Except the base of the street, and all they did was to sweep and wait that the water level of the river decreased.	to the shelter. With some machinery were able to take out the lids of the sewerage pipes. Went to find support and shelter towards their neighbors and relatives. After the flood they returned back home. In La Pradera the community activated the alarms, swept the streets, not much affectation inside the homes.	very difficult. In La Pradera since the affectation was low, a Support brigada was put together to support the neighboring familias, with clothing and food.	schools. They helped taking out the water with pumps. Identified the vulnerable population to help evacuate and providing support with food. Fifteen days alter, provided disinfectants for the sewerage and a general vaccination rally.	mediator (called conciliadores), to help establish a united environment during events of such magnitude. Provide orientation about where can the community go for aid support. Raise awareness about the risk and the responsibilities faced towards these kinds of events.
Group 4. Llano Grande y El Cardal	In El Cardal seventeen families were affected. They lost mattresses, blankets, books, clothes, beds, TVs. In Llano Grande forty seven families affected. The loss was furniture, appliances, beds, TVs kitchen ítems, objects from the first floor, food.	The water level in El Cardal reached 1 mt in the lower homes close to the river. In Llano Grande it reached 80 cms in the homes of the center of the block, where the water stayed.	El Cardal did not evacuate towards other homes, but waited the water level decrease. With the help of the community, they pulled the water out to avoid loss of items inside their homes. Some families went to their neighbors & relatives. In Llano Grande people climbed to the higher floors and to the terrace with the home objects. Called the rescue agencies for help	Support to pull out the water from the homes, organize the community to distribute tasks to the neighbors, tell the community about the emergency so they could pull out their items and themselves. Call the security and risk prevention agencies to come to the emergency site.	Civil Defense came to inform people to evacuate their homes towards other places. The police made an assessment of the events and facts, and tried their best to help pull the water out of the homes. Later food packages were delivered by the Alcaldia as well as blankets and mattresses.	Support from the institutions keeping the river clean. Maintenance of the sewarage pipes & system. Training in disaster prevention, support with the Colector Canoas, infrastructure works by urbanism Dept. Education, prevention and orientation in the face of risks and disasters. Community awareness & unity. Elaboration of an emergency plan.

Table 10-8 provides the list of one, two and three story affected buildings in the barrios of the pilot project area. Not all the one story homes have to evacuate. Some homes have built small walls in the entrance that impede the water to go inside the homes. But some two and three story buildings do require to evacuate since it is not uncommon that more than one family live in the premises. While the Table needs more refinement, it provides a good basis for a general overview of the buildings and homes conditions.

Table 10-8 Summary of Houses Prone to Flooding in Pilot Project Area

Houses - and N° of Floors) prone to Flooding					
Barrio	**No. of Inhabitants (1)**	**Houses in Risky conditions**			
		1 floor	**2 floors**	**3 floors**	**Total**
Florida II					
Cra 2 B (solo Sur)	**130 homes & 350 persons**	5	5	2	12
Cra 2A (norte)		12	20	6	38
Cra 2		9	15	9	33
Cra 1B		23	3	5	31
Cll 8		2	0	0	2
TOTAL Florida II		**51**	**43**	**22**	**116**
Cohabitar					
Cra 2 A (sur)	**70 homes & 280 persons**	5	10	2	17
Cra 2 Bis		7	8	5	20
TOTAL Cohabitar		**12**	**18**	**7**	**37**
Cien Familias					
Cra 1 & Cll 7 y 8	**300 persons**	5	1	0	6
Cll. 7 con 1		8	0	0	8
Cra 2 Este con 8 y 7		6	0	0	6
Cra 1By1A con 7y8		8	3	0	11
TOT Cien Familias		**27**	**4**	**0**	**31**
Pradera II					
Cra 2A Este	**500 persons**	13	20	8	41
Cra 2B Este		9	11	2	22
Calle 7,8,9		8	12	6	26
TOTAL Pradera II		**30**	**43**	**16**	**89**
Florida I					
Cra 4 Este	**2,200 persons**	11	9	0	20
Cra 5		0	1	0	1
Calle 10		1	2	1	4
Calle 9		5	2	0	7
Calle 8		20	9	0	29
Calle 7		5	6	0	11
TOTAL Florida I		**42**	**29**	**1**	**72**
Llano Grande					
Manzana F	**1000 persons**	10	5	3	18
Manzana A		0	0	0	0
Manzana C		12	7	0	19
Manzana G		4	8	0	12
Manzana B		11	14	3	28
Manzana E		3	3	0	6
Manzana D		10	8	2	20
TOT Llano Grande		**50**	**45**	**8**	**103**
El Cardal					
Cra 8 Este	**800 persons**	10	28	1	39
Cra 8A Este		7	18	8	33
Cra 9 Este		8	3	3	14
Cll 11		3	1	0	4
TOTAL El Cardal		28	50	12	90
7 BARRIOS	**Aprox 5430**	**240**	**232**	**66**	**538**
(1) Estimation data provided by JAC leaders					

(8) Evacuation Routes and Meeting Points and Shelters

In the Community Maps the Evacuation Routes are marked with green arrows. The Meeting Points are marked with a circled green "E" letter. The locations for shelters were discussed in the workshops. It appeared clear that the entire area had insufficient options to shelter a large number of people affected.

Most of the Meeting Points are open space. The Evacuation Drills led leaders to reconsider the Meeting Points according to the following criteria: safe distance to the hazard, difficulties on accessing the Shelter point; delays in obtaining permission to use a given space owned by some other neighborhood were considered.

Florida II, Cien Familias and Cohabitar shifted their location from the Sports Open Space next to the Divino Niño Parish Church, to the opposite side of the neighborhood, the high grounds in the back east sector, called as the former "Ladrillera of Dr. Murcia". This is not a place that has roof.

Likewise, still remains unclear where people evacuated from El Cardal and Llano Grande would find shelter. El Cardal community does not have a Community Center, and Llano Grande's Community Center is exposed to flood. As meeting places, both communities mentioned to go to higher grounds, where at least they would not flood. But these places have no roofing, they could get wet because they are open space.

In the case of Florida I, they do have a Community Center, but it is in no condition to shelter people for too long. Photos below are witnesses of the conditions of this place which needs repair.

The Community Center at Florida I is an ample space, used during May 2006, which can hold up to 300 people. Nevertheless roof leaks, windows, ventilation and illumination, in bathroom and kitchen area is key. This center is owned by the neighborhood association. The Alcaldía CLOPAD coordinator explained that a legal procedure needs to be written promptly in order to make the required investments. Signing an agreement with the JAC board stating the center plays a shelter role in an emergency is one pending task to be achieved by the CLOPAD..

Photo 10-3 Community Center

An agreement between the Soacha municipality and the JAC administration on the Community Center to accomplish the role of a public shelter in case of emergency is a task that urgently needs to be done. This way funds could be put available in order to provide infrastructure investment by the municipality. The municipality can search for donations from third parties. The Social Development Secretariat of the municipality has temporary shelters identified. It is recommended to avoid sending people to shelters far from home. The items possibly needed in shelters are explained in Table 10-9.

Table 10-9 Conditions of Possible Shelters in Pilot Project Area

Topics	Florida II-Cohabitar Cien Familias	Florida I	El Cardal	Llano Grande	Panama Rural
Items needed at the shelters Actions taken to improve the conditions of the shelters.	Needed items: 100 cleaning kits, cooking kits, mattresses and blankets. First aid kit, 200 dippers, 10 flashlights, 2 radios, water storage, six lamps. Non perishable & perishable food for 15 days for 300 families.	Needed items: 100 mattresses, blankets, medicine, a water tank for 200 persons. Frozen and canned food boxes of juice, canned food, soap, towels, flashlights for 70 homes and 300 persons. Since the Community Center is privately owned (by the JAC) investments need to be sorted out juridical.	For 100 families blankets, mattresses, pots, non perishable food, flashlights, batteries, water for 8 days. Support from the Alcaldía, Red Cross, Civil Defense & doctors without borders. Still unresolved is the 2nd and 3rd floor homes that have different families living in each floor. Some homes have terraces.	Approximately 110 families would need shelter. Food, blankets, mattresses, medicine.	The shelters require 40 mattresses, blankets, a cooking kit, a semi-integral stove, first aid kit. People trained to provide first aid, water, two portable bathrooms, flashlights with batteries, 2 radios and 40 cleaning kits.

Table 10-10 Situation of the Meeting Points

Neighborhood	Meeting Point	Location	Condition
Florida II Cohabitar Cien Familias	Originally the meeting point was the Sports field, could attend 60 homes, equivalent to 100 families, or 300 persons. This was shifted to Former Ladrillera of Dr. Murcia.	Intersection Cra. 2 & Cll. 7	Even when next to the river, it is in a high ground that did not flood in May 2006. Does not have roof or walls only open space. Currently the JAC working in finding funding for building its roof
Pradera II	Towards higher grounds at the east end of the street.	Cra. 2 towards up ground	Open space
Florida I	Florida I Community Center	Diag. 7 No. 4 - 09	Roofing condition vulnerable. Needs bathroom and kitchen repairs.
Llano Grande	Towards Parques del Sol 1; a long distance to walk, not so good for special needs people.At Parques del Sol II, to walk to Parques del Sol I.	Calle 13 & Cra. 2 And Cra. 6 & calle 12	Parques del Sol I: has a Coliseum managed by the Alcaldía.
El Cardal	Old Ladrillera El Porvenir and San Carlos	Calle 13 & Cra. 2 And Cll. 9 & Cra. 9	It remains unclear the output of the permits to enter Ladrillera El Porvenir, and to San Carlos.
Panamá	Towards Fusungá Community Center	1 km south by main road to Vda. Fusungá	Only for eight families are prohe to flood hazard.

In Llano Grande and El Cardal originally one Meeting Point defined was Parques del Sol II. During November 7th meeting and during the November 8th Drill this location as changed to Parques del Sol I. During the evaluation of the November 8th 2007 Drill, there were comments that the chosen Meeting Point was too far for an evacuation. This place was not recommended for elders, ill people and other special needs population.

Table 10-11 in the following page is a summary of all the leaders responsible for all the Evacuation Plan> JAC leaders, Street Coordinators and Meeting Points Coordinators, for all neighborhoods.

10.5 Community Based Disaster Management Manual

A draft manual has been prepared which is currently being used as a trial version in the community meetings held during the month of July 2007. The following concepts were applied for preparation of the manual.

- Each barrio has its own material with specific information pertinent to their area.
- The manual is the simplest possible version for community members. Visually and written sections are balanced, with clear ideas, simple language and short to read. The design of the manual allows for easy use, and easily posted homes in a visual place,- such as refrigerator door, a window or wall.
- Each manual contains a map of their area with the evacuation route, the meeting point, the affected area and the number of stories of the buildings. Also the names of the leaders in their barrio, with phone numbers, and other contact agencies such as the Firefighters, Alcaldía and Red Cross. All the manuals have common recommendations regarding what do to during a flood emergency.
- Four specific manuals were created for El Cardal, Llano Grande, Florida I La Pradera, and the group of Florida II- Cien Familias- Cohabitar. An example of the manual can be found in the next page.

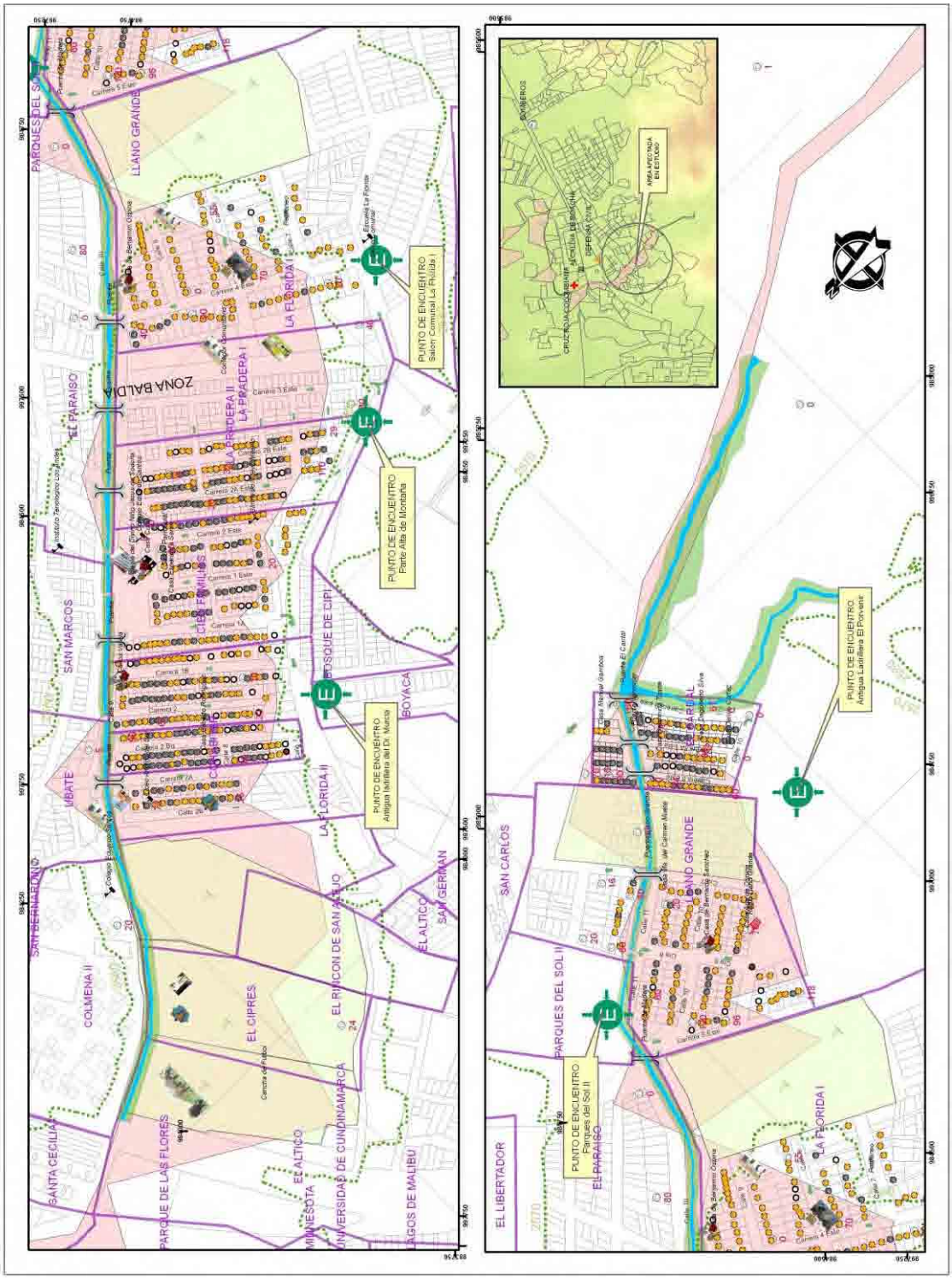
An example of the Manual is found in Annex 10-3.

