Report of World Bank Mission to the Dominican Republic

by

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Institutional Strengthen Component:

The country of the Dominican Republic was severely impacted by the direct hit of Hurricane Georges. This natural event led to a significant disaster that has greatly affected the entire country, including destroying all meteorological sensors and equipment as well as most of the hydrological sensors and equipment. The damages to the infrastructure, agriculture, forests and many others sources of income establish a precedence. The significant amount of deaths (269) mainly due to floods, drew the attention of the government and that of the international Community

The government of the Dominican Republic requested financial assistance from World Bank in order to restore the economy and bring back essential services to the population. The World Bank put together a mission to the country to make a general assessment and coordinate with the government the establishment of priorities as they deemed necessary. In coordination with the Government of the Republic it was decided that the institutional strengthening of the Meteorological and Hydrological Services as well as from the Office of the Civil Defense needed high attention. In addition it was considered as high priority the implementation of measures for disaster prevention, mitigation, and preparedness. The communication and coordination of all these efforts, including those dealing with the information to the public and their responses were also included in the action item list to received financial assistance.

The framework for institutional strengthening in response to disaster is the so called concept of Integrated Warning System. This concept is widely used in the USA and is based on three basic components: Detection and assessment of the event; Communication to emergency managers and response; Warning dissemination and response. The first component is basically carried out by the NMSO, its Hydrologic support by the INDRHI and in case of Tropical Cyclone the support of the US National Weather Service thru its TPC/National Hurricane Center. The second component is carried out by the OCD and the Comite Nacional de Emergencia (CNE) and the third component is carried by all government institutions including the NMSO, OCD, CNE, ETC. In order for the public to respond properly efforts must be made well ahead of time in educational campaigns on disaster preparedness, prevention and mitigation. There are various projects addressing this subject within the reach of the Dominican Republic government.

The Dominican Republic National Meteorological Service Office (NMSO) provides weather forecasts and warnings for the whole country. St. Kitts and Nevis. The NMSO is also responsible for collecting hourly and synoptic weather observations at the Santo Domingo Airport and 5 other regional airport and for the issuance or Terminal Aerodrome Forecasts (TAFS) for these Airport. The office also collect data from and issue forecast for the Agricultural Sector and the marine community. There are several networks of data acquisition; a Climatological Network (30 stations), a Synoptic Network (7 stations) and Agricultural Network (5 stations), Aeronautical Network (5 Stations) and a Hydrological Network (30 Stations). Except for the Hydrological network all are managed by the NMSO. These observations are critical information for the weather forecast and warnings process but particularly the hourly and synoptic observations from the Aeronautical Network which are used for aircraft traffic approaching and departing the airports.

The NMSO is also responsible for disseminating forecasts and warnings to alert appropriate government authorities, the media and the public of adverse weather conditions to provide for the protection of life and property. The ability to collect weather observational data and disseminate warnings on a continual and timely basis will provide inhabitants with lead time to take measures to significantly reduce the loss of life and minimize property damages.

A Strengthen Early Detection, Warning and Response Systems

One of the project sub-component is to establish an effective early warning system to alert appropriate government authorities and the public of adverse weather conditions to provide for the protection of life and property. Strengthening the existing early detection and warning capabilities of the National Meteorological Service Office (NMSO) will assist Dominican Republic in mitigating effects of extreme natural weather events such as hurricanes, tropical storms, thunderstorms and floods. The establishment of automated sensors of meteorological and hydrological data such as rainfall and river levels both by satellite and radio wave transmission is the basis for the real time assessment of potential life threatening conditions. A well-defined hydrometeorological information infrastructure offering an effective means of distributing forecasts and warnings to appropriate government authorities and other Disaster Coordination Office and the public will provide government and inhabitants with lead time to take measures to significantly reduce the loss of life and property damages. The ability of the government to respond to any emergency or disaster will depend on coordinated efforts made by the Office of the Civil Defense well ahead of time and the educational and preparedness programs carried out to reach the community in order for them to respond properly.

a. Strengthen the National Meteorological Service Office ($300K)

