Project Completion Report

PCR

Project Name: National Program of Flood Early Warning

Country: Haiti

Sector/Subsector: Environment, Rural Development and Disaster Risk Management

Original Project Team: Caroline Clarke (RE2/EN2); other members: Denis Corrales (COF/CHA), Juan Carlos Páez (COF/CDR), Ana Maria Linares (RE2/EN2), Javier Jiménez, (LEG/OPR2), Ophélie Chevalier (consultant) and Eliana Smith (RE2/EN2).

Project Number: HA-L1005

Loan Number (s), TC(s): National Program of Flood Early Warning (1642/SF-HA, 2389/GR-HA)
Technical Assistance for the National Program of Flood Early Warning (ATN/MD-11565-HA)

QRR Date: June 11, 2013

Final Approval Date of PCR: June 18, 2013

PCR Team: Principal Author and Members: Bruno Jacquet (RND/CHA); Hori Tsuneki (INE/RND); Emilie Chapuis and Marise Etienne (PDP/CHA); Jean Eddy Amajuste (CDH/CHA); Lisa Restrepo (INE/RND); Taos Aliouat (LEG/SGO)

Acronyms and Abbreviations

BID	Banque Interaméricaine de Développement Inter-American Development Bank
CCPC	Comité Communal de Protection Civile Civil Protection Municipal Committee
CIAT	Commission Interministérielle pour l'Aménagement du Territoire Inter-ministerial Commission for Land Use
CNIGS	Centre National d'Information Géo-Spatiale National Geospatial Information Center
CNM	Centre National de Météorologie National Meteorological Center
COUN	Centre d'Opérations d'Urgence National National Emergency Operations Center
CRH	Croix Rouge Haïtienne Haitian Red Cross
DPC	Direction de la Protection Civile Civil Protection Directorate
EWS	Early Warning System
GRD	Gestion de risque et des désastres Disaster Risk Management
MARNDR	Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural Ministry of Agriculture, Natural Resources and Rural Development
MDE	Ministère de l'Environnement Ministry of Environment
MICT	Ministère de l'Intérieur et des Collectivités Territoriales Ministry of Interior and Territorial Collectivities
ONEV	Observatoire National de l'Environnement et de la Vulnérabilité National Environment and Vulnerability Observatory
PNAP	Programme National d'Alerte Précoce National Early Warning Program
SNRE	Service National de Ressources en Eau National Water Resources Service

Table of Contents

Annexes

I. Basic Information

BASIC DATA (AMOUNTS IN US$)

PROJECT NO: HA-L1005

TITLE: National Program of Flood Early Warning.

Borrower: Government of Haiti
Executing Agency (EA): MARNDR

Loan(s): 1642/SF-HA
2389/GR-HA
Sector: Environment, Rural Development and Disaster Risk Management

Lending Instrument: INV- Investment

Poverty Targeted Investment (PTI): Yes

Social Equity (SEQ): Yes
Environmental Classification: C

Date of Board Approval: July 20, 2005
Date of Loan Contract Effectiveness: July 28, 2005

Date of Eligibility for First Disbursement: September 30, 2005

Months in Execution

*** from Approval:** 89
*** from Contract Effectiveness:** 89

Disbursement Periods

Original Date of Final Disbursement: December 31, 2012
Current Date of Final Disbursement: December 14, 2012
Cumulative Extension (Months): 41
Special Extensions (Months):

Loan Amount(s)
*** Original Amount:** US$5.000.000
*** Current Amount:** US$5.000.000
*** Pari Passu (if applicable):** 99.00

Disbursements

*** Amount to date:** US$ 4.534.522 **(%):** 90.6%

Total Project Cost (Original Estimate): US$5.000.000

Redirectioning
Has this Project?
Received funds from another Project [ ]
Sent funds to another Project [ ]
N/A [X]

To/From Project Number	From Sub-Loan Number	Amount

*** Current amount (adjusted for redirectioning):**

On Alert Status
Is project currently designated "on alert" by PAIS: No
If yes then why is the project on alert (DO , IP Ratings and/or relevant PAIS indicators):

Comments on relevance of "on alert" status for this project (if applicable):

Summary Performance Classifications				
DO	[ ] Highly Probable (HP)	[X] Probable (P)	[ ] Low Probability (LP)	[ ] Improbable (I)
IP	[ ] Highly Satisfactory (HS)	[X] Satisfactory (S)	[ ] Unsatisfactory (US)	[ ] Very Unsatisfactory (VU)
SU	[ ] Highly Probable (HP)	[X] Probable (P)	[ ] Low Probability (LP)	[ ] Improbable (I)

II. The Project

a. Project Context

Haiti faces a multitude of conditions that make it highly vulnerable to disaster: highly degraded environment, high poverty levels and public and private infrastructure generally weak and inadequately built and located in relation with land use conditions. Disaster risk in Haiti is a process of both social and economic construction, sharpened by the previously mentioned vulnerability conditions.