Table 10-11 Coordinators and Leaders for the Evacuation Plan

RESPONSABLES POR BARRIO. ALERTA Y EVACUACION POR INUNDACION RIO SOACHA							
Responsabilidades	**Florida II**	**Cohabitar**	**Cien Familias**	**Pradera II**	**Florida I**	**Llano Grande**	**El Cardal**
Coordinador por Barrio:	Carlos Varela cra.1bNo.9-19 tel. 7-22-82-87	Gilberto Hernández cra.2bis No. 8-23 tel.5-76-07-00	Esperanza Sanín cra.1 No. 8-15 tel:7-22-62-91	Blanca Barbosa Cra.2a Este No. 7D-22 Tel: 5-76-42-81	Benjamín Ospina Cll. 10 No. 3-49 Tel: 7811611	Jorge Lagos Cll 9 No. 5-40 Este Tel: 7-22-24-57	Dagoberto Silva Cra. 8 No. 10-39 tel.314-310-79-87
Coordinador por Punto de Encuentro:	Miguel Aguilar Cll. 10 No. 2 - 07 Tel:7-26-24-99	Gilberto Hernández cra.2bis No. 8-23 tel.5-76-07-00	Ramiro Salazar cra.1 No.7a-50 te.317-321-73-68	Derly Janet Martínez. Crr. 2 B Este No. 8-23. Tel: 7-32-88-81	Amparo Herrera Cll: Diag 7a No. 5A-51E Tel: 7-26-13-01	Nelly Marquez Cra. 10A No. 5-18 Este Tel:7-22-08-38	Amparo Gamboa Cra. 8a este No. 11-10 tel.5-78-49-90 Cra. 8a este No. 11-10 Manuel Gamboa Cra. 8a este No. 11-10 tel.5-78-49-90
Encargada /o por Calle:	**Cra 2 B** Sara Palacios **Cra 2 A** Isabel Montoya **Cra 2** Gustavo Osuna Cra. No. 9-25 Tel: 7-81-39-73	**Cra 2 Bis** Juan Perez cra. 2bis No.8-18 B17tel.5-77-35-22	Cra 1 y Cll 7 y 8 Jose Santos Benites Tel: 5-75-43-14 Cll 7 con 1 Martha Corchuelo Cra. 1 No. 7A 50 Tel:317-30-85-20	Cra 2A Este Pedro Guzmán Cra. 2A Este No. 8-33 Tel: 5-77-30-17 Edgar Lopez	Cra 4 Este Luis Hernando Arenas Cra. 4E No. 8-14 Tel: 7-21-06-55 Cll 9 Nelly Nataly Gonzales Cra. 4 No. 8-34 Tel: 7-81-62-83	Cra 7 Con 11 María del Carmen Muete cll. 11 No.6-43 Tel. 7-81-43-80 Cra 6 Jorge Lagos cll.9 No. 5-40este tel. 7-32-37-53 Cra 5 Margarita Caicedo cra. 5esteNo.10-36 tel.7-22-13-06	**Cra 8 Este** Leidy Piranique Tel: 5-79-79-73 Cra 8 A Este Erika Puentes Cra. 8a este No. 10-09 tel.5-90-09-48
Encargada /o por Calle:	Cra 1 B Jose Torres cra.1bNo.8-00 tel.5-77-24-23 Teresa Estupiñan Jose Rodriguez	**Cra 2 Bis** Juan Perez cra. 2bis No.8-18 tel.5-77-35-22	Cra 2 Este con 8y 7 Adela Castro **Cra. 1 B y 1 A con 7 y 8** Esperanza Sanin Cra. 1 No. 8-15 Tel:7-22-62-91	Cra 2 B Este Blanca Barbosa Cra.2a Este No. 7D-22 Tel: 5-76-42-81	Cll 8 Jose E. Morales Cll. 5 No. 5-19 E Cll 7A Carmen Rosa Ruiz Medina Cra. 6 No. 5-04 Cll 10. Jorge Lugo Cra. 4 No. 8-59 Tel: 7-81-62-83 Cll. 5A Maria Trinidad Caro Cll 5 No. 5-18E Cra5. Jose E. Morales Cll.5 No. 5-19E Tel: 7-21-45-50	Cll 9 Isabel Molano cll.9 No.5-30e tel.7-21-26-73 Cll 10 Pilar Ballesteros tel.7-21-70-76	Cra 9 Este Deisy Marcela Ruiz Tel: 7-21-71-46 **Cll 11** Leidy Piranique Tel: 5-79-79-73
Encargada/o de Seguridad por calle:	Jose Torres cra.1bNo.8-00 tel.5-77-24-23 Carolina Contreras cra.2No.7-52 tel. 7-22-58-21	Gilberto Hernández cra.2bis No. 8-23 tel.5-76-07-00	José Santos Benítez cra.1a No.7a-40 tel.5-75-43-14 Adela Castro cll 8este No.1-25 tel.5-77-13-35	Martha Infante	Amparo Herrera Cll: Diag 7a No. 5A-51E Tel: 7-26-13-01		Danilo Cortez cra. 8e No. 10-04 tel.7-21-65-79

Annex 10 -1 Illustrative Images of All Stakeholders Involved in the CBDM Plan

Annex 10 - 2 Community Hazard Map



PLAN COMUNITARIO DE MONITOREO Y ALERTA TEMPRANA

7 PASOS PARA PROTEGERNOS DE UNA INUNDACION

1. Baje los tacos de la electricidad y cierre registro del gas antes de evacuar.
2. Apile los enseres de valor, que queden en la vivienda, colocándolos en los puntos mas altos (150m) para evitar que se mojen.
3. Al salir lleve con usted una reserva de agua potable, alimentos y provisiones de emergencia
4. Asegúrese de que todos en su casa y calle conozcan como funciona el sistema de alerta temprana (alarmas, sirenas, pitos, perifoneo).
5. Antes de salir, recuérdele a sus familiares el punto de encuentro y la ruta donde debe dirigirse durante la evacuación
6. Si su casa puede resultar afectada por la inundación, antes de salir revise y evite tener instalaciones provisionales para sus equipos eléctricos y materiales que el agua pueda llegar a deteriorar.
7. Tranque puertas y ventanas excepto las mas bajas con el fin de dar salida al agua.

ES MEJOR PREVENIR QUE LAMENTAR

EQUIPO FAMILIAR PARA EMERGENCIA

Existen seis grupos de elementos que usted debe disponer en su hogar con el fin de estar preparado para situaciones de emergencia, estos son:

Almacene agua solo en embases plásticos, como en botellas de gaseosa mega familiar

Mantener una provisión de alimentos (no perecederos) para tres días como mínimo.

Prepare un botiquín para primeros auxilios: Espadrapo, curas, bajalenguas, gasas, vendas, isodine espuma y solución.

Disponga de herramientas básicas para superar situaciones criticas: como cierre de válvulas aperturas de puertas y ventanas y control de escapes de agua.

Tenga siempre a mano accesorios básicos para superar una emergencia estos son: Linterna, radio, llaves de repuesto, fósforos, documentos de identidad

Cada miembro de la familia debe guardar algunas prendas personales las cuales deben empacarse en bolsas plásticas.

LOS PROPOSITOS DEL SISTEMA DE MONITOREO Y ALERTA TEMPRANA

- Salvar la vida de las personas y evitar que se vuelva a presentar lo del 11 de Mayo del 2006.
- Mejorar la capacidad comunitaria para prevenir desastres.

Se monitorean las condiciones hidro – meteorológicas.

Se prepara un sistema de alerta temprana basado en los datos colectados.

La comunidad debe:

- ☑Evacuar en un evento de inundación.
- ☑Entender el sistema de alerta temprana.
- ☑Tomar las acciones necesarias.

Qué es el Monitoreo del Río de Soacha

Consiste en tomar medidas con equipos (Pluviómetros y limnimetros) y visualizar del nivel de agua del río, en los siguientes puntos:

Monitoreo continuo

-San Jorge, toma las medidas de las lluvias.

-Bomberos, toma las medidas de las lluvias.

-Ladrillera Santa Fe, mide el nivel del agua en cauce.

Alerta temprana

- San Jorge, toma las medidas de las lluvias.
- Cárcel Zaragoza, toma las medidas de las lluvias y el nivel del agua.
- Llano Grande mide el nivel del agua en cauce.

RUTAS DE EVACUACION Y PUNTOS DE ENCUENTRO

EL CARDAL: Ir por la Cra 8 Este y 8A Este hacia la antigua ladrillera el porvenir.

LLANO GRANDE: Subir a la urbanización San Carlos y Parques del Sol II, por las Cra 7 y 6.

FLORIDA II, COHABITAR Y CIEN FAMILIAS: Ir hacia la Cll 7, Para llegar a la Iglesia Cien Familias y a la cancha múltiple.

FLORIDA I: Ir por la Cll 8 y coger hacia la Cll 3, para llegar al salón comunal del barrio.

PREDERA II: Ir hacia la Cra 3, para ir hacia la montaña.

NO PODEMOS
EVITAR LA OCURRENCIA
DE FENOMENOS
DE LA NATURALEZA
PERO SI EVITAR DESASTRES.

PLAN COMUNITARIO DE MONITOREO Y ALERTA TEMPRANA

RESPONSABLES BARRIO LLANO GRANDE:

Ana Isabel Molano
5785969

María del Carmen Muete
7814380

Ana de Ospina
5786343

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DIRECTORIO DE TELEFONOS PARA EMERGENCIA

Coordinación CLOPAD	311-5475386, 312-3868252, 5-755700
Bomberos Soacha	310-8694040, 7-8227983
Defensa Civil Soacha	7-814775
Cruz Roja Cundinamarca	4-281111, 5-400502
Hospital Mario Gaitan Yanguas	5-978999 Ext. 134
Hospital Cardiovascular del Niño	5-922979 Ext. 118/119
Secretaria de Salud	312-3869460, 5-752830/40/60
Empresa de Acueducto y alcantarillado	3-447000 Ext. 116
Empresa de Energía–CODENSA	6-016060
Empresa de Gas Natural	3-144500, 3-485500

CHAPTER 11 TEMPORARY WORKS

11.1 Background

In the Territorial Ordering Plan (POT) of Soacha Municipality, the Municipality classifies El Divino Niño area as a "Hazard Zone by Landslide", and the Municipality is implementing a relocation program of houses which are located in the hazard zone.

At the preparatory stage of this study (September 2005), Soacha Municipality requested a study and implementation of emergency measures for slope protection at El Divino Niño, and the Study Team carried out the study and investigation. As a result, the Study Team concluded that the relocation of houses was the only way to assure safety of residents, that no other measures were practical and that some measures even had a possibility to induce a further dangerous situation. The Soacha Municipality agreed on this conclusion.

As mentioned above, El Divino Niño area has been designated as landslide hazard area by the Soacha Municipality, however, the dangerous area in concrete form has not been specified. Therefore, the Study Team examined and decided a Critical Zone using the following criteria, and details are shown in Chapter 8 in this report.

- Slope angle is not less than 30 degree and slope height is not less than 5m
- Distance from the slope toe is within twice the height of slope.

Since there are many houses to be relocated in the Critical Zone, the relocation of all houses seems to take time. Considering this situation and to prioritize the houses for relocation, the Critical Zone was classified into two (2) zones; Emergency Zone (the area within 10m or 2 rows of houses from the toe of the slope) and the rest.

Although the Soacha Municipality implements the relocation program based on this priority and relocation of houses in the Emergency Zone has been completed, there are many remaining houses facing critical situation in the Critical Zone. Therefore, it is recommended to implement temporary works to reduce the risk to remaining houses by small-scale slope failures and rock falls. The main work items of the temporary works are construction of a protection wall on the boundary of the Emergency Zone after houses have been relocated and drainage channels.

In this connection, the Study Team carried out the plan and design of the temporary works in the third and forth field works of the Study, and the results are presented in the following sections.

11.1.1 Purpose of the Temporary Works

The purposes of the temporary works are:

- To reduce the risk to remaining houses in the Critical Zone by small-scale slope failures and rockfalls,
- To inform the neighborhood that the critical zone is a risk zone, and
- To be a symbol of an emergency measure to prevent new settlement in the risk zone.

11.1.2 Items of the Temporary Works and General Plan

The temporary works composed of four major work items described below:

- Construction of a temporary protection wall along the boundary of the Emergency Zone against small-scale slope failures and rock falls
- Construction of drainage channel in front of the temporary protection wall
- Construction of a conventional drainage channel at the upper part of El Divino Niño area
- Installation of sign boards to inform the risks

The general plan of the temporary works is shown in Figure 11- 1.

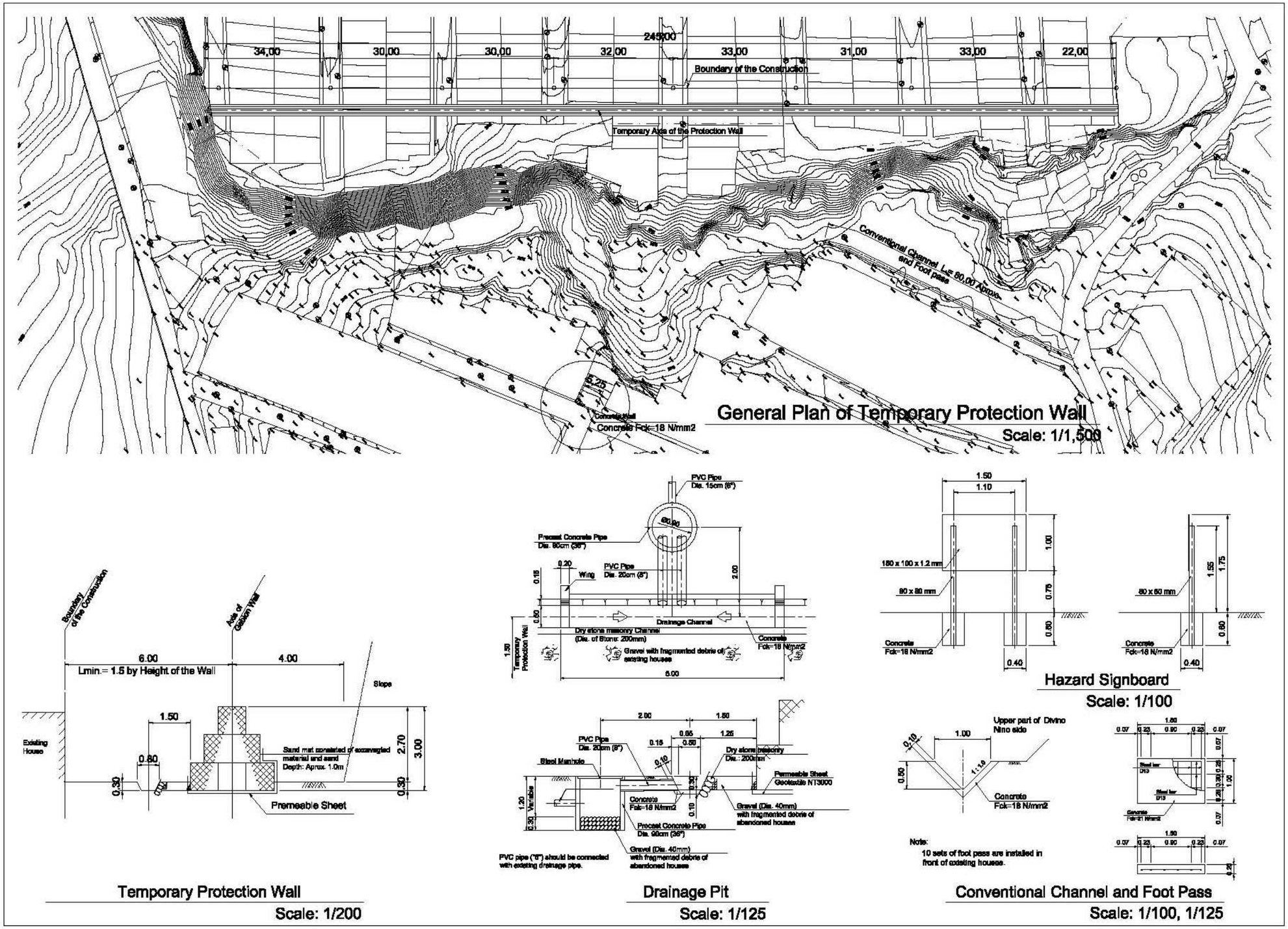


Figure 11- 1 General Plan of the Temporary Works

11.2 Plan and Design of Temporary Works

11.2.1 Present Condition

El Divino Niño area is located at 1.4 kilometers to south of the center of Soacha Municipality. In El Divino Niño area, there are two (2) housing estates across the principal road "1B Este". In the housing estate located in front of the cliff, there are nine (9) blocks, and 165 houses and existence of small factories has been confirmed in these blocks. In the 1980s, El Divino Niño area was utilized as a borrow pit for construction materials. After the activities of borrow pit were terminated, the area has been abandoned and a steep cliff has remained. Later on, inhabitants have started immigrating from outside of the Municipality and settled in the area mostly without legal titles for about 15 years.