This sub-component can finance: (i) enhancement of the present satellite receiving station, (ii) computers with high-speed modems and printers, (iii) INTERNET connectivity, (iv) dedicated phone lines including "Hot line", (v) establishment of physical equipment and methodology for communicating the information to government and public, (vi) purchase of Commercial Hurricane Tracking software such as Hurrtrack (3 licenses), Automated Weather Stations (7 stations) and (vii) training associated with new equipment

Background:

An enhanced satellite receiving station to acquire and process meteorological data from the National Oceanic and Atmospheric Administration's (NOAA) geostationary weather satellite (GOES) covering the Caribbean Region with a high resolution imaging system would supply weather information on early storm warnings, hurricane tracking, and severe storms. This information can be supplemented with radar images and data from hydrometeorological and Aeronautical networks. Therefore, access to high-resolution satellite imagery in real-time becomes critical for early detection of storm systems that might affect the country.

Pentium computers (450 MHz and 56k modem) and Internet connectivity will create a fundamental basis for the exchange, sharing, acquisition and dissemination of critical meteorological and hydrological data and products. This ability will provide access to a larger data set from regional and international centers. In addition these computers will allow the handling and process of the data by the meteorologist in the office in order to automatized the forecast and warning process. Some of the computers will be utilized to monitor and retrieve weather data from the seven (7) aeronautical stations. Others will be used for the inter-exchange of Meteorological and Hydrological data among government agencies.

The use of a hurricane tracking program such as Hurrtrack will allow the office in the decision making process not only for them but also fro the media, government and the public. This software is commercially available and is widely used in the USA. It works with both, on line via Modem or thru INTERNET connection.

Recommendations:

- Purchase of a workstation or terminal to receive satellite imagery faster and with higher resolution (5K)

- Purchase of 7 PCs for the collection, dissemination and retrieval of the aviation observations in real time. There are 7 aeronautical stations in the main airports that does not comply with the regulations of minimal equipment and technical personnel. (30k)

- Purchase of 3 PCs for a local area network and for the use of specialized programs such as PC-GRIDDS allowing the STAR FOUR PC as a stand alone workstation to received the WAFS broadcast only. This will diminish the probability of failure of the WMO/ICAO sponsored STAR FOUR system.

In addition, this lan will allow the automatization of the data handling process. In addition three printers of high quality (Laser) (12K)

- Purchase of one PC to serve as the INTERNET Server and a dedicated phone line. The quotation for a dedicated phone line of at least 56 Kps is around $400 for installation and $800 monthly charges ..WARNING...this is recurrent cost which we will be able to finance just the first year with the commitment of the DR government to finance the later years.

- Purchase of seven automated weather stations for the Airports. (70K).

- Purchase of seven PCs and software, one for each program (Climatology, Agrometeorology, Synoptic meteorology, Tropical Meteorology, Hydrometeorology, Aeronautical, and one for the Director of the NMSO). If the proposal of the Meteorological Institute then these can be re-arranged and the resources be revisited. (25K)

- Purchase of three licenses of the hurricane tracking program, Hurrtrack. This program is used online or thru internet to update hurricane data directly from the US National Hurricane Center. (5K)

- Training (40K)

    - UNIX training for the use of STAR FOUR, Satellite and Radar.
    - Training on the use, manipulation, interpretation and dissemination of the Meteorological information for the Media, Emergency Managers, and government officials, particularly Civil Defense and members of the CNE (Seminar and courses given by the TPC/NHC and FEMA, attendance and participation in national hurricane conferences, familiarization trips of government officials to other countries, etc.)

PC should be at least 450 MHz with 56k modem, with appropriate software. Some of them can be laptop.