Haiti is the poorest country in Latin America and the Caribbean, with almost 60% of its population living below the poverty line. Nearly 70% of Haitians depend on agriculture, mainly subsistence farming. This sector employs 25% of the labor force, with a consequent expansion of the informal sector. Poverty in Haiti is a major source of vulnerability to disaster.

With a history of thousands of small and medium disasters, the flooding in Gonaives in 2004, which caused more than 3,000 deaths, clearly revealed the increasing pace of country's vulnerability as well as the lack of resources available to warn population. This disaster raised awareness within authorities about the urgent need to have real-time information to alert population about imminent risks, thus preparing for eventual disasters in a proactive manner, save lives and assets as well as develop risk reduction capacity in the medium term.

The Haitian Government and IDB recognized these needs and initiated negotiation to support the financing of the "National Early Warning Program for Floods and Cyclones" (PNAP in French). The program was launched and implemented between 2006 and 2012 by the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR), in partnership with the Ministry of the Interior and Territorial Collectivities (MICT), and with support from the Bank through operations 2389/GR-HA and ATN/MD-11565-HA.

The implementation of PNAP took place in a context of political instability (2007 and 2010 country's presidential elections) and weak institutional capacity that affected the operation. One of the most critical factors was the weak capacity of the National Water Resources Service, a key technical institution, which implied changes in the process of coordination and implementation.

Haiti's instability has been exacerbated by the major impact of the January 12, 2010 earthquake, which resulted in more than 200,000 deaths. It also paradoxically contributed to both weakening the key entities and reinvigorating the process of risk management in the country. Despite this unstable and vulnerable context, the program has been adapted and a significant share of expected results has been achieved.

b. Project Description

i. Development Objective

The objective of the Program was to provide the country with the capacity to identify and better prepare for flood risk, with special emphasis on reducing the loss of lives.
The program has been implemented at national, municipality and community levels. The early-warning system has been installed in the 32 following municipalities: Anse à Veau, Arcahaie, Arniquet, Baradères, Bassin Bleu, Cabaret, Camp Perrin, Carrefour, Cavaillon, Cayes, Chambellan, Chansolme, Chantal, Cité Soleil, Croix des Bouquets, Grande Saline, Gros Morne, Jacmel, Jérémie, Lasile, Léogane, Maniche, Moron, Petit Goâve, Pilate, Port de Paix, Port-au-Prince, Saint Marc, Tabarre, Torbeck, Verrettes.

ii. Components

The program was divided into five components:

1. Monitoring and flood forecasting
This component aimed at developing a monitoring and forecasting system to alert people living in flood risk areas.

2. Communication
This component aimed at bringing timely communications of flood warnings to communities to allow them to take immediate actions to reduce loss of life.

3. Community preparedness and response to early warning
This component aimed at providing technical assistance for local civil protection committees and authorities to equip the population to respond in case of a warning, by developing an adequate level of preparedness and response in case of emergency. It was responsible to implement communal warning, evacuation plans and simulations.

4. Institutional strengthening for the operation of the early warning system
This component was responsible to train and build capacity of key institutions such as the National Risk and Disaster Management System, the Permanent Secretariat of Risk and Disaster Management (SPGRD), the Directorate of Civil Protection (DPC), the Ministry of Agriculture, as well as de-concentrated and decentralized structures (Departmental and Communal Civil Protection Committees).