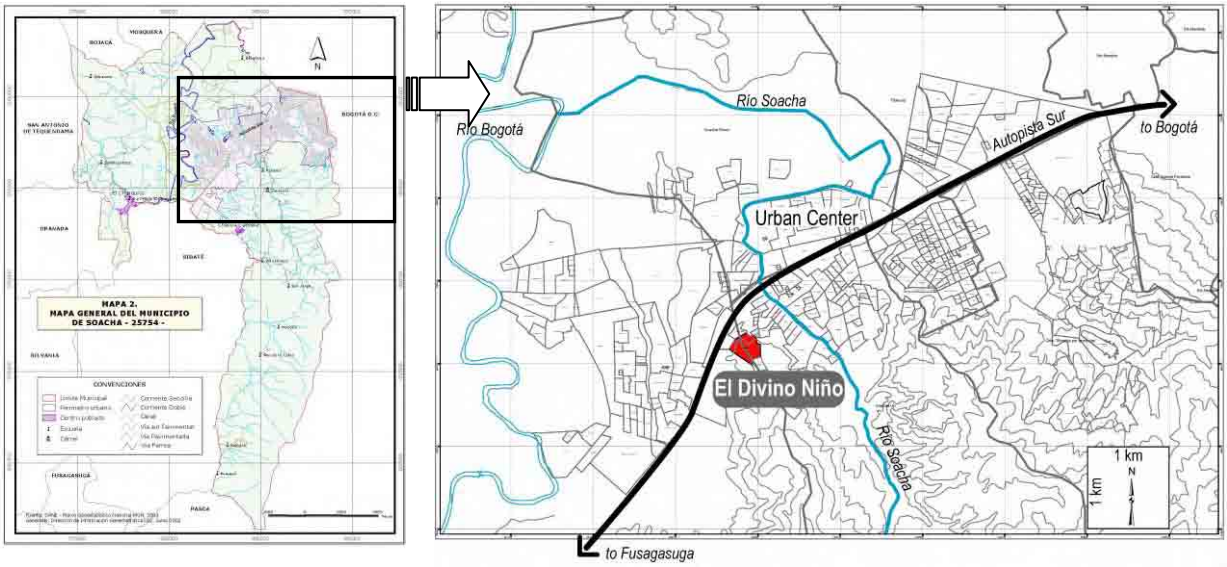


Figure 11- 2 Location of El Divino Niño area

On the cliff surface, it was estimated from the positions of rocks and materials on the slope that several landslides had occurred in the past. The bedrock is developed toward inside of the cliff and sediments such as sand and gravel have been deposited in the space between rocks on the bedrock through the movement of landslides. At present, the rocks are supported by the bedrock and these sediments. There is a possibility of rockfalls and landslides if these supporting materials are eroded due to rainfall.

11.2.2 Plan and Design of the Temporary Works

El Divino Niño area was selected as the pilot area in Soacha Municipality where has many hazardous areas. The method of the temporary works should be applicable to another area in the Municipality. In general several types of the protection wall have been established as the countermeasures for small-scale landslide failures and rockfalls. The requirements for the temporary protection wall in El Divino Niño area are:

- To install the wall using design and construction method, which is, normally applied in this country
- To use the construction material which can be, easily obtained
- To utilize the debris produced by demolition works of the abandoned houses
- To install in lots according to the progress of relocation program by the Municipality
- To repair using homogeneous material in case of the protection wall will be damaged

Based on the requirements mentioned above, gabion wall was recommended in the Minutes of Meeting signed on November 20th, 2006.

(1) Temporary Protection Wall

The function of the temporary protection wall is to absorb and stop the kinetic energy of: a) sliding, b) rolling c) free falling and d) bouncing of falling rocks in several sizes which are on the slope surface. The energy produced by movement of a falling rock is proportionate to its size and height of the slope. Consequently the design of the protection wall is implemented based on the following flow.

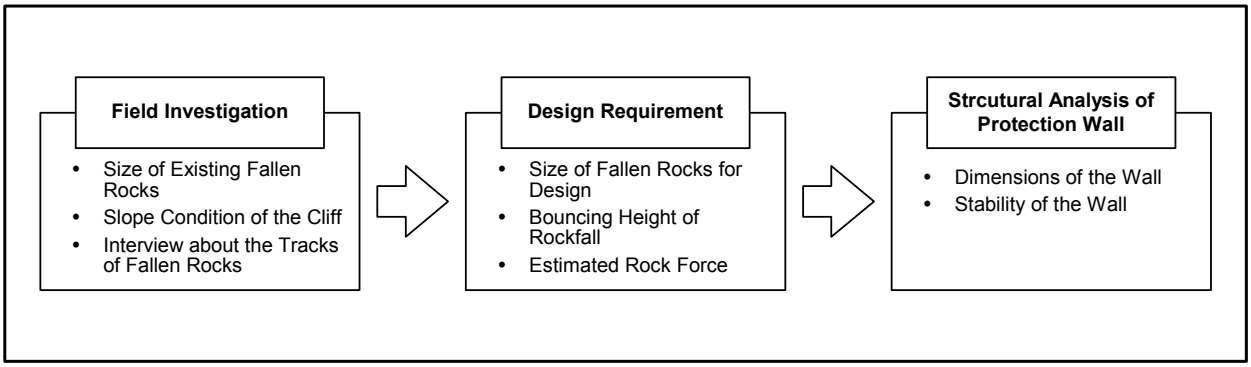


Figure 11- 3 Design Flow of the Protection Wall

1) Design Rockfall

a) Design Rock Size

The design rock size was decided based on the field investigations of rocks on the slope surface and the actual sizes of the fallen rocks.

The rocks on the slope which may fall in the future were investigated using stereo pictures as shown in Data Book 3. The rocks on the slope were classified into two (2) categories of: 1) high possibility of rock fall in the near future and 2) middle possibility of rock fall in future. According to this investigation, 271 rocks in total which may fall in the future were detected and the rocks classified high and middle possibility were 83 and 188 respectively. The result of the investigation is shown in Figure 11- 4.

		Possibility of Rock falls		
No. Picture	Block	High	Middle	Total
R-1605	8	4	4	8
R-1606	7 & 8	9	19	28
R-1607	6 & 7	8	14	22
R-1608	6	4	9	13
R-1609	5 & 6	2	6	8
R-1610	4 & 5	1	2	3
R-1642	4 & 5	11	19	30
R-1643	4	23	27	50
R-1644	3 & 4	4	16	20
R-1645	3	10	39	49
R-1646	2 & 3	5	22	27
R-1647	2	2	11	13
Total		83	188	271

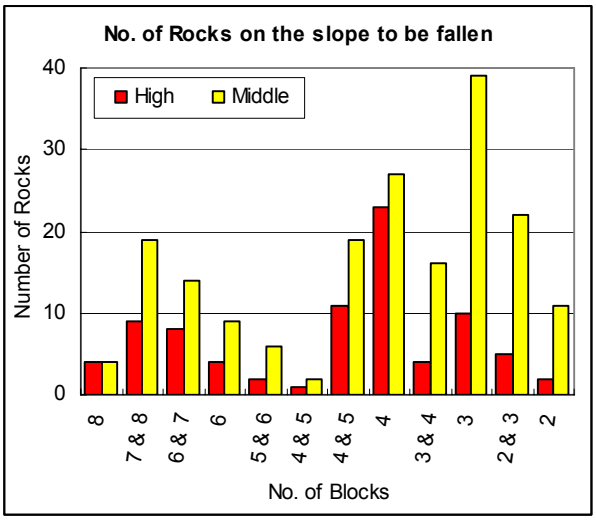


Figure 11- 4 No. of Rocks on the Slope to be Fallen by Blocks

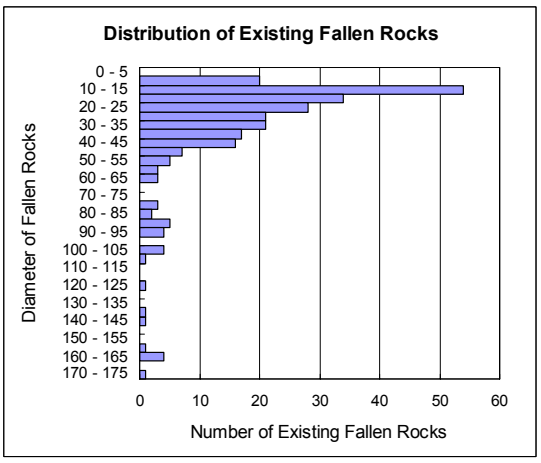
It was difficult to measure the size of rocks on the slope due to its location; therefore the size of rocks was measured using existing fallen rocks.

i) Measuring of Existing Fallen Rocks Size

Previously size of fallen rocks in each residential block of the area has been confirmed through the interview and measurement at the site. The fallen rocks which were measured in the nine (9) blocks were 275 in total.

ii) Size of the Fallen Rocks

The form of measured rocks was variable; therefore the actual size of the rocks is converted to spherical form based on the estimated volumes. The size distribution of fallen rocks and rock size accumulation curve are shown in Figure 11- 5.



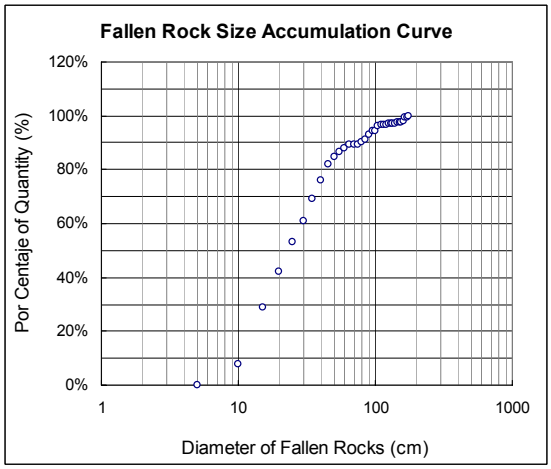


Figure 11- 5 Analysis of Size and Size Distribution of the Fallen Rocks

The objective of the Temporary works is to reduce the risk of the neighbors in the critical zone temporarily, against rock fall from the slope until relocation by Soacha Municipality is completed. Usually temporary works are designed based on available data because the structure is temporary. Therefore in the design of the temporary works in El Divino Niño area, using the information on existing fallen rocks. The diameter of 175cm which was the largest recorded was adopted as the design size of fallen rock as shown in Table 11-1.

Table 11- 1 Diameters Distribution

Distribution	Diameter (cm)
D_{50}	20
D_{60}	25
D_{70}	35
D_{80}	40
D_{90}	80
D_{100}	175

(Source: JICA Study Team)

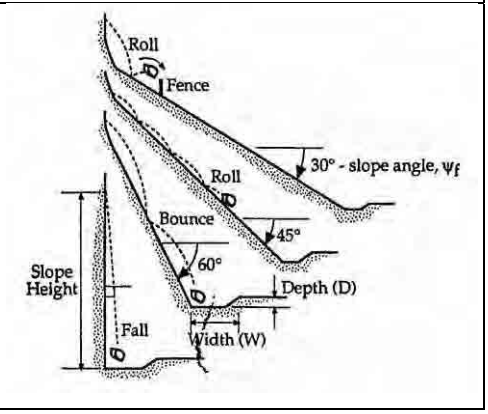
b) Bouncing Height of Rock fall

For simulate the bouncing height of falling rocks in El Divino Niño area, the data of slope soil mechanics and the trace of the falling rocks on the slope are basically required. However these required data were not available at the site, therefore the design bouncing height of falling rocks was estimated based on the empirical knowledge.

According to the topographic survey conducted in December 2006, the slope angles of cliff in El Divino Niño area varied from 39 to 75 degrees as shown in Figure 11- 6.

Generally falling conditions of rocks are almost fixed according to the slope angles as shown in Table 11- 2. Since falling rocks tend to depart from the slope on the slope angles of 55 to 75 degrees, bouncing height of falling rocks on the slope from 55 to 75 degrees is considerable as estimate maximum bouncing height.

Table 11- 2 Falling Condition of the Rocks according to the Slope Angles

Slope Angles θ	Falling condition of Rocks	Falling Conditions by the slope angles
$75^o < \theta$	The rocks tend to stay close to the face and land near the toe of the slope.	
$55^o < \theta < 75^o$	The rocks tend to bounce and spin, with result that they can land a considerable distance from the toe and a wide ditch is required.	
$40^o < \theta < 55^o$	The rocks will tend to roll down the face and into the ditch and a steep outer face is required to prevent them from rolling out.	

(Source: Landslides Investigation and Mitigation Special Report 247, Transportation Research Board National Research Council, National Academy Press Washington, D.C. 1996)

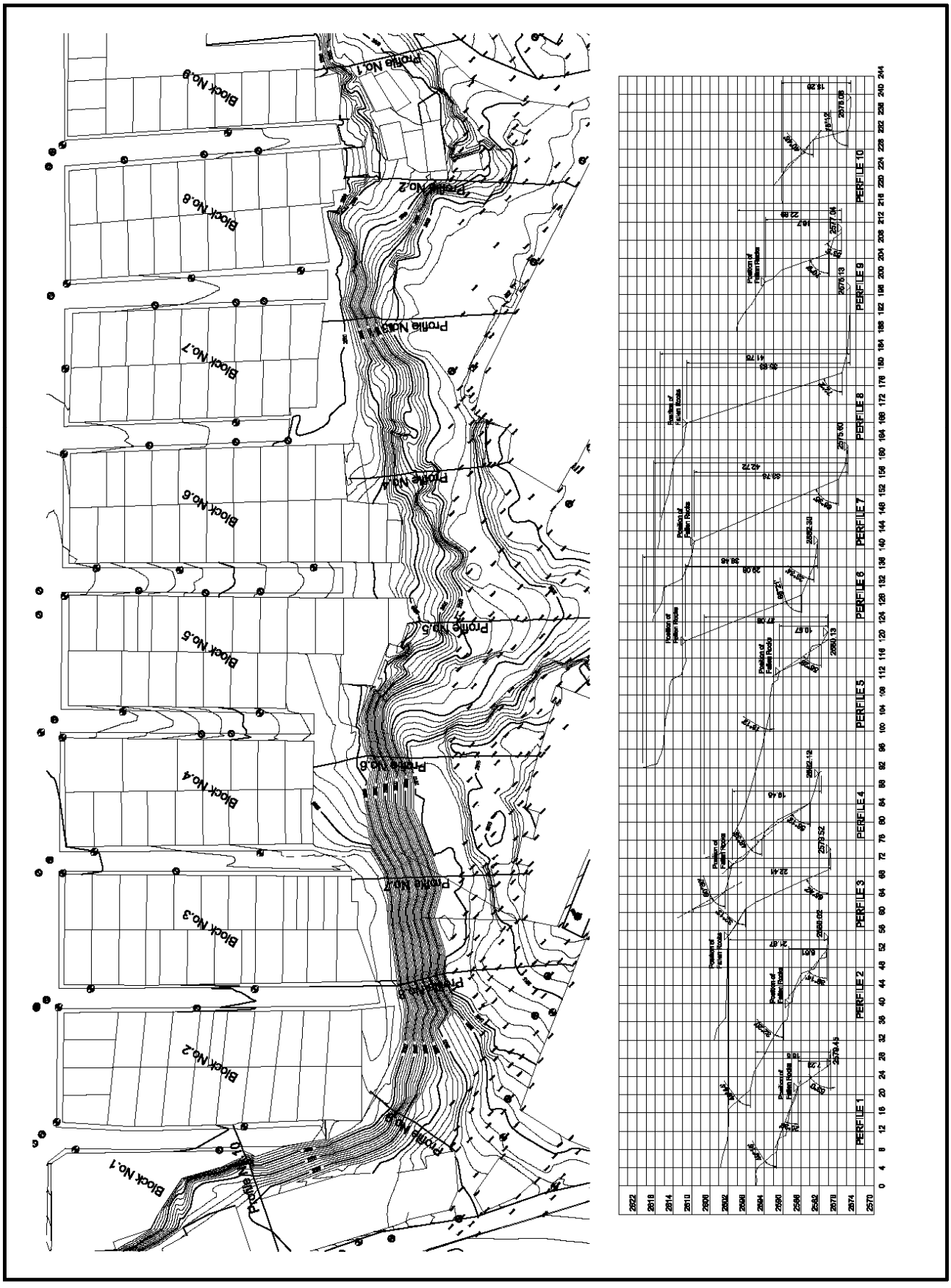


Figure 11- 6 Profile of the Slope

The bouncing height of falling rocks has been confirmed through the experimentation in Japan, the slope had an angle of 40 and 55 degrees and its surface were roughly but no vegetation. In experiments in Japan, 80 to 85% of the total bouncing heights recorded as maximum were confined within 2.0m. However if there are some protuberances on the slope surface, the bouncing height of falling rocks excesses 2.0m.