Three of the computers need printers associated with their installation Some of these computers need Internet access. Additional phone lines are recommended for the National Meteorological Service. One phone line should be dedicated to Internet access. Another line should be dedicated to a voice mail system providing up-to-date forecasts and warnings, since and an impending storm often overloads the current system. Another line needs to be dedicated solely to coordination among the Government agencies. Another line should be a "Hot line or Ring Down" between the NMSO and OCD. This will allow the NMS to continue with their mission of forecasting the weather and warning the government and public on adverse weather conditions. At the same time will allow rapid dissemination and close coordination with the OCD of the critical weather conditions and warnings.

b. Development of a Dominican Republic Ham Weather Radio Observation Network (100K)

This sub-component can finance (i) weather stations integrated with a modem and an Automatic Weather Packet Reporting System, (ii) antennas (iii) generators, (iv) spare parts and maintenance, and (v) training associated with development of the Ham Weather Radio Observation Network.

Background:

This network will not only provide the National Meteorological Office with a greater aerial view of weather conditions, but serve as a communication pathway for disseminating information about storms to help save lives and reduce property loss. Providing ham radio operators, law enforcement or fire department officials with reliable instruments capable of measuring weather conditions automatically increases the chance of obtaining critical information before, during and after a hurricane since they are already likely to represent the only operable communication pathway to and from a hurricane devastated area. Development of a network of 5-10 ham weather radio operators will provide critical auxiliary weather observations, such as wind, gusts, barometric pressure and rainfall to the National Meteorological Services and the U.S National Hurricane Center in Miami. In the context of hurricanes, observations on lower atmosphere variable are critical for better understanding of the tropical cyclone structure and intensity. If ham weather stations are equipped with a solar panel they will have approximately three days of backup power for collecting and disseminating observations if commercial power is lost.

c. **Development of a Local Flood Alert Warning System ($275K)**

This sub-component can finance establishment of a flood warning data collection system that would encompass six basic components: (i) sensors that detect the weather event; could be a rainfall gage, river gage, temperature, wind, relative humidity, barometric pressure or a combination of them, (ii) a transmitter that encodes and transmits the data from the gage to a repeater or directly to a base station, (iii) a repeater that receives and transmits the signal to the receiving base station, (iv) a base station, which includes a receiving antenna, a receiver that receives the information at the base station, a decoder that decodes the information and a computer with appropriate software that stores the information and presents it to the user in different formats; such as: tables, graphics and maps, (v) hiring of specialized consultant(s) that will advise on: an effective flood warning system, provide automated flood warning data collection system standards, site selection of necessary equipment, equipment operation and maintenance, and equipment installation, and (vi) appropriate training related to the operation of the local flood alert warning system.

Background:

A flood is a natural hazard that can occur at any time and in any location. The frequency and magnitude of flooding can vary from minor flooding, causing only an inconvenience, to major flooding, resulting in loss of life and extensive property damage. Since the occurrences of flash flooding can not be avoided, they are persistent in the Tropics, and the potential for losses are significant, government officials can establish a local flood warning and response system to mitigate such flood losses.

The Dominican Republic's topography and relatively large territorial extension combined with the variation in climate and rainfall intensity patterns make it very subjected to flash floods. In order to warn the population with sufficient time, the Meteorological Services need rainfall and river data in real time. The implementation of a rainfall/river network system called "ALERT" (Automated Local Evaluation in Real-Time) is one of the local flood warning systems (LFWS) that is defined as a community based system to provide government officials with information in advance that can be translated into a response. An emergency action plan is an integral part of establishing a LFWS, since the best forecast is of little value if people do not take appropriate action. ALERT will make available to government officials the information required to evaluate the immediate flood potential from rainfall which has already occurred and will assist in evaluating the risk to the local area from additional rain in the next few hours. This will give a maximum effective flood warning lead-time, allowing local officials to make decisions on flood response and emergency planning. The ALERT System is not designed to prevent flooding, but to provide lead-time to local officials during impending floods

Data collection and monitoring are necessary to provide communities and citizens with better forecasts and warnings. The NMSO is the agency responsible for weather and flood forecasts and warnings for the Dominican Republic In order for the NMSO to provide timely and reliable flood forecasts and warnings, they need access to rain gauges and strearm flow information in real-time This data is critical to collect and monitor in the preparation of issuing warnings to alert communities of possible evacuation and to prompt property protection measures. Currently, the NMSO has several networks (Climate, Agrometeorology, Synoptic, and Aeronautical) but none of them report on real time. In addition most of these sensors were destroyed of damaged by Hurricane Georges. The restoration of these networks is addressed in sub-component D where the automatization of them is recommended.