5. Public Awareness and Education Campaign
This last component focused on developing a national awareness and education campaign aimed at improving population's response to flood warnings and alerts. It included the development of public information on risk and communication materials, as well as their dissemination nationally in the high risk areas, through press and media.

c. Quality -At- Entry Review (if applicable)

Quality -At- Entry Review			
[ ] Highly Satisfactory (HS) - 1	[ ] Fully Satisfactory (S) - 2	[ ] Less than Satisfactory (LS) - 3	[ ] Unsatisfactory (U) - 4

III. Results

a. Outcomes

ACHIEVEMENT OF DEVELOPMENT OBJECTIVES (DO)	
Development Objective(s) The main objective of the PNAP was to provide the country with the capacity to identify and better prepare for flood risk, with special emphasis on reducing the loss of lives.	**Key Outcome Indicators** 1. Loss of human lives reduced by 75% Given that there was no baseline and practical means of verification, there is no quantitative measure to verify the indicator. Nevertheless, there is clear evidence of the frequent use of PNAP to warn the population by activating the evacuation alarms (during Isaac and Sandy tropical storm in 2012). 2. % of the system (EWS) installed 100% of the surveillance was installed in 100% of expected watersheds.

1. *Classification: P*

Planned Outcomes	**Outcomes Achieved**
Baseline End of Project 1.1B_N/A 1.1E A flood risk warning mechanism is operational in 35 municipalities of 13 vulnerable watersheds. 1.2B_N/A 1.2E Population of targeted vulnerable areas able to respond to alerts	1.1 A warning mechanism installed and operational in 31 municipalities of 13 watersheds. 1.2 All targeted municipalities have surveillance equipment and evacuation maps

Reformulation.

[X] N/A

PPMR Retrofitting. Indicate if and when the PPMR was retrofitted and explain any changes resulting from this exercise.

[X] N/A

Summary Development Objective(s) Classification (DO):

[ ] Highly Probable (HP) [X] Probable (P) [ ] Low Probability (LP) [ ] Improbable (I)

The National Risk and Disaster Management System now possess a new capacity to monitor the behavior of local hydro-meteorological processes, alert people at risk and act in an organized manner at central level and community levels. This warning system fills a gap in technical, scientific and operational information, necessary for better flood risk management.

The system has been used several times to launch alerts about large-scale events, such as hurricanes as well as more localized phenomena. The program has also developed local capacity to use alarm sirens without depending on the central institutions. Many communities have already had the opportunity to launch preventive alerts.

Through these efforts, the PNAP has contributed to strengthen the national system capacities in all scales. Although there is no quantitative data, it is recognized that thanks to the provision of in-time warnings the Program has significantly reduced fatalities.

National institutions and other entities in risk management have been trained in the use of the early warning system (EWS). Such training increases the likelihood of sustainability in this investment. A demand for information and technology has also been created among national institutions, humanitarian assistance entities and international cooperation in general, which brings significant opportunities for adoption and absorption of the system.

However, the serious problem of institutional handover to national entities is still pending and strengthens the sustainability and operations of the EWS.

Country Strategies

The program was aligned with the three country strategies which covered the execution period (Interim Strategy 2005-2006, 2007-2011 and 2011-2015 strategies) given that reducing natural disasters impacts and environment degradation remained a top priority for investments agreed between the Haitian Government and the Bank. The program was also part of the efforts to strengthen the capacity of national and local institutions. The implementation of the Flood Early Warning System (EWS) brought direct and indirect contributions to reduce disaster impacts, including:

Objective of the country strategies: Reduce natural disasters impacts and environmental degradation

- Strengthening capacities of the most vulnerable municipalities involves direct reduction of loss of life and impact of disasters at national, regional, municipal and local scales.
- The creation of a hydro-meteorological monitoring network and a competence of collecting and processing statistical data directly contribute to better risk, environment and territorial management.

Objective of the country strategies: Support the revitalization of agriculture.

- The creation of a good quality hydro-meteorological database and the capacity for climate analysis could contribute to reduce vulnerability of agricultural production, since the system enhances the availability of information for seasonal planning and early warning.

Objective of the country strategies: Support the development of institutional capacity towards a reform of the Public Administration.