It is rare that the falling rocks bounce over the height of 2.0m from a slope surface, therefore in this Study, the maximum bouncing height of falling rocks was set at 2.0m from a slope surface.

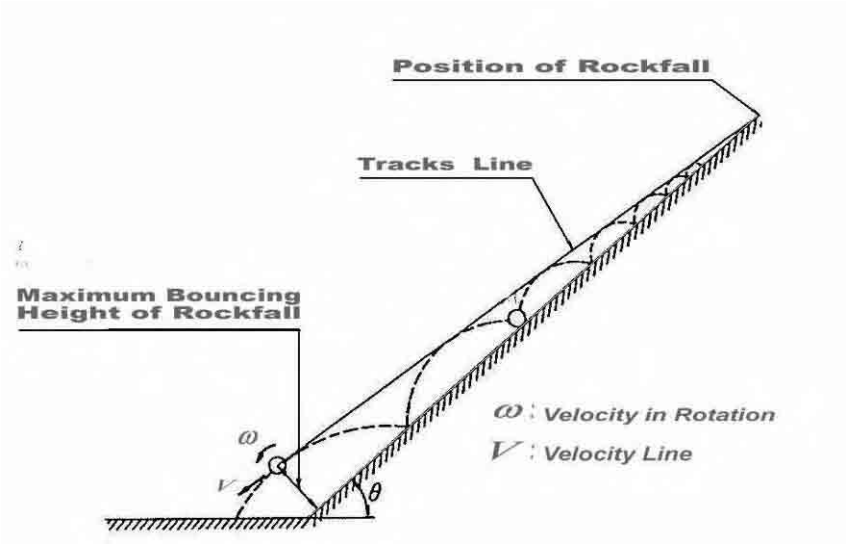


Figure 11- 7 Tracks of the Fallen Rocks

(Source: Handbook of measures of rock falls, Jun. 2004 Japan Highway Association)

2) Design of Temporary Protection Wall (Gabion Wall)

a) Form of Gabion Wall

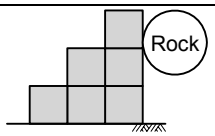
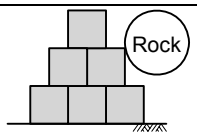
The minimum required height of the wall was settled 2.0m due to the bouncing height of the falling rock. Because of the bouncing height means the height from the land surface to the center of the rock, the height equivalent to the radius of design falling rock size should be added to the minimum required wall height. The diameter of rock for design is 175cm therefore the required wall height should be 2.875m. On the other hand, the height of majority houses in Critical Zone is estimated less than the required wall height. Therefore the protection wall is constituted by three (3) layers of gabion which has a standard height of 1.0m

i) Layer Arrangement of Gabion

The gabion wall is structurally positioned between a reinforced soil wall and a concrete wall. Therefore the wall surface will be dented when a falling rock hits the wall. Its flexible characteristic should be considered for the layer arrangement of gabion, although the Lame's constant of gabion is not clearly

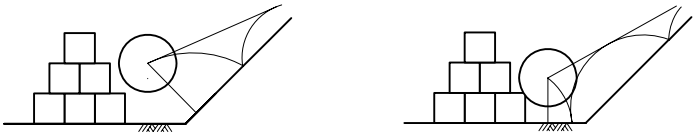
Based on the comparison shown in Table 11- 3, terraced layer arrangement is applied for the gabion wall.

Table 11- 3 Comparison of Gabion Arrangement

Item	Gabion Arrangement A	Gabion Arrangement B
1. Gabion Arrangement		
2. Rock Resistant	- Center of gravity of wall is positioned toward to rockfall side, therefore this arrangement of gabion wall put up high resistance to collision of falling rocks. Good	- Its center of gravity is positioned at the center of wall therefore resistance to the falling rocks is not higher than the gabion arrangement A. No
3. Structural aspect	- The wall will be dented when the wall receives the impact force of rockfalls therefore the gabion located on top will loss its stability. No	- Due to terraced arrangement of gabion, the stability of gabion is kept if dent caused by fallen rocks. Good
	- The construction joints are appeared due to the arrangement of gabion. Besides perpendicular wall part will be warped by the inadequate construction method. No	- Construction joints are not appeared due to terraced arrangement of gabion therefore installed gabions are rigid respectively. Good
	- In order to minimize the construction cost, the debris produced by demolition works of existing houses should be used. The form of debris may be pointed-sharp due to its production; therefore the debris should be installed inner of the wall to prevent injury. In this arrangement, the each gabion block supports independently its upper block. Therefore the original strength by stone is required for each gabion block. Generally the strength of debris may be lower than the rock for gabion, Therefore the debris is not applicable for this arrangement. No	- As mentioned in the gabion arrangement A, the form of debris may be pointed-sharp. Therefore the debris can be installed to gabion block located in center of base layer. The resistance of the debris is lower than the rock for gabion, however terraced arrangement type has structurally a clinching function each other. Therefore it is possible to use the debris for gabion wall. Good
3. Workability of construction	- The gabion at the slope side should be perpendicularly installed therefore form works should be required. No	- Due to terraced arrangement of gabion, the workability in the site is kept. Good
4. Maintenance	- The rocks behind the wall should be removed when rock falls occur, however it is difficult to access to the rocks due to vertical wall form. No	- Due to terraced arrangement of gabion therefore it is easy to access to the rock falls. Good
5. Evaluation	Not applicable	Applicable

ii) Sand Mat for Absorb Impact Force of Falling Rocks

In general the protection wall is designed supposing the condition that falling rocks hit directly the wall. However some of falling rocks seems to hit indirectly the wall through the ground behind of the wall.



Design Condition Actual Condition

Figure 11- 8 Conditions of Falling Rocks

In the demolition works of abandoned houses by the Municipality, unsuitable materials for gabion wall which are bricks and excavated material are produced in the site. Based on the construction law and environmental aspect, transportation and disposal fee are required for these materials. However these materials can be used as the cushion to absorb the impact force of falling rocks.

In order to maximize utilization of the produced materials in the site, the sand-mat consisted of 1) excavated material and 2) debris produced by demolition works is installed behind of the gabion wall. In the rock shed utilized for the road, minimum thickness of sand-mat is applied 90cm considering penetration depth of rock falls to sand-mat. Therefore approximately 1.0m height is considered for sand-mat.

Based on the mentioned above, the form of gabion is shown in Figure 11- 9.

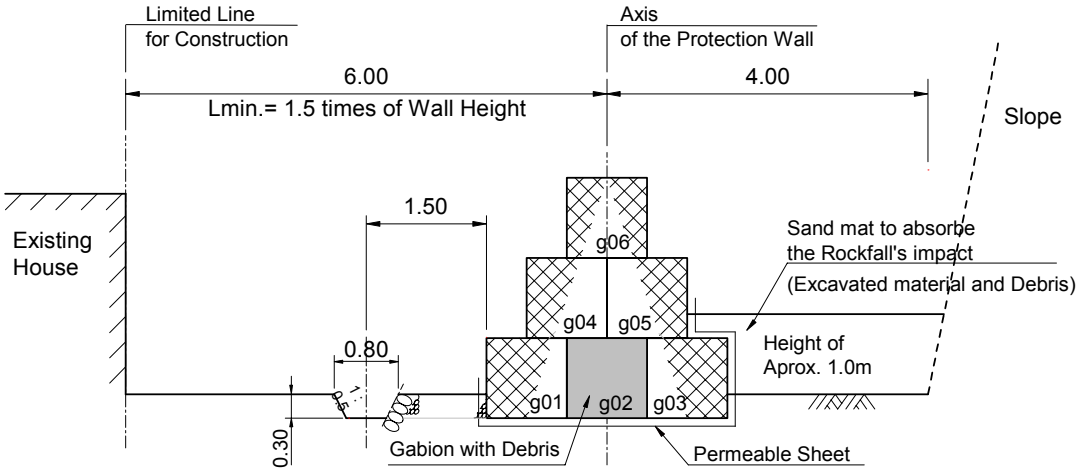


Figure 11- 9 Form of Gabion Wall

b) Axis of Gabion Wall for Installation

El Divino Niño area was a borrow pit area approximately 20 years ago, therefore the baseline of cliff meanders along the past disordered excavation line. However the axis of gabion wall is installed in a straight line disregarding meandering baseline of cliff. Advantages of this method are:

- To reduce the distance of gabion wall,
- To be able to install easily the coordinates of axis of gabion wall,
- To be able to install the gabion wall according to the relocation progress, and
- To be a monument to avoid new settlement in the risk zone after construction

The gabion wall is basically installed in the emergency zone. However since it is difficult to install the wall in loose slope area, the wall axis is temporary installed as shown in Figure 11-10.

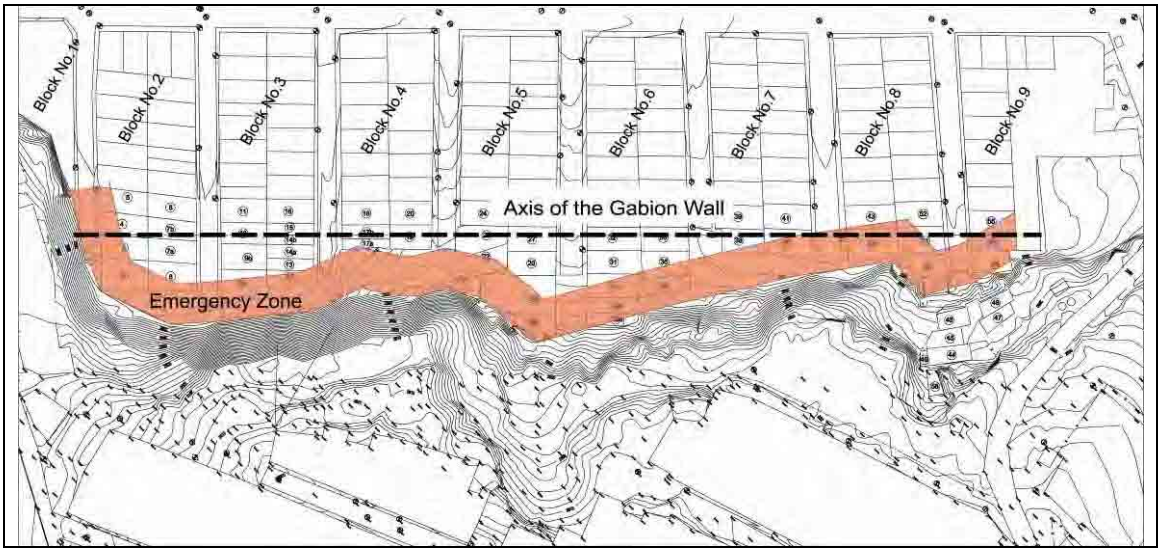


Figure 11- 10 Axis of the Gabion Wall

c) Structural Stability of Gabion Wall

Structural stability of gabion wall is described in Data book.

(2) Drainage Channel in front of the Temporary Protection Wall

At the area where the wall is installed there is not any drainage system for runoff water from the slope by rainfall. Furthermore it confirms that influence of runoff water from the slope to the houses because the foundation level of the houses is lower than the street.

In case that the temporary protection wall is installed in the emergency zone, the runoff water from the slope will accumulate in the space between the wall and the slope. After that the stored water will drain directly to the houses. Consequently the drainage channel should be installed the house side of the temporary protection wall.

The rainwater collected by the drainage channel will be conduced to the drainage pit installed at center of the street. After that a part of the collected water penetrates in the ground and the other part is drained by gravity flow through the existing drainage pipe.

(3) Conventional Drainage Channel on the top of the El Divino Niño area

Many rocks are found out on the surface of slope in El Divino Niño area as shown in Figure 11- 11, and these rocks are supported by deposits and/or sediments between rocks. In rainy season, these materials which support the rocks is eroded by intense of rainfall, the disasters caused by rockfall are often informed. Therefore a conventional channel to minimize the erosion mentioned above is required on the top of slope in El Divino Niño area.

Figure 11- 11 Rocks supported by Deposits and Sediments in Street No.4 in El Divino Niño area

According to the topographic map, the elevation of top of slope is irregularity due to disordered excavation in 1980s. The horizontal distance of slope is estimated approximately 250m, and in this distance the space from residential block No. 7 to 9 is only available to install a conventional channel due to regularity elevation. Therefore a conventional channel is installed approximately 80.0m, and corrected rainwater is drained to the access road.

On the other hand, since the land elevation on top of slope from residential blocks No. 2 to 6 is too much irregular, the earthwork to maintain channel slope should be required. For execution of earthwork, excavation and compaction works should be required on top of the slope. And it is impossible to take a security of neighborhood of residential blocks No. 2 to 6. Furthermore if the ground for the channel is prepared, new immigrant comes to settle. At present rainwater at the upper area of El Divino Niño area is directly discharged to the slope between residential blocks No. 5 and 6 from the access road. In order to prevent the discharge, the concrete wall is installed to the access road. By this concrete wall, the access road becomes water way road in rainy season and collected rainwater of upper area is drained to the approach road of the upper area.

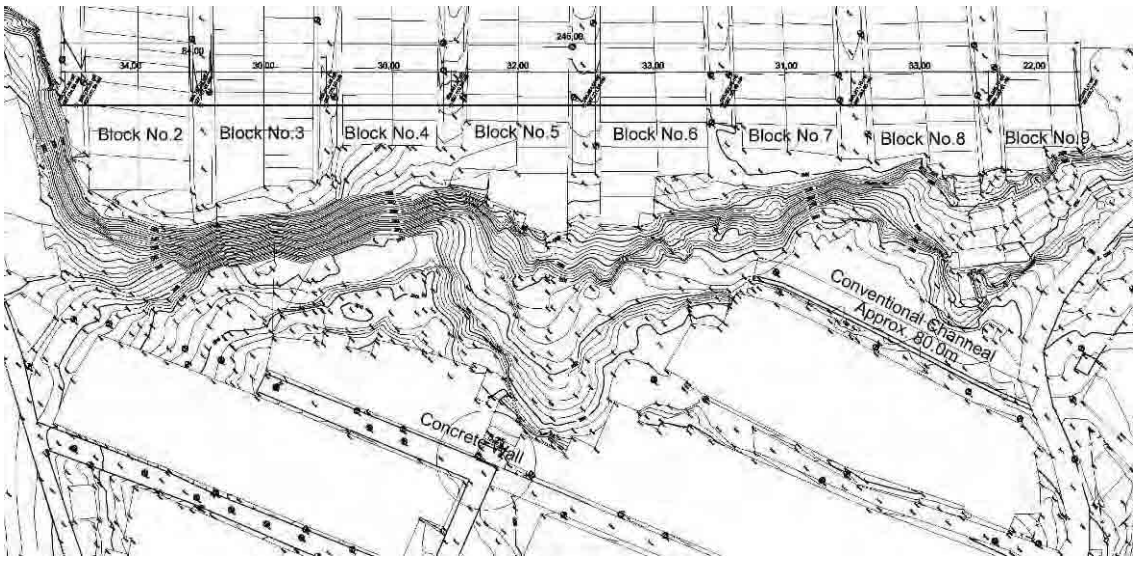


Figure 11- 12 Conventional Channel on the Top of Slope, El Divino Niño area

(4) Hazard Sign Board for Landslide

The temporary protection wall contributes to the security of the neighbors in the Critical Zone and the relocation program implemented by Soacha Municipality. However this wall does not make a definite promise to the security of illegal residents in the future. Therefore the hazard sign boards to announce the neighbors about the objectives of the temporary protection wall and dangerous zone where they live.