There are other agencies and organizations with invested interest in Meteorological and Hydrological data. The CDE and OCD to mention two, for instance, need the data for their operations. It is important that these other users hive access to the real time data Five base stations are allocated in this project. One each for NMSO, OCD, INDRHI, SDE, and the Water Management Agency.

d. **Restoration of NMSO Data Acquisition Networks. ($250K)**

This sub-component can finance: (i) Instrumentations (Thermometers, Rain Gauges, Psychrometers, Thermographs, Barometers, and Aneroids, and other weather instruments), (ii) Spare parts, (iii) Automatic Weather Stations with data logger and long-line dissemination capabilities, and (iv) training.

Background:

Hurricane Georges destroyed or damaged all field sensors that were serving to collect data for Climate, Agrometeorology, Aeronautical and Synoptic assessment. This is the base data utilized to forecasting the weather and provide warnings. The data is also used for specialized forecasts such as for crops/agriculture use which is part of the sustainable development of the country. The Country Aeronautical Program and airports operations depends on the hourly and synoptic observations obtained thru these networks. In addition some of these stations are part of the World Observing Program and World Weather Watch program under the United Nations Program. It is critical the NMSO restore these networks and have access to the data. It is also recommended that some of the actual stations be replaced with fully automatic stations so they can report in real time. This can be accomplished by combining resources from/with other sub-components.

e. Telemetric Network for the INDRHI. ($1.5M)

This sub-component can finance: (i) instrumentation, (ii) Hardware and Software, (iii) Ground Station, (iv) Installation costs, (v) Technical advise/assessment from the contractor and the US Geological Survey, (vi) Spare parts and maintenance for the first year of operations.

Background:

The Instituto Nacional de Recursos Hydraulicos (INDRHI) is government agency for the hydrological assessment and water management of the Country. The Office of hydrology of the INDRHI developed a proposal to re-establish and expand a telemetric rainfall/river Network based on satellite transmission and reception using the Data Collection Platform (DCP) units. The proposal was submitted to the Inter-amerian Development Bank for Financial assistance. It has not been approved yet. Pending the allocation of funds from the IDB, the Work Bank would be in a position to provide assistance in financing or Co-financing the INDRHI proposal for the establishment of the Telemetric Network.

The INDRHI proposal for the Telemetric Network need some adjustments. It is recommended that its implementation be broken down into two phases. The first phase would be to establish 50 stations in the four main basins of the Country. This would include the Ground Receiving Stations with backup power and Uninterrupted Power Supply (UPS), etc. Total cost should exceeds the ($1M). A second phase would be for the expansion of the network to other basins $300K is allocated for this purpose.

The US Geological Survey (USGS), Caribbean Region, in Puerto Rico has extensive experience with this type of network. In addition, they can provide training and technical assistance in the site selection, installation, operation and management of the network The assistance can be either in Spanish or English. It is recommended the USGS be contracted to facilitate the implementation of this network. 200K is allocated for this purpose.

The INDRHI has the technical expertise and resources for the management and administration of this Network. The INDRHI also as the Hydrological advisor to the Met Services. Therefore this INDRHI Network can be supplemented or complemented with the ALERT network, sub-component C. It could also be complemented or supplemented by the proposed Automated Stations, sub-component A. It is recommended that all rainfall/river data acquisition networks be managed by the INDRHI to better utilized resources.

critical that the NMSO has access to real time data in order to respond the some of the appropriate rain gauges in real-time. There needs to be coordination between the National Meteorological Service and the Ministry of Agriculture to ensure that both organizations are able to access the data to meet their specific missions.

f. Strengthening of the Office of the Civil Defense. ($1.3 M)

This sub-component can finance: (i) establishment of new structure to house the OCD, with an Emergency Operation center fully equiped, (ii) Communication Equipment (VHF radio communications, Telephones, hot lines, satellite data receiving stations, Trunking Systems, etc.), (iii) Establishment of a National Emergency Alert System, (iv) Technical Assistance, (v) Development of a National Response Plan, and (vi) Training and professional development.