- The program has directly strengthened institutional capacities, including technical training to use the system.

b. Externalities

The PNAP has been implemented in a very complex environment. In the first phase, the political crisis and its impact on the partner institutions caused that the problematic of risk and the necessary investments for its management received very little attention. A second phase was then characterized by a strong presence of international entities with technical and financial resources for risk management, motivated by the growing impacts of disaster. This changing environment for the Program and the progressive achievement of results generated a series of externalities. The most notable are:

- The EWS design, particularly the technical specifications for the surveillance equipment, has become a standard in the country. The latter was taken over by large projects (such as WINNER/USAID) and other partners developing local risk management projects. This allows for better alignment and coherence of investments in this area.
- The construction of a database containing quality statistical and real-time information has created opportunities for decision-making processes in areas such as civil works, agricultural production and tourism. The EWS also provides information and data usable for research to establish models, scenarios and risk trends. This information can also be used in planning process.
- The development of maps that detail hazards and resources has provided access to essential information for the process of strengthening local capacities and territorial planning. Some other programs (including funded by the World Bank) already incorporate this data to better target actions.
- PNAP methodology, evacuation codes, sirens and messages generated by the system were included in training modules for the Haitian Red Cross and other collaborating international partners.

c. Outputs

The following product description comes from the latest version of the Progress Monitoring Report as well as from the final evaluation. However the PMR indicators and products did not well represent the components as they were much more conservative than originally conceived in the project. This may cause bias in the analysis where 100% of the PMR product has been reached although it only represented part of the forecasted activities, such as in component 3 and 5.

Component 1

Expected Products: 47 sirens installed
55 hydro-meteorological stations installed

Products obtained: 47 sirens installed in all target communities (29 functioning as of November 2012)
54 hydro-meteorological stations installed – 16 meteorological and 38 hydrological (36 functioning as of November 2012)

Component 2

Expected Products: Central station operational.

Products obtained: 1 central station operational with trained personnel for its utilization.

Component 3

Expected Products: 35 municipal committees trained for emergency response
Products obtained: 32 municipal committees equipped with hazard maps, evacuation scenarios and available for the local committees in case of disaster.
Communication material in stock, however not yet distributed.
Awareness raising journeys organized.
Promotional spots transmitted during national radio broadcasts.

Component 4

Expected Products: 6 departmental committees and Civil Protection Directorate (DPC) equipped with effective communication means for the hurricane season.
Products obtained: DPC duly equipped. Communication equipment for the Departmental Committees in stock, but not yet distributed.

Component 5

Expected Products: Implementation of a communication strategy oriented to improve understanding of flood risk in a vast part of the population.

Products obtained: Communication strategy defined but partly only implemented with some broadcasted radio spots.

IMPLEMENTATION PROGRESS (IP)	
Components (Outputs):	**Main Indicators of Products/Outputs** 13 watersheds equipped with observation and communication network % of floods predicted and communicated Number of operational automatic warning systems % of operational automatic data communication Number of local committees equipped with maps and evacuation plans % of at risk households reached by messages

1. Monitoring and flood forecasting

Total cost of Component 1: US$ 2.200.000
Total cost of component 1 (after transfer of categories): US$ 3.390.000
Counterpart: US$ 0
IDB: US$ 3.390.000
IDB Disbursement: US$ 3.162.735
Disbursement Percentage: 93.3%

Classification**:** S

Key Output Indicators:

Planned Outputs		**Outputs Achieved**
Baseline	End of Project	
1.1 N/A	1.1E 47 Sirens installed	1.1 47 sirens installed – 29 operational as of the end of November (end of project)
1.2 N/A	1.2E 55 Measuring stations installed	1.2 54 hydro-meteorological stations installed

All targeted watersheds, including rivers, were equipped with measurement instruments. Weather stations and limnimeters were installed upstream in target areas in accordance with EWS technical requirements. These stations control the sensors in order to take readings at regular intervals. In terms of flood prevention, the equipment installed in target communities is capable of generating relevant and timely information about possible flooding in downstream at risk areas.

Control boxes have been installed in easy-to-reach parts of siren system, according to established protocols. Siren warning stations can be: i) remotely triggered by people with access to e-Vigilance software or ii) manually activated from boxes located near the sirens.

The cost of the equipment in these investments had been underestimated in the original program design. It was therefore necessary to replenish this category of investment with nearly US$ 1,190,000 from other components.

The program has generated important results in terms of technical equipment and the capacity to generate information and alert. However, it is possible that the sustainability of these investments could be questioned, as institutional commitment and handover is not provided for equipment management and maintenance, once the external cooperation is finished.

Restructuring. Indicate if this component was restructured (date of approval by Manager). Briefly discuss the consequences of these changes**.**

[X] N/A

2. Communication

Total cost of Component 2: US$ 500.000
Total cost of component 1 (after transfer of categories): US$ 348.775
Counterpart: US$ 0
IDB: US$ 348.775
IDB Disbursement: US$ 228.903
Disbursement Percentage: 65.6%

Classification: S

Key Output Indicators:

Expected Products/Outputs		**Products/Outputs Obtained**
Baseline	End of Project	1.1 1 Central station operational with trained personnel for its utilization.
1.1 NA	1.1E Central station operational	

Different communication processes have been developed and are operational. Data transmission from monitoring stations to central station is done automatically, via satellite and GPRS networks, and the information is stored in the E-vigilance software which makes it available “on demand”.