11.3 Implementation Concept of Temporary Works

The implementation of temporary works must be commenced after the housing relocation is completely carried out by Soacha Municipality without any social problem on its execution.

The number of families who will be relocated is 56 in total and small scale and large scale families are included in this number. Furthermore location of these families is dispersed in nine (9) residential blocks.

Therefore the construction works will be carried out parallel with the relocation activities by the Municipality.

(1) Organization for Temporary Works

The relocation progress should be usually informed by Soacha Municipality to the Study Team. The Municipality requests the installation of temporary works to the Study Team when one (1) or some residential blocks are completely unoccupied without any social problem. The Study Team carried out the previous technical investigation to confirm the site conditions based on the municipal request letter.

If there are some blocks which satisfies the installation of temporary protection wall, the Study Team will order to the Contractor the installation of the wall after contracting with Local Contractor.

The organization of the temporary works is shown in Figure 11- 13.

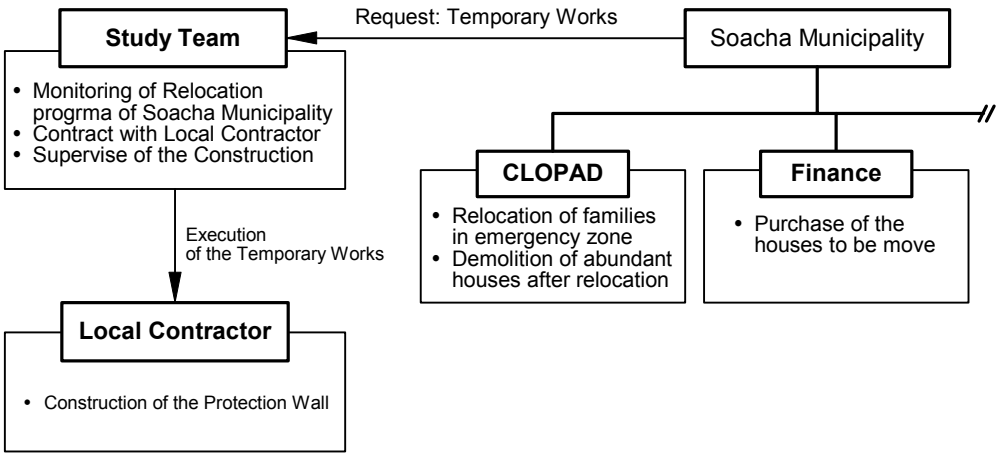


Figure 11- 13 Organization of the Temporary Works

For the execution of the temporary works, the responsibility of both parties which are the Municipality and the Study Team is clarified as following Table 11- 4.

Table 11- 4 Responsibility on the Execution of the Temporary Works

Category	Municipality	Study Team

1. Relocation		
1) Relocation of families	O	-
2) Demolition works of abundant houses	O	-
3) Care of the community	O	-
4) Permission based on the environment law	O	-
2. Construction Works		
1) Warranty of existing infrastructure in the critical zone	-	O
2) Permission based on the construction law	-	O
3) Construction of temporary protection wall	-	O

(2) Packaging considering Progress of Relocation Activities

It is required three (3) months to install the temporary works after the completion of the relocation activities by the Municipality consisted of 1) relocation of families and 2) demolition works of abandoned houses. Therefore according to the progress of relocation activities, there was a possibility that some items of the temporary works can not be executed during the construction period.

As mentioned in 11.3 Implementation of Concept for the Temporary Works, the construction works will be carried out parallel with the relocation activities by the Municipality. Since the families to be relocated settle in nine (9) residential blocks at present, the temporary works is divided into following 10 packages according with the number of residential blocks, the roads and work items.

Table 11- 5 Details of the Packages to Contract

Package No.	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Residential Blocks	-	*No. 2*	*No. 3*	*No. 4*	*No. 5*	*No. 6*	*No. 7*	*No. 8*	*No. 9*	*Streets*
1. Protection Wall	-	31.8	25.4	25.3	26.9	27.7	25.5	27.8	22.0	34.8
2. *Drainage channel	-	31.8	25.4	25.3	26.9	27.7	25.5	27.8	22.0	34.8
3. Drain pit	-	1	1	1	1	1	1	1	1	0
4. Sign Board	-	1	0	0	0	0	0	0	0	7
5. Conventional Channel	80.0	-	-	-	-	-	-	-	-	-

Note: *Drainage and conventional channel mentioned in the table are installed in front of the wall and top of the slope respectively.

(3) Modification of Temporary Protection Wall Axis Corresponding to the Unoccupied Residential Blocks

The axis of the temporary protection wall is installed provisionally at 6.0m from the construction boundary. This boundary was modified or changed according to the relocation activities by the Municipality. Therefore the coordinates of the wall axis can be also modified.

If the space between construction boundary and wall axis becomes large after clarifying the construction boundary by the relocation, some houses by new immigrants who come from outside the community are immediately installed in its space. Therefore the modification of wall axis requires the opinion of the Municipality and Community.

(4) Method of Contract

Items of the temporary works consists of 1) gabion wall, 2) drainage channel by dry masonry, 3) conventional channel by simple concrete and 4) hazard sign board, therefore high technical capabilities are not required. Namely the temporary works is composed of the works that neighboring residents in community can participate as unskilled labor.

However following necessary information for the temporary works design was insufficient because the

relocation of families was not commenced in the design stage. Furthermore there was a possibility that the relocation would be rejected by the community.

- Actual foundation level to install gabion walls due to existence of houses
- Location and size of existing aqueduct and drainage pipes
- Boundary of the houses due to no existence of landowner
- Quantity of debris to use for the gabion wall because of the investigation of houses could not be carried out

There are two (2) types of which are 1) unit price contract and 2) lamp sum contract for the construction works. In the unit price contract, the unit price of the work item is fixed among the owner and contractor and the payment to the contractor is carried out according to the quantity of the executed production. As to the lamp sum contract, the total amount of the works is fixed among the owner and the contractor in case of no design change.

For the implementation of the temporary works, the unit price contract method is not suitable for this Study due to the short construction period and the number of construction package. Therefore the lamp sum contract method is applied as following conditions.

Table 11- 6 Conditions of Temporary Works

Item	Description	Specifications
1. Temporary Protection Wall	1.1 Gabion Wall	Structure: 3 layers of gabion block
		Distance: 245m
	1.2 Sand mat	Structure: Excavated material and debris
		Distance: 245m
2. Drainage Channel	2.1 Drainage Channel	Structure Earth channel with dry masonry
		Distance: 245m
	2.2 Drain Pit	Structure: Precast concrete pipe
		Units: 8 sets
3. Conventional Channel	3.1 Conventional Channel	Structure: Concrete channel (180kN/mm^2)
		Distance: 80.0m approx.
4. Hazard Sign Board	4.1 Hazard sign board	Structure: Steel board
		Units: 8 sets

(5) Selection of the Local Contractor

In order to execute the construction immediately when request of the technical assistance is offered by the Municipality, the Study Team selected previously the Local Contractor who had a sufficient experience. As to select the local contractor, three (3) phases consisted of 1) prequalification of the contractors who participate, 2) evaluation of technical proposal prepared by contractors and 3) economic evaluation for the execution was prepared. Through these phases the contractor was selected however the contract between the Study Team and selected Local Contractor should be done after receiving the request from Soacha Municipality and confirming the site conditions.

11.4 Construction Plan

Based on the request by the Municipality, the temporary works is implemented as following conditions.

- Site: El Divino Niño area
- Borrow pit for the temporary works: Cantera Recurso and/or Cantera Cueva de Zorro
- Spoil bank for the temporary works: La Maya
- Construction Period: 3 months (90 days)

- Conditions for commencement of works: When the residential blocks is unoccupied by the Municipality

(1) Temporary works Operation

Following two (2) phases are prepared for the implementation of the Temporary works.

1) Preparation of the Design and Tender Documents

In this phase, all documents for execution of the construction works are prepared. Furthermore the details of documents such as the design and construction method are modified and supplemented through monitoring of relocation activities by Soacha Municipality.

The documents to be prepared are as follows:

- Review of basic design based on the field investigation
- Selection of construction material to be used
- Cost estimate based on the design and required quantity
- Preparation of the tender documents consisted of 1) instruction of tender, 2) technical specification and 3) tender drawings
- Monitoring of relocation activities by Soacha Municipality
- Execution of the prequalification of the bidder and bidding

2) Construction Supervision

The supervision by the engineer consists of, 1) operation control based on the construction schedule, 2) quality control of material, 3) control of completed structure and 4) design change or instruction to the contractor according to the site conditions. In order to develop adequate technical transfer to the Municipality and local contractor, local engineer for the supervision of the temporary works are selected and employed by the Study Team. Especially the items which local engineer supervises are:

- to check that the construction method of the contractor is adopted to technical specification and design drawings
- to instruct to the contractor from the status of the temporary works between actual condition and construction schedule
- to instruct to the contractor the modification of wall axis through the discussion with the Municipality
- to verify some obstacle which disturbs the construction and inform to related organization
- to confirm that the construction works by the contractor consider living of habitants who live in the critical zone or not
- to verify that the construction works is carried out under paying attention to falling rocks from the slope

(2) Procurement of Construction Material

As to the execution of the temporary works, the construction material which can be obtained in and around Study Area was selected. Procurement of the construction material to be used is described as follows.

1) Cobble stone for gabion

Two (2) borrow pits called “CANTERA RECURSO” and “CANTERA CUEVA de Zorro” are 5km

away from El Divino Niño area. These borrow pits are normally utilized for gabion works by the Municipality therefore the cobble stone of these borrow pits is procured.

2) Gabion net

A few of factories of gabion net are found out in Bogotá Municipality. The quantity of gabion net to be used is almost fixed so a package purchase of gabion net can be possible.

3) Cement and Aggregate

The material for the concrete works can be procured from Bogotá and Soacha municipalities. Due to facilitate the material management, the material for the concrete works is procured from Soacha Municipality.

4) Steels

Steels for reinforced concrete, the manhole cover or steel board can be procured in Bogotá and Soacha municipalities. Due to the quantity of the steel in the Temporary works is limited the steels is procured in Soacha Municipality.

5) Geotextile Sheet

Due to the location of factories, geotextile sheet to be utilized as permeable sheet can be procured in Bogotá Municipality.

6) PVC Pipe

PVC pipe can be procured in Bogotá and Soacha municipalities. Due to small quantity required PVC pipe is procured in Soacha Municipality.

7) Construction Machinery

The period of the temporary works is short, and special heavy machinery is not required due to simple structure. Therefore the construction machinery which the Contractor holds is utilized.

8) Spoil Bank

The spoil bank for debris produced by construction works which is called “la Maya”, is located near the site of borrow pits mentioned above. Here debris of concrete, wood and various materials can be received.

(3) Schedule of the Temporary works

The required item from the preparation of documents to execution of the Temporary works is shown in Figure 11- 14, based on the relocation activities by Soacha Municipality, the following schedule will be modified and executed.

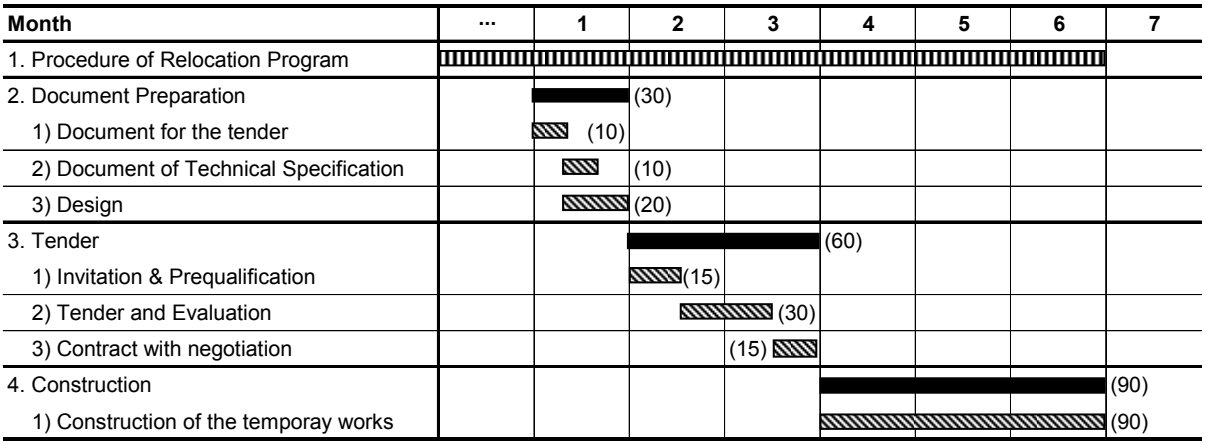


Figure 11- 14 Schedule of the Temporary works

11.5 Implementation of the Temporary Works

The relocation program by the Municipality was carried out according to the size of families in the emergency zone. The Municipality relocated the small scale families to Quintanares area from November to January 2008. As to large scale families, the apartment for relocation is under construction therefore the Municipality prepared the subsidy to relocate them temporary apartment, and this temporary relocation was completed until 3rd of February 2008. By request of the Municipality based on the relocation progress, the Study Team started to implement the temporary works in November 2007 and February 2008.

11.5.1 Contract

(1) Selection of the Local Contractor

In order to maximize utilization of construction period, the Local Contractor was selected in following schedule before completion of the relocation program by the Municipality. And Inversiones G&R S.A. in Bogotá was selected through evaluation in the Public Tender.

- 2007/Jun/08: Invitation of the Tender
- 2007/Jun/25: Prequalification of the Contractor
- 2007/Jun/28: Distribution of Tender Documents
- 2007/Jul/19: Tender/Evaluation

(2) Contract for Implementation of the Temporary Works

According to the relocation progress, the Municipality sent the request letters to the Study Team to implement the Temporary Works. The Study Team investigated with the Municipality's counterpart about the site conditions. After this investigation, the Study Team made a contract with selected local contractor for targeted packages of the Temporary Works corresponding to the letter by the Municipality. Fulfilled Contracts are shown in Table 11- 7.

Table 11- 7 Fulfilled Contract

Contract Number	1st Contract EQUIPO ESTUDIO – G & R S.A – 2007 – 11.	2nd Contract EQUIPO ESTUDIO – G & R S.A – 2008 – 02.
Date of Contract	2007/Nov/22	2008/Feb/04
Contracted Package	Package No. 9 + No.1 (50%)	Package Nos. No.1 (50%) to 8 and 10
Period	2007/Nov/22 to 2008/Feb/19 (90 days)	2008/Feb/04 to 2008/Feb/29 (26 days)

11.5.2 Construction Control

The construction works is generally gone on under the instruction stipulated in General and Technical Specifications and design change as the need arises. The whole construction works is controlled by 1) operation control, 2) quality control, 3) control of completed works, 4) labor management and 5) safety program and practices.

(1) Executive Organization for the Temporary Works

As mentioned above, the Temporary Works was carried out dividing two (2) contracts. For its execution, following organization was applied in both contracts. In the Article 2.12 in General Specification, it is stipulated that the Contractor should employed the labor of 30% from the community for his execution. In 2nd Contract, the labors from the community were employed by the Contractor as shown in Figure 11- 15. On the other hand, the security of the construction site was secured by the community people employed by the Contractor, however to make assurance double sure the construction site was under the control of National and Military Police until completion of the construction works.

The number in parenthesis in the figure below gives the employment condition in 2nd Contract.