Background:

The Office of the Civil Defense created by Article 1 of the law #257 of June 17, 1966, establishes the responsibility of the Office as to assure the adequacy of preparedness to face and response to the natural disasters such as Floods, earthquakes, tropical storms, hurricanes, fire, and other natural or technological hazards to preserve the economy, public safety, and life and property. It is responsible for coordinating the functions of other government agencies and private organizations to implement effective preparedness actions tin case of disasters. To date the OCD lacks: facilities for the establishment of an Emergency Operations Center, Communications Systems, A National Response Plan, Equipment to respond to emergencies, Professional Development Programs, Educational Programs for the community, Emergency Alert Systems, etc.

In order for the OCD to accomplish its mission a well define plan for institutional strengthening need to be put forward and implemented by the DR government.

It is the intent of this Financial assistance to renovate and modernize the OCD. There are additional needs in the OCD such as Vehicle, specialized and equipped trucks, ambulances, fire trucks, and helicopters, etc., that thus assistance is not considering since it should be provided by the DR Government.

g. Technical Assistance and Training (500K)

This sub-component can finance: (i) training courses, symposiums and workshops associated with agrometeorology, climatology, media training, equipment maintenance (repair and preventative, satellite interpretation, hydrology and specialized meteorology for personnel involved with hydrologic and meteorology operations, (ii) technical assistance related to meteorological equipment operations and maintenance, (iii) training courses, conferences, seminars, familiarization trips in and related to disaster preparedness for meteorologist, hydrologist and personnel from the Civil Defense. Technical assistance from the USA and Puerto Rico Governments and others.

Background:

With the recent advances in science and technology in meteorology and hydrology, effective and efficient up-to-date training of staff in operational meteorology and hydrology is critical to maximize the information from new technology and to minimize error of misinterpretation of observational data. The Regional Specialized Meteorological Center (TPC/NHC) along with the Federal Emergency Management Agency of the US short seminars and workshops that can be fully utilized. The Government of Puerto Rico host an annual hurricane conference where the NWS is the main contributor

The Federal Offices in Puerto Rico such as NOAA/NWS, FEMA, UGSG, as well as Puerto Rico Agencies such as Civil Defense, can be resources that the Dominican Republic government can take advantage. Puerto Rico and the Dominican Republic share a fair amount of similarities: cClimate, Natural Hazards, Topography, Geography, Culture and Language

The following component has not been addressed in detail. The projects presented are a must if we want to focus the efforts on Prevention, Preparedness and Mitigation...

h. Disaster Prevention and Mitigation...($1.9M) ...

This sub-component can finance: (i) Various Projects and Plans related to Disaster Prevention and Mitigation put forward by government agencies and Organizations, (ii) Various studies needed for the community preparedness, and mitigation of floods due to Dam Breaks, Intense rainfall, Meteorological events such as Tropical Cyclones, Troughs, Cold Fronts, etc. and oceanic events such as Tsunamis.

Comite Dominicano de Mitigacion /OFDA/OEA
There is a proposal for a three year project that cost approximately $700K
Recommendation. **.$300K**

Informe del PNUD/SEOPC/CNE sobre Fortalecimiento de la capacidad Nacional para prevenir, mitigar y atender desastres de origen natural y technologico, Septiembre 1998. Cost would vary but as we should finance a pilot proyect with a cost of approximately **$300K.**

Informe/Propuesta de las Fuerzas Armadas (Gen. Los Santos) para prevencion y mitigacion de desastres. The Armed Forces has a proposal similar to the above but is an initiative from the DR government that amount around $1M. This need to be considered and a pilot proyect be financed. I recommend allocating **($500K)**

Flood Frequency analyses **(200K)**
US National Weather Service/FEMA

Flood Inundations Studies, Riverine and Costal **(250K)**
USGS

Application of the "Dam Break" model and development of inundation zone maps **($250K)**
University of Puerto Rico

Improvement of the Seismic Network **(100K)**

Total cost of sub-component equals US $6.125 Millions