It is important to take into consideration that there is still a lack of automatically launched warnings with pre-established thresholds or protocols. At this time, a human operator is required to access the network, review the information and make a decision on whether to alert or not. In order to progress towards an automatic alert capability, it is necessary to continue collecting data, calibrating the system and defining thresholds and protocols for action.

A group of 16 people from institutions in connection with the project were trained in the use of the system and have a password to enter the E-vigilance network (technical, administrative, and observation functions):

- PNAP Technique Direction: 1 person
- National Water Resources Service: 4 persons
- National Meteorology Service: 2 persons
- Civil Protection Directorate: 6 persons, including DPC director.
- SPGRD and donors: 3

Positive results were obtained in this component; however the same institutional handover problem arises for the management of the EWS. Skills have been created and key people trained, however the institutional management of the system must be clarified and agreed upon between the Ministries. At the same time, resources must be made available for the maintenance of the EWS.

Restructuring. Indicate if this component was restructured (date of approval by Manager). Briefly discuss the consequences of these changes**.**

[X] N/A

3. Community preparedness and response to early warning

Total cost of Component 3: US$ 400.000
Total cost of component 1 (after transfer of categories): US$ 1.225
Counterpart: US$ 0
IDB: US$ 1.225
IDB Disbursement: US$ 1.225
Disbursement Percentage: 100%

Classification: S

Key Output Indicators:

Expected Products/Outputs		**Products/Outputs Obtained**
Baseline	End of Project	3.1 32 Municipal committees trained for response
3.1B NA	2.1E 35 Municipal committees trained for response	

32 targeted municipalities possess standard flood hazard and evacuation maps called "Communal alert and evacuation plans". These plans contain topographic data of hazard areas (high probability, probability), location of hydro-meteorological monitoring instruments and sirens, as well as information of diverse topics (centers for evacuees, churches, town halls and other institutions of interest). The maps also provide tables explaining the distribution of responsibilities for alerts, as well as the different alert levels with corresponding action plans.
The infrastructure-related aspects needed an increase of resources which have been taken from other categories. The loss of resources of component 3 has been compensated by the mobilization of additional resources from the technical assistance ATN/MD-11565-HA (HA-T1096), approved in 2009 with an additional amount of US$ 1,000,000. This situation explains that the component has a satisfactory rating although it only disbursed US$ 1225 (more details in d. Project costs).

Restructuring. Indicate if this component was restructured (date of approval by Manager). Briefly discuss the consequences of these changes**.**

[X] N/A

4. Institutional strengthening for the operation of the early warning system.

Total cost of Component 4: US$ 425.000
Total cost of component 1 (after transfer of categories): US$ 201.150
Counterpart: US$ 0
IDB: US$ 201.150
IDB Disbursement: US$ 199.621
Disbursement Percentage: 99.2%

Classification: S-I

Key Output Indicators:

Expected Products/Outputs		**Products/Outputs Obtained**
Baseline	End of Project	4.1 Communication equipment for the Departmental Committees in stock, but not yet distributed. DPC duly equipped.
4.1B NA	4.1E Departmental Committees and Civil Protection Directorate equipped with means of communication for the hurricane season.	

At the end of the project, most of the communication equipment intended to be installed in the departmental committees were already purchased, but not yet distributed. According to the Program Coordination Unit, this was due to the lack of decision on the necessary institutional structure to manage the EWS. The distribution plan has been included in the technical cooperation ATN/MD-13623-HA approved in December 2012 (US$ 440,000) to consolidate the results of both HA-L1005 and HA-T1096 operations and ensure sustainability of the system.

Civil Protection Directorate was expected to receive technical support, however the person who was assigned did not continue after the first year, and has not been replaced. Regarding the equipment, DPC currently possesses adequate capacities of preparedness and response to hurricane season.