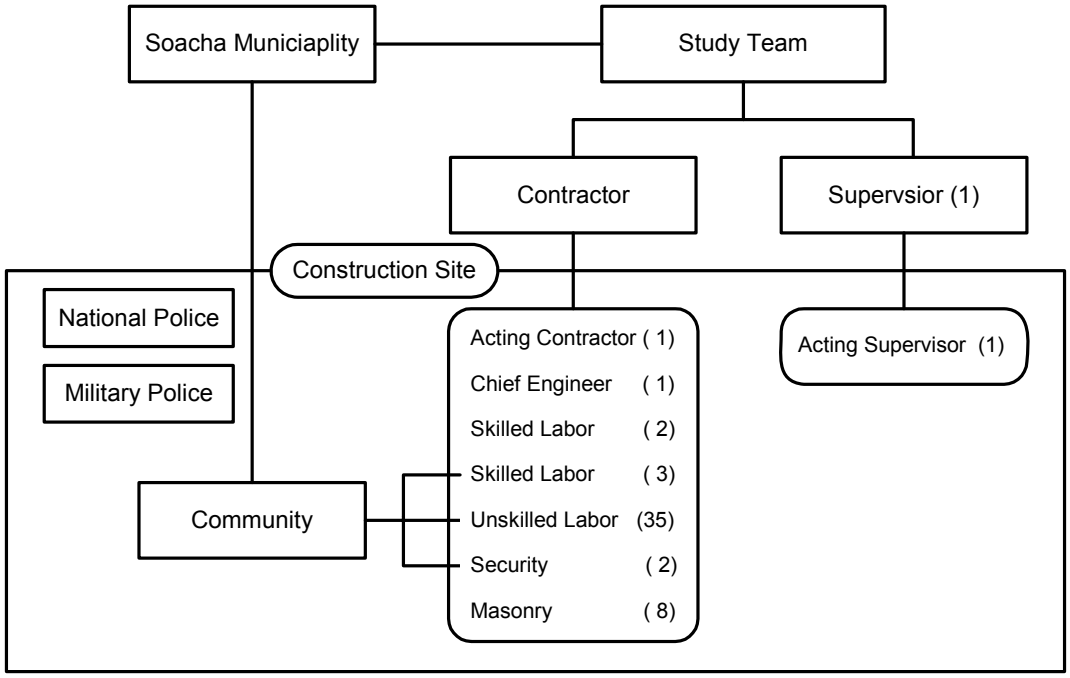


Figure 11- 15 Executive Organization for the Temporary Works

(2) Operation Control

1) Construction Method

The temporary woks are installed in the vacant area produced by the relocation program, and the vacant area is divided into two (2) areas by the wall when the construction works is completed. As to the area between the wall and steep slope, there is normally some possibility that the rocks on the steep slope may fall. On the other hand, as to the area between the wall and existing houses in Critical Zone, the wall should be closely installed toward to the existing houses. Therefore there is no sufficient area for the construction materials and heavy machinery. Consequently the construction by manpower was applied to both of 1st and 2nd Contracts.

In 2nd Contract, the contractor organized a team consisted of (1) skilled labor and (7) unskilled labor, and committed five (5) teams to the works of gabion wall.

The construction method and its process are shown as follows.

(a) Gathering of the debris by the demolition works toward to the steep slope side for the security against falling rocks from the slope

(b) Gathering of the excavated material by the earth work to steep slope side

(c) Transportation of the cobble stone to the site and installation of form works for gabion

(d) Installation of the stone to gabion net by manpower

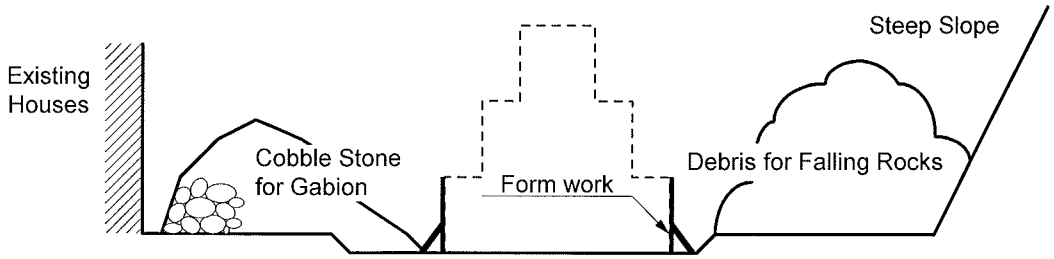


Illustration of the Construction Method

Figure 11- 16 Construction Method

2) Operation Control

As mentioned above, the Temporary Works consisted of 10 packages was divided into two (2) contracts. Since the deadline for the temporary works was until February 2008 due to the period of this Study, the 1st Contract commenced in 22 of November 2007 held 90 calendar days until 19 of February 2008. However 26 calendar days was only available in the 2nd Contract commenced in 4th of February 2008. The construction works in the 2nd Contract was on "the Critical Pass" from its beginning therefore operation control of the Temporary Works was carefully done in the 2nd Contract. Items of operation control were follows.

a. Construction Schedule

Principle work item of the temporary works was the gabion wall therefore the construction schedule in 2nd Contract was controlled by gabion quantity volume per day. The labor from the community did not have any experience of engineering works therefore labor's ability to install the gabion wall was measured by the Contractor and Supervisor and its ability was estimated 50m^3 per day. Based on this ability, the construction schedule was verified every day. When it was confirmed delay of its schedule, the construction method and working hours were revised among the Contractor and Supervisor. As example, in the beginning transported cobble stone from borrow pit was so large for the gabion wall therefore cobble stone had to been broken in the site to adjust the size. Therefore the Supervisor negotiated with the owner of the borrow pit to transport adequate size of cobble stone.

b. Network of Construction Material Supply

It was necessary to import a lots of construction materials to be used in the site due to short construction period. However it was impossible to transport all requires materials in the site due to restricted space as mentioned above. Therefore the supply of the construction materials was controlled according to the construction progress.

c. Inspection by the Supervisor

The inspection by the Supervisor was normally carried out to the important point according to the construction progress and General and Technical Specifications. In order to avoid to remake the structure due to misunderstanding by the Contractor, the intermediately inspection was carried out at all times.

(3) Quality Control

In order to secure the quality of temporary works, following materials to be used were confirmed and approved based on the Article 4.9 in General and Technical Specifications.

a. Cobble stone for gabion

Cobble stone for gabion wall was purchased from the borrow pits authorized by the CAR. According to demanded quantity of the stone, following borrow pits in the Municipality were selected.

- El Tesoro
- Santa Ana

b. Gabion net

Based on the Article 6.4 in Technical Specification, gabion net was supplied by the Manufacture called “Alambres y Mallas S.A” in Bogotá under approval by the Supervisor. Required quantity of gabion net was estimated approx. 370 nets due to 245m distances therefore this quantity was over the capacity of manufacture’s supply. As to shortage of the quantity, other gabion nets which have over quality were transported. Transported gabion net in the site was carefully kept in the storage and was fabricated in the site according to the construction progress.

c. Cement and aggregate

Due to small quantity required, cement and aggregate was supplied from the local market in the Municipality. Cement to be supplied in the site was called “Diamante” as a brand name. In order to maintain its quality, transported cement and aggregate were carefully kept in the storage.

d. Steels

Steels bars for reinforced concrete is used for the foot pass of conventional drainage channel on the top of slope in El Divino Niño area. Quantity of the steel bars was less than 0.5ton therefore the steel bars were provided in local market. In order to prevent the rust on the bars, the bars were carefully kept in the storage.

e. Geotextile sheet

Material characteristics of geotextile sheet are controlled by the Article 6.4 in Technical Specification. According to the supply conditions by the Manufacture, the material was transported from following two (2) manufactures.

Manufacture	Product Name	Material Color
PAVCO	NT3000	Black
LAFAYETTE	BX40	White

f. PVC pipe

PVC pipe is used for connection between drainage channel in front of the wall and drainage pit, drainage pit and existing drainage pipe. Therefore required quantity of PVC pipe was not so much even if quantity of all drainage pits is considered. Consequently the PVC pipe of the manufacture called "NOVAFORT" was supplied from local market in the Municipality.

g. Construction Machinery

Construction machinery was used for preparation of sand mat behind of the wall only. Considering falling rocks caused by the vibration of the machinery, small type backhoe loader of JCB was used.

(4) Control of Completed Works

The completed products will be basically remade with expenses of the Contractor when it will be found out some defects on the quality of products. This remake works of the completed products not only requires the expenses but also the time. In order to avoid the remaking of completed products and maximize utilization of short construction period, intermediately inspection in large numbers was carried out according to the progress of construction works. From this inspection, several defects and misunderstanding could be found out on the products still in progress, and large remaking works could be avoided. Furthermore technical instruction could be given to the labors consisted of community people through this inspection.

Technical instructions to the community people are as follows.

- Installation of form work to avoid bulge out the gabion wall due to horizontal pressure by the stone
- Selection of the cobble stone to avoid aperture between stones
- Placing of the cobble stone in the gabion net to avoid aperture between stones

General view of the Temporary Works is shown as follow.

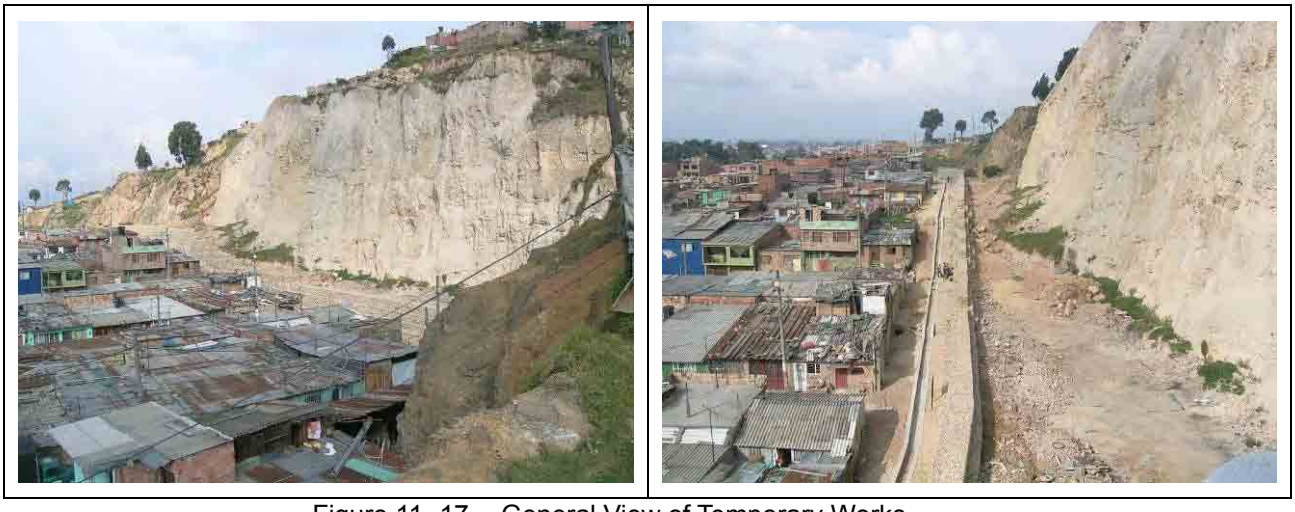


Figure 11- 17 General View of Temporary Works

(5) Site Management

There were some telegraph poles controlled by CODENSA and TELECOM in the vacant area by the relocation program, and these poles located in the residential blocks Nos. 6 to 8 were just on the wall axis. Therefore the Study Team coordinated these private companies in cooperation with the Municipality, and these telegraph poles were taken safely out by the owner company without any disturbance to the contractor's works.

As to the vacant area by the Municipality's relocation program, obligation of tree planting is stipulated in the Article 262 of Territorial Ordering Plan (POT) by the Municipality. Utilizing the construction

period, the Study Team prepared the meeting to establish the concept of tree planting plan between the Municipality and CAR.

(6) Labor Management

In 2nd Contact, 40 labors were employed from the Community. From the beginning of the construction works, the Contractor rented some rooms of a house at street No.3 in Critical Zone as his office. This office served preparatory accommodations therefore two (2) specialists of gabion wall stayed their office 24 hours in order to manage the conditions of labor's health and working hours.

(7) Safety Program and Practice

1) Security against falling rocks

The construction area is risk area by falling rocks and landslide therefore construction works should be basically suspended on a rainy day considering falling rock from the steep slope. Furthermore for making sure of the security on the construction works against falling rocks, the debris and excavated material in the site was put toward to the steep slope to absorb impact force of falling rocks when rocks on the slope may fall. As to the installation of gabion wall, cobble stone was loaded to the gabion from existing house side.

2) Security in the site

In order to maintain the security in the construction works, security goods such as helmet were delivered to all labors. And the Contractor put all labor under an obligation to wear the goods before commencement of the works. Also for the security for community people including children, security tape to prohibit entering the construction area was installed around the construction area. Furthermore, security of the site at night was maintained 24 hours by the community people employed by Contractor. The security against the criminal acts in and around the construction site was controlled by the National Police and Military Police Battalion No.13.

11.5.3 Design Change

The site conditions such as geographical features were cleared after the demolition works of houses by the Municipality. The difference between the original design and actual conditions of the site were adjusted by means of "Design Change" stipulated in Contract.

Items modified by design change are described as follows.

(1) Temporary Protection Wall

1) Axis of Temporary Protection Wall

In the original design, the wall axis is temporary installed considering the relocation boundary decided by the Municipality. In the construction stage, topographic survey for establishment of the wall axis was carried out along the boundary of vacant lots after completion of the Municipality's relocation program. The area, where the Municipality executed relocation and demolition of houses covers not only Emergency Zone but also some part of Critical Zone, therefore the wall axis was established under the following criteria with topographic survey result.

- The wall should be installed in the Emergency Zone and toward to the boundary of vacant lots by the Municipality's relocation as much as possible.
- The wall axis should be a straight line along the vacant boundary, which facilitates to install the wall considering technical level using community people as labor.
- Distance between the wall axis and steep slope should be kept more than 4.0m based on the original design.

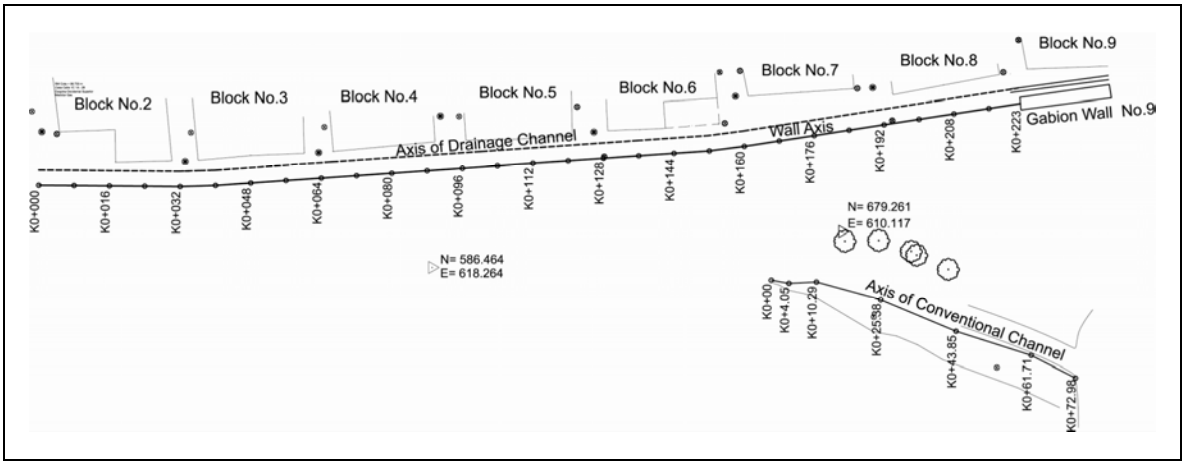


Figure 11- 18 Axis of Temporary Wall

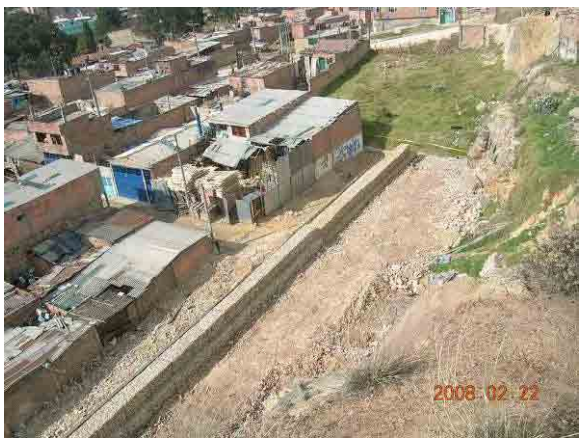
2) Gabion made of Debris

In the original design, the debris produced by demolition works was applied as a material of gabion installed in center of first floor in order to minimize construction cost. In the relocation process by the Municipality, the demolition works of houses was carried out by mutual aid of community. The re-useful materials of houses were carefully taken out, and delivered to community people who helped the demolition works. Therefore quantity of debris to be used for gabion became fewer than the estimated quantity in design stage. Consequently the gabion made of debris was adopted cobble stone instead of the debris, as same as other gabion.

3) Additional Protection Wall

There is a private lot for sale between the residential block No. 9 and sloping road to access the upper part of El Divino Niño area. Here a boundary wall made of concrete has been installed by the land owner at right angle to the temporary protection wall axis. In the design stage, it was expected that this boundary wall could be utilized instead of the temporary protection wall therefore the temporary protection wall was not considered at this boundary. However it was confirmed that this boundary wall is too lower than the temporary protection wall after demolition works by the Municipality.

In order to avoid new settlement from this place, the temporary protection wall with a length of 8.0m was considered in the 2nd Contract.



Before Installation

After Installation

Figure 11- 19 Additional Protection Wall

4) Sand Mat

As mentioned above, the quantity of debris became fewer than the estimate in design stage, most

of the material for sand mat was covered by excavated and homogenous material produced by the construction works.

(2) Drainage Channel in front of the Temporary Protection Wall

1) Drainage Channel made of Dry Masonry

Since rainwater from steep slope is conveyed to drainage channel through aperture of the gabion wall, the channel slope is made of dry masonry which guarantees infiltration of rainwater. And cobble stone with a diameter of 200mm is applied for dry masonry of channel slope. In the construction stage, it was found out that the channel slope made of dry masonry can not guarantee its stabilization in long term therefore top of channel slope was fixed with concrete.


Figure 11- 20 Fixing of Cobble Stone by Concrete

2) Drainage Pit

Rainwater in drainage channel is delivered to the drainage pits in each street. In a drainage pits, collected rainwater is drained and percolated to existing drainage pipe installed by the community and underground respectively. From the hearing to the Community, a diameter of existing drainage pipe was approximately 6inches. Therefore, in original design, precast concrete pipe with a diameter of 900mm was applied for the drainage pit due to easy connection with existing pie and making good progress. The exiting pipe and drainage pit would be connected making a hole on the concrete pipe wall.

Based on the community's information, location and diameter of existing pipe were confirmed by means of excavation works in the construction stage. From this investigation, the diameter of more than 6inches was confirmed between supervisor and contractor. Furthermore it was confirmed some streets have 2 to 3 drainage pipes. It is technically impossible to make some hole on the concrete pipe according to the number of existing pipe. Therefore the pit made of brick was applied in order to facilitate connection with the existing drainage pipe.

Figure 11- 21 Structure of Drainage Pit

(3) Conventional Drainage Channel on the top of El Divino Nino area

Conventional channel is installed in front of the houses therefore 10 foot passes were considered on the channel in original design. In the construction stage, it was confirmed that the number of houses are eight (8), which two (2) houses have their garage. Consequently a foot pass which has twice the size of width was installed to two (2) houses with garage considering passing of the car. For remaining houses, one (1) foot pass was respectively installed.

Conventional Channel	Concrete wall

Figure 11- 22 Conventional Channel and Concrete Wall to be a Water Way Road in Rainy Season

(4) Hazardous Sign Board for Landslide

In order to let community people understand the objects of the temporary works, the expression of the hazardous sign board was written in an easy style using illustrations. Furthermore considering of the Municipality's activities in the area after this Study, the words to be used for the hazardous sign board is followed to the Territorial Ordering Plan (POT) by the Municipality.

The principal contents of hazardous sign board are shown as follows.

- Hazardous map with Critical Zone in El Divino Niño area
- Explanatory note of landslide and falling rocks
- Background of the Temporary Works
- Objectives of Temporary Works

Figure 11- 23 Hazardous Sign Board

11.5.4 Technical Transfer to the Community

The temporary works was installed by the community people under Local Contractor. After relocation program by the Municipality, some 100 families are remained in Critical Zone in El Divino Niño area. In 2nd Contract, some 40 persons from these families have been employed by the Contractor for complete the temporary works in the contracted period. The items of temporary works did not contain any engineering works which require technical experience however these employed people did not have any experience of engineering works.

In the beginning, the gabion body that is baggy at its face was often confirmed. From the investigation, this phenomenon was due to the stone pressure caused by the placing way of stone and form work. Therefore the Contractor and the Study Team carried out On the Job Training to the community people through the temporary works.

(1) Placing of the Cobble Stone in Gabion Net

The gabions in Colombia, two (2) sizes of stone are normally used. The large one is placed for face of gabion, and small one is for inside. If these stones are not good combination in the net, the face of gabion body is buggy due to horizontal pressure when form work is taken out. As the easy method to avoid this problem, the supervisor instructed the labor to fill small size stone in the aperture between the stones.

Figure 11- 24 Instruction by the Supervisor

(2) Form Work for the Gabion Net

As other cause that the gabion face is baggy, it was enumerated that the support capacity of form work is not sufficient in the installation of the stones. Consequently the supervisor shook the form work to confirm fixing condition. When the fixing conditions of form work is not sufficient, the supervisor

instructed labors the point to fix of form work.

	
Before Improvement (without Support)	After Improvement (with Support)

Figure 11- 25 Supporting of Form Work

11.5.5 Temporary works Information to Related Organizations

In order to introduce the temporary works as an example of the countermeasure for risk area, the Study Team invited related organizations such as CAR, INGEOMINAS, United Nation, OCHA and DIAKONIE to the site in the construction stage. And the relocation program by the Municipality and the details of temporary works were explained to the organizations.

11.6 Social and Environmental Consideration

11.6.1 General

During the discussion of JICA Preparatory Mission for this Study in September 2005, Soacha Municipality requested JICA to conduct some countermeasures for landslides in the Study Area. After the 1st phase of the Study in June 2006 started, the Study Team concluded that as it is described in 11.1 Background of this Chapter, during the discussion of the JICA Monitoring Mission on November 2006 in Bogota, the relocation of houses is the only way to assure the safety of residents and no other measures are impractical, and some measures have even the possibility to induce a further dangerous situation. The Soacha Municipality agreed this conclusion.

Apart from the conclusion, Soacha Municipality has been implementing the relocation program from the risk area. In El Divino Niño area, which is the most critical area in the Study Area, if the relocation from emergency zone is completed in the Study, implementation of temporary works whose objects were described in 11.3.1 of this Chapter was proposed by the Study Team. Due to extensive efforts of Soacha Municipality, the partial relocation from the Emergency Zone in El Divino Niño area was finished by the end of November 2007, the Study Team started the Package 9. The remaining relocation from the emergency Zone was completed by the end of January 2008, therefore the Study Team conducted the remaining packages and finished the temporary works in the Study period. In this context, the relocation is purely dedicated matter to Soacha Municipality and in other words, Soacha Municipality did not implement the relocation just because of the temporary works by JICA.

Temporary works were completed by the end of February 2008 during the Study period according to the original plan in terms of work volume.

11.6.2 Socio Economic Aspects

Table 11- 8 summarizes the existing socio economic aspects of El Divino Niño area by information from Soacha Municipality in few statistics about socio economy of El Divino Niño area. There are

2,353 total population and 576 families. An average family size is calculated in 4.1 persons per family.

Population density is calculated in 269 persons per hectare (gross). The density shows higher (1.25 times) than 215 persons per hectare (gross)[1], the average population density of Commune 6 including El Divino Niño area. The residential area looks layout but is densely built to the slopes. Most buildings are one or two story. Electricity and water are supplied by CODENSA and EAAB but there are no drainage/sewerage systems in the area.

Table 11- 8 Socio Economic Aspects of El Divino Niño area

	Item	Description
	Location	- 1.5 km in southwest from urban center - 400m from Autopista Sur
2.	Demography (Information from experimental survey 2003 DANE)	
2.1	Population	- Area below slope: 1,717 inhabitants, Area above slope: 636 inhabitants - Total: 2,353 inhabitants
2.2	Number of families	- Area below slope: 398 families, Area above slope: 178 families - Total: 576 families
2.3	Number of houses	- Area below slop: 399 houses, Area above slope: 182 houses - Total: 581 houses
2.4	Average family size	- 4.1 persons/family
2.5	Education levels (head of family)	- N.A.
3.	Economy	
3.1	Major occupations	- Area below slop: 254 studying inhabitants and 513 working inhabitants - Area above slope: 101 studying inhabitants and 212 working inhabitants
3.2	Average family income	- N.A.
4.	Infrastructure provided	
4.1	Water supply	- Supplied by EAAB (Aqueduct and Sewage Entity for Bogotá[2])
4.2	Power supply	- Supplied by CODENSA (Electricity Power Company[3])
4.3	Drainage/sewerage	- None
4.4	Solid waste disposal collection	- 2 days per week by a private company
5.	Social facilities provided	
5.1	Schools	- None
5.2	Religious facilities	- N.A.
5.3	Meeting halls	- None
6.	Land	
6.1	Area size	- 87,606 m^2 (Barrio area)
6.2	Land use	- Residential but not planned area
6.3	Land ownership	- Less than 50 families would have legal titles of land
7.	Social organizations/programs	
7.1	Neighborhood community association	- JAC (Junta de Acción Comunal – Groups for Community Actions)
7.2	Active organizations/programs (International org., NGOs)	- None

(Source: Soacha Municipality)

[1] 65,525 population, 305 hectare from the survey of DANE 2003
[2] Empresa de Acueducto y Alcantarillado de Bogotá
[3] Compañía de Energía SA

11.6.3 Procedure of Environmental Consideration

(1) Legal Framework

There are no laws or guidelines on EIA procedure in Colombia. The MAVDT (Ministry of Environment, House and Land Development) requires the Environmental Licenses or Permission as an alternative to EIA. The environmental license authorizes implementations of projects that utilize natural resources and can deteriorate natural/social environment. The guidelines of Environmental Licenses or Permission are stipulated in the decree 1220 April 21, 2005 based on the Law 99, 1993. The guidelines explain the project categories the license or permission is required and about environmental impact study to obtain the license or permission. However, the guidelines describe so generally and nationwide that it is very difficult to apply the guidelines to the urgent landslide countermeasure project (hereinafter the Project).

Cundinamarca CAR West Region Office (hereinafter called "CAR") has jurisdiction over Soacha Municipality on environmental issues. The CAR grants the environmental license or permission to projects in Soacha Municipality. The CAR established an office of Soacha (hereinafter called "CAR Soacha") in November 2006. Both CARs will be responsible to manage environmental issues of Soacha Municipality in coordination.

According to the CAR, the environmental license or permission is not necessary for the Temporary works of El Divino Niño area. As a reason of unnecessary, the CAR explains that the land category of El Divino Niño area is that the area does not include (or is outside of) the compatible area for mining activities with reference to the polygons defined in the Resolution 1197 from 2004 announced by Environmental and Territorial Housing Ministry. It would mean that the Temporary works does not intend to develop natural resources and the site is also located at area with little natural environment (resources).

(2) CAR Technical Suggestions for the Temporary Works

As the background of temporary works mentioned in the Chapter 11.1, the temporary works (construction of a protection wall) are proposed to reduce the damages to remaining houses by small-scale slope failure and rock falls after the houses are relocated from the critical zone.

After a meeting of the CAR Soacha, Soacha Municipality and Study Team, the CAR Soacha determined that the Environmental License is not required for the temporary works as explained in the letter below. The CAR Soacha gave Soacha Municipality and Study Team three technical suggestions to consider other measures to prevent and reduce the risk: to provide drain system for rain water; to plant between slope and the protection wall; and to remove rocks being about fall down.

Letter from the CAR Soacha

Ref: Notification No 887 of February 21st of 2007

Respectful Sir,

Based on the technical visit done together on February 26th, 2007 and the information supplied with this letter, the Corporation projected the following technical report, and the following aspects were determined:

- Given the hazard of blocks and rocks falling from the old slope quarry, the high vulnerability of the population settled in the top, body and base of this slope, it is established that part of population of the barrio El Divino Niño, is in high risk.
- The alternative proposed by JICA Study Team consisting of a series of civil works, is feasible and applicable, and it constitutes in a great measure the management and risk decreasing.
- Once done the evaluation of the works proposed by JICA Study Team and analyzed regarding to the Decree 1220 of April 21st of 2005(about environmental licenses), is established that these

works do not require the procedure of Environmental license. On the other hand, there are not trees species inside or around the slope to be managed , therefore, it won't be required the permission of forest use, also like this it won't be required the water awarding , or any other type of environmental permission , however the following recommendations should be taken on account:

- The construction material coming from quarries, such as stone, sand etc…should come from a legal source, it means a quarry with mine and environmental license,
- On the other hand, the debris material, originated mainly from demolitions, should be placed in a dump with valid environmental permissions.
- Based on the civil works proposed by –JICA Study Team- and the site visit, it is recommended to consider other measures for the prevention and risk decreasing, like:
- Determine the flow lines of runoff waters in the high part of slope or top, with the purpose of establishing the necessary works to intercept such waters and through works like pavement constructions, sewage systems and other hydraulic works, to capture or deviate the runoff waters to major works of rainfall waters network or sewages system of the barrio and in this way diminish the water filtration to the slope, that constitutes one of the actions that accelerates the blocks or rock falling.
- Regarding, the land area that will be between the slope and the retaining wall, it is recommended to take away all the debris material product of the affected houses demolition, for then, starting with the replanting and reforestation of it. It is recommended that trees to be planted have a height bigger than 1 meter and also to make the maintenance to guarantee their survival, with the purpose of avoiding invasion and settlement of new population.
- In the future to study the possibility of doing the moving away of blocks and rocks that represent an imminent fall down hazard, or looking for mechanism of engineering works as the fence and bolts of slope, to assure or confine the material that belongs to the free face of slope.

Considering the affectation risks to population, assets and belongings of the inhabitants of barrio Divino Niño, there was sent copy of conclusions and recommendations of technical report with the purpose that CLOPAD- (Local Committee for the Prevention and Disasters Attention) of Soacha Municipality coordinates the corresponding actions.

Yours sincerely,

MARIA CLAUDIA GONZALES CAYCEDO

Chief Municipality Office of Soacha

Note: A Spanish letter was translated in English.

11.6.4 Anticipated Environmental and Social Impacts and Monitoring Results

In the Progress Report 2, the following anticipated impacts were listed up. In fact, the temporary works were quite small scale civil works relying on manual works and during the implementation period in the fifth field work in Colombia, any negative impacts were recognized. The following is the anticipated impact and monitoring results during the Study period.

(1) Social Impacts

Job opportunities

The temporary works were conducted as the sub-contracting work in the Study. The Study Team specified in the technical specification for the contractor that at least 70 percent of the labor for the temporary works must be employed from El Divino Niño area. As a result, 40 people from El Divino Niño area participated into the work, which contributed to the local economy (Photo 11-1 and Photo 11-2).

Traffic disturbance

The temporary works are mainly the work that labor stack boulders and gravels on the leveled ground to make gabion wall and the usage of heavy machine was limited only to install sand mat behind the gabion wall and the excavation of drainage pit. Once the boulder and gravels were transported to the site, after that, the traffic of the vehicle for material transportation was few. Therefore any complains from people living near the site was not coming out.

Avoidance of troubles

All the residents to be relocated from the Emergency Zone in the course of the relocation program by Soacha Municipality were agreed with the relocation. That was the results of a series of workshops held by the Soacha Municipality and the Study Team during the Study Period, in which people understood the risk of rock falls, and was because the new houses which Soacha Municipality prepared were better than those in El Divino Niño area. Also the temporary works themselves were contributed to the local economy, any troubles related with residents were not recognized. This was because Soacha Municipality set up a special section for people's matter in the Municipality in advance and collaborated with community leaders in El Divino Niño area.

Landscape

According to POT, the area which is declared by Soacha Municipality as public use of land should be vegetated with tree or grass. Soacha Municipality, together with CAR, is planning to plant trees in the space between the slope and the temporary wall.

Photo 11-1 Local People Working Manually for Temporary Works

Photo 11-2 A lot of Local People working for Temporary Works

(2) Environmental Impacts

Vibration, Noise, Dust and offensive Odor

The temporary works are mainly the work that labor stack boulders and gravels on the leveled ground to make gabion wall and the usage of heavy machine was limited. Therefore vibration, noise, dust and odor were not recognized.

Waste

The materials for the temporary works were boulder / gravel , wire net for gabion, geotextile and concrete for drainage channel. Other than the boulder / gravel, only required amount was procured , so that surplus material as waste was not generated. Also the surplus boulder and gravel were used for the sand mat (cushion) between the slope and the temporary wall, the work did not produce any waste.

(3) Monitoring of Relocation Program by Soacha Municipality

The relocation conducted by Soacha Municipality was not because of the implementation of the temporary works in the Study period. Therefore the background and monitoring results of the relocation was attached as Annex of this Report.

11.6.5 Environmental and Social Impacts, Mitigation Measures and Recommendations for Future Implementation of Temporary Works

The temporary works implemented in the Study in El Divino Niño area has the objectives described in the section 1 in this Chapter. In Soacha Municipality, there are still a lot of people living in critical zones of landslides, and the basic policy of the mitigation measures of damage was recommended in the section 4 of Chapter 8. If Soacha Municipality studies the critical zones in other areas based on the recommendations in the Study in future by herself, the implementation of temporary works can be applied in order to conduct the necessary relocation smoothly.

Table11-9 is the summary of negative impacts, mitigation measures and recommendation for future implementation of temporary works prepared based on the results of the El Divino Niño area's temporary works in the Study.

Table 11-9 Environmental and Social Impacts, Mitigation Measures and Recommendations for Future Implementation of Temporary Works

Impact	Mitigation Measures	Recommendations for Future Implementation
Traffic Disturbance Traffic disturbance will be raised by incoming and outgoing of construction vehicles and equipment. Traffic congestion and traffic accidents are possible issues at narrow streets in the community.	In the construction plan in the future, the work should be done by labor basically and the usage of heavy machine should be minimized, for example, the frequency of material transportation by trucks into community area should be minimized. In the construction plan, installation of traffic signs at the entrance and exit gates of vehicles and heavy equipments, and providing of adequate parking lots, appointing of staff in charge of traffic control and giving of instructions the drivers should be included.	The control of frequency of transportation of construction material and truck is possible by reducing of daily work volume considering the longer construction period.
Avoidance of Troubles The relocated people could have complains on the conditions of new houses and relocation procedures and the neighborhood residents could have complains on the environmental deterioration.	Distribution of hazard map and holding of community workshop should be done in order to let people recognize the danger of rock falls and the necessity of temporary works. Also the consensus regarding the condition of relocation should be obtained among the people and Soacha Municipality. When setting up of the conditions of new houses, a lot should be applied to ensure the fairness as well as the conditions of large families and handicapped persons should be considered. Regarding the complaints of the neighborhood residents, selecting of man power works and implementing of the mitigation measures for Traffic Disturbance should be prioritized.	-ditto- For the area where rock falls and landslide disasters are anticipated in near future, the national declaration of disaster should be considered from the viewpoint of saving of life.
Landscape The temporary works could generate oppression to the residents and unpleasant landscape in communities.	The temporary works has a objective to let people the danger of rock falls and prevent the invading of new houses, the oppression to the residents can not be helped. Regarding the unpleasant landscape, based on POT of Soacha Municipality, the relocation area should be vegetated.	Based on the articles of POT, Soacha Municipality should coordinate with CAR to formulate a land use plan for each relocation area.
Vibration, Noise, Dust and offensive Odor Loading and unloading of materials, activities of vehicles and machineries could	In the construction plan in the future, the work should be done by labor basically and the usage of heavy machine should be minimized, for example, the frequency of material transportation by trucks into community area should be minimized. Regarding the noise and dust to be	The control of frequency of transportation of construction material and truck is possible by reducing of daily work volume considering the longer construction period. Also since the work volume is reduced, the size

generate vibration, noise disturbance spread of dust pollution and offensive odor from exhaust gas.	generated, in the construction plan, setting of screen between the construction site and residential area and spraying of water at the access road and loading/unloading sites.	of construction vehicle can be smaller.
Waste Solid waste and waste water could generate insect breeding, disease and offensive odor.	In the construction plan, the procurement of construction material should be necessity-basis in order not to generate waste materials. Also one kind of the construction materials, gravel, should be used as sand mat cushion between the slope and the temporary wall. In the temporary works, the usage of water is limited to the works of concrete for drainage channel in front of the gabion wall, and the quantity is so small that the problem of waste water can not be generated.	Prior to implementation of temporary works, anticipated waste material in the construction site should be investigated in advance and the corresponding disposal method should be decided with the related organizations such as CAR.

11.6.6 Monitoring Plan for Environmental and Social Impacts

Among the environmental and social impacts for the future implementation of temporary works, the "Traffic disturbance", "Vibration, Noise, Dust and offensive Odor", "Waste" can be regarded as the impacts to be considered in each temporary work implementation plan. Regarding the "Avoidance of troubles", as shown in the Table below, distribution of hazard map, people's understanding of danger of rock falls and landslide and importance of the temporary works through repeated community workshops and preparation of relocation manual based on the experiences in El Divino Niño area, and the confirmation of relocation process are quite important. These things are the responsibility of Soacha Municipality. Regarding the "Landscape", Soacha Municipality should continue to coordinate with CAR as well.

Table 11-10 Monitoring Plan for Environmental and Social Impacts on Implementation of Temporary Works

Impact	Monitoring Plan
Traffic disturbance, Vibration, Noise, Dust and offensive Odor, Waste	Soacha Municipality as implementing Body of temporary works, should consider the mitigation measures in the future construction planning, referring to results of temporary works in El Divino Niño area. During the construction period, Soacha Municipality as implementing body should monitor the impact on Traffic disturbance, Vibration, Noise, Dust and offensive Odor, Waste.
Avoidance of troubles	Soacha Municipality should monitor the following for each 6 months. ● Progress of distribution of hazard map in critical areas ● Progress of holding of community workshops ● Progress of Preparation of relocation manual based on the experiences in El Divino Niño area relocation, and the progress of relocation in the future temporary works area.
Landscape	Based on the articles of POT, Soacha Municipality should monitor the coordination with CAR to formulate a land use plan for each relocation area.

CHAPTER 12 RECOMMENDATIONS FOR SOACHA MUNICIPALITY

12.1 General

(1) Integration of Information

The existing and future information and data, for example, hydro-meteorological data, disaster records, social survey results as well as cadastral data of the Municipality, should be arranged in accordance with their intended uses (objectives, for example, setting of early warning criteria by accumulating rainfall and disaster records and confirmation of present conditions of communities).

(2) Capacity Development of Firefighter Station

The Firefighter Station of the Soacha Municipality is proposed as the monitoring center of the early warning system in the Municipality. As the present station has lack of human resources and operational capacity, the Municipality should consider further capacity development of the station. The office space of the present Fire Station should be extended urgently and the security for the installed monitoring equipment should be strengthened.

(3) Dissemination of monitored hydrological data

The data monitored at the Firefighter Station, Llano Grande Station, Ladrillera Santa Fe Station, Prison Station, Fusunga Station and San Jorge Station should be disseminated in the Soacha website periodically in order that ordinary people and other organizations can have access to them without any restriction.

(4) Cooperation with CREPAD

The pilot project activities done in the Study are very useful and should be extended to other municipalities which have similar landslide and flood problems in the Cundinamarca Government. Soacha Municipality should support other municipalities, in cooperation with CREPAD, regarding the preparedness for disaster prevention activities

12.2 Landslide

(1) Non-structural measures against Landslides

It is recommendable to relocate people from Critical Zones as a measure against disasters on the steep slopes in the abandoned quarries in Soacha Municipality to use the experiences in the relocation in El Divino Niño area to advantage. The houses close to the steep slopes in the abandoned quarries should be relocated to safe areas. But it could take a long time to relocate them from Critical Zones because there are many steep slopes in abandoned quarries and houses in Critical Zones. The following non-structural measures are recommended.

a) The people in Critical Zones should be relocated. Priority of relocation should be given to the people in the greatest danger in Critical Zones.

b) Until all the people in Critical Zones have been relocated, Soacha Municipality should take care of the safety of the people remaining in Critical Zones.

c) The people remaining in Critical Zones should be informed that they are in Critical Zones and always are at risk even in fine weather.

d) In heavy rain, Soacha Municipality should be on the alert for the people in Critical Zones

e) To obtain the basic information about alert level of rainfall, Soacha Municipality should collect rainfall data.

Process for Relocation

Relocation from all Critical Zones in Soacha Municipality is necessary to protect the people's lives and properties. As it could take a long time to complete the plan, relocation from more dangerous areas with the following steps is necessary.

a) Complete the program of relocation from Emergency Zone in El Divino Niño area

b) Set up Emergency Zones in La Capilla area.

c) Proceed with the program of relocation from Emergency Zones in La Capilla area following the process in El Divino Niño area.

d) Set up Critical Zones and Emergency Zones in El Arroyo (Villa Esperanza) which is surrounded by steep slopes also formed by mining activities.

e) Proceed with the program of relocation from Emergency Zone in El Arroyo (Villa Esperanza) following the process in El Divino Niño area.

f) Set up Critical Zones and Emergency Zones in other areas where steep slopes in abandoned quarries exist, and proceed with the program of relocation from Emergency Zones.

g) After completion the program of relocation from Emergency Zones, proceed with the program of relocation from Critical Zones in El Divino Niño area, and continue the relocation from Critical Zones in the same order as that from Emergency Zones.

Measures up to the Completion of the Relocation Program

In the process of the relocation program, it is important to protect the peoples who stay in Emergency Zone**s** and Critical Zones using Community Hazard Map until the relocation program has been completed.

(2) Monitoring of Landslides in Soacha

Precipitation monitoring and records of landslides which commenced in the pilot project of this study should be continued in order to collect and accumulate the basic information for the analysis of the relation between rainfall and occurrence of landslides and to study landslide disaster prevention measures. The results can be analyzed with the methods mentioned in Chapter 10. In order to improve the resolution of precipitation monitoring, installation of automatic-record-type rain gauges is recommended in Altos de Cazuca area once the precipitation data have been accumulated and analyzed. The number and locations of installation of the automatic rain gauges should be decided with the data accumulated.

(3) Other recommendations

The steep slope in the abandoned quarry site has unstable rocks of several meters in diameter, which could fall down toward the houses below the slope. On the backside of the slope, there is landslide area, therefore slope cutting cannot be conducted. As the existence of unstable rocks is an urgent issue, the Soacha Municipality has been conducting removal of large rocks by blasting above the houses as a temporary measure. There is a possibility that the remaining rocks fall down to the houses. It is also anticipated that, in the slope, next to the rock layer which was taken out, there are other unstable rocks. In this sense, a substantial countermeasure such as relocation is necessary and such program should be promoted. Soacha Municipality must implement actions to prevent construction and extension of residential houses in these areas according to Law 388 of 1997, Decree 564 de 2006 and POT of Soacha with the recommended steps mentioned in Section 14.2 (1).

12.3 Flood

The activities carried out in this Study, such as monitoring of rainfall, water level and riverbed

elevation, information transfer/evacuation drill, etc. should be continued with the Soacha Municipality's initiative. Soacha Municipality and the communities within it will take necessary actions and/or measures, if issues arise in the activities.

(1) Continuous Monitoring of Rainfall and Water level

Equipment installed in Fire Station, Llano Grande Station, Ladrillera Santa Fe Station, Prison Station, Fusunga Station and San Jorge Station, which will be the property of Soacha Municipality, should be maintained by each station with the support of Soacha Municipality.

Data recording sheets for each station, which have been provided by the Study Team, should be provided by the Soacha Municipality after the Study.

The data recording sheets of each station filled by the observers should be collected by the Fire Station once in two weeks. The data should be inputted into the Fire Department Database by the Fire Department.

The data stored in the database of Fire Station should be disseminated periodically so that the data should be shared by IDEAM, CAR and EAAB.

(2) Enhancement of People's Understanding of Monitoring Activities

The automatic stations (San Jorge Rainfall Station, Ladrillera Santa Fe Station and Fire Fighter Station) have data displays to indicate the currently monitored data. The actual data should be monitored through the data display of the data logger continuously.

The observer at Fusunga should visit the upstream station (San Jorge Rainfall Station) periodically in order to understand the hydrological response. Also the communities in Llano Grande should visit the upstream water level station (Ladrillera Santa Fe Station) periodically in order to monitor the warning criteria.

In Ladrillera Santa Fe, both a staff gauge and an automatic water level sensor were installed. The monitoring of the staff gauge and the data display should be done in parallel instead of relying solely on the automatic sensor's data.

(3) Training on Information Transfer and Evacuation

The Soacha Municipality should organize and conduct continuous training on information transfer and evacuation. In an early warning system, "information transfer" and "evacuation" are very important. Especially, information transfer, which means how to transfer the monitored data timely and accurately and how to make people understand their meaning correctly, is significant. Soacha Municipality has been doing the evacuation well, however it should organize training on such information transfer continuously.

(4) Dredging of the Soacha River and the Tibanica River

Management and maintenance of the Soacha River and the Tibanica River including dredging should be done by CAR, EAAB and Soacha Municipality. Regarding the dredging, it is important to consider the longitudinal balance of channel flow capacity. In the case of the Soacha River, at the moment, the downstream of the Autopista Sur should be dredged extensively since the flow capacity there is lower than the other reaches.

12.4 Community Disaster Prevention Activities

(1) Role of Soacha Municipality

In the course of a series of community workshops held in the Study, Soacha Municipality recognized

the importance of its role as facilitator between CLOPAD and communities. It means that Soacha Municipality should put an emphasize on creating a supportive, inclusive and safe working environment for disaster prevention, rather than setting top-down rules or limiting information sharing to a minimum. Soacha Municipality should confirm its role and maintain and develop the disaster prevention activities.

(2) Expansion to other communities

Through the repeated community workshops in the Study, interaction among the communities in the study area developed significantly and disaster-prevention-related-organizations made significant progress. The communities participated in the monitoring and disaster prevention activities, and the community leaders in particular, also became interested in the Soacha River itself and hydrological data, as well as gained some confidence in holding workshops by themselves. Soacha Municipality should expand the community disaster prevention activities in cooperation with the community leaders involved in the pilot project.

12.5 Temporary Works

The Study Team sincerely expresses full respect for the Soacha Municipality's efforts of relocating people from the landslide emergency zone.

Even though the temporary works have been completed, the Study Team does not guarantee the safety in the remaining critical zone in El Divino Niño area. Therefore, the Study Team recommended that the relocation program should be continued by the Soacha Municipality.

The temporary works were implemented in the Emergency Zone after the relocation program by the Municipality. In this situation, the following recommendations are given.

(1) Manual for the Relocation Program

Until this relocation program, the Municipality had not had any experiences of the relocation of people from hazardous areas and the relocation in El Divino Niño area is defined as the first such experience for the Municipality. The processes and methods in the municipal relocation program; for example 1) informing the community of the risk in the hazardous area through seminars, 2) examination of the legal process, 3) solutions of problems at new settlement areas, etc., were legally implemented. The results of the relocation works which the Municipality has examined and decided are very useful for other dangerous areas of the Municipality. A relocation manual which includes the experience and results of the relocation activities up to now is required in order to facilitate their application to other relocation programs.

(2) Countermeasures including Temporary Works

In the period of this Study, several countermeasures were executed by the Municipality in response to disasters. The countermeasures for the disasters require suitable and adequate execution in a short time. In order to respond promptly to disasters, it is recommended that a unified management system which is based on the measures so far executed by the Municipality is prepared.