Restructuring. Indicate if this component was restructured (date of approval by Manager). Briefly discuss the consequences of these changes**.**

[X] N/A

5. Public Awareness and Education Campaign

Total cost of Component 5: US$ 150.000
Total cost of component 1 (after transfer of categories): US$ 4.850
Counterpart: US$ 0
IDB: US$ 4.850
IDB Disbursement: US$ 4.850
Disbursement Percentage: 100%

Classification: I

Key Output Indicators:

Expected Products/Outputs		**Products/Outputs Obtained**
Baseline	End of Project	5.1 Two journeys to raise awareness. Communication Plan elaborated. Radio spots broadcasted.
5.1B NA	5.1E 90% of beneficiaries better understand risk.	

This component was the least developed of the program. Although the communication plan has been developed, it has not really been developed or tested. There is no quantitative means to check population's understanding of the risk since no initial or final survey was conducted. The awareness campaign which should contribute to improve the understanding and response of populations to warnings and flood alerts has been limitedly developed. Intermittent actions were conducted before and during 2011 and 2012 cyclone periods, using some products developed in the framework of the communication plan (awareness oral spots). The dissemination of the spots was made primarily through metropolitan area radio stations.

Restructuring. Indicate if this component was restructured (date of approval by Manager). Briefly discuss the consequences of these changes.

[X] N/A

d. Project Costs

Budgetary Category Number/ Name	Initial amount approved (US$)	Total amount approved after category transfer (US$)	% Difference	Total amount disbursed (US$)
Component 1: Monitoring and flood forecasting	2,200,000	3,390,000	+54.1%	3,162,735
Component 2: Communication	500,000	348,775	-30.2%	228,903
Component 3: Community preparedness and response to early warning	400,000	1,225	-99.7%	1,225
Component 4: Institutional strengthening for the operation of the early warning system	425,000	201,150	-52.7%	199,621
Component 5: Public Awareness and Education Campaign	150,000	4,850	-96.8%	4,850
Program administration	510,000	721,000	+41.4%	701,525
Evaluations and audits	400,000	218,000	-45.5%	169,876
Expenses	268,000	49,213	-81.6%	0
Capitalization fees	147,000	65,788	-55.2%	65,788
TOTAL	**5,000,000**	**5,000,000**		**4,534,522**

The implementation of the project quickly revealed that the infrastructure-related aspects should be a key factor, given the initial technical capacities. A quite non-existent hydro-meteorological network and insufficient local information coverage highlighted the need to invest more in this area to successfully create the adequate technical capacity. This caused an increase in the resources of component 1 by 54% from the resources of others.

This situation and the delay to recruit the firm working on program socio-institutional aspects resulted in the mobilization of additional resources from the technical assistance ATN/MD-11565-HA (HA-T1096), which was approved in 2009 with an additional amount of US$ 1,000,000, intended to compensate for the transfers of categories within 2389/GR-HA. This situation explains the achievement of results in component 3 with a disbursement of only US$ 1.225, since these activities have been funded by the additional resources.

Concentration in the technical aspects is also visible in the component 5 (public awareness) which has experienced a reduction from the originally budget $150,000, to less than $5,000 spent. The firm only managed to write the communication strategy but did not implement it.

The technical cooperation ATN/MD-11565-HA was closed at the same time as the donation agreement 2389/GR-HA and has been disbursed at 81.57%.

The use of the budget clearly shows the project situation: a strong contribution towards the installation of infrastructure and the generation of information, but still serious investment needed to be made in terms of institutional strengthening and awareness-raising.

IV. Project Implementation

a. Analysis of Critical Factors

Since the beginning of the operation country political instability affected the implementation. The situation changed the conditions in which the project was supposed to be developed and, for example, a relatively significant delay (more than one year) in the implementation of key activities was caused by the demotivation generated among international firms potentially interested in coming to work in Haiti.

Institutional conditions have also played a very important role. Although a memorandum of understanding had been signed by the Ministry of the Interior and the Ministry of Agriculture to establish their level of responsibility in program implementation, the institutional arrangements for EWS management were not well defined and necessary decisions about the distribution of responsibilities among the different entities involved were not taken. The institutional weakness that characterized the institutional structures, including the National Water Resources Service, complicated the implementation process. This institutional situation has been accentuated by the replacement of Majors by "Interim Agents" who struggled to gather the information accumulated in the town halls. This has also been complicated by the fact that permanent staff and Municipal Civil Protection Committees have not always been well integrated in the decision-making process during installation period.

The 2008 hurricane season was very active (four hurricanes in a month) and helped to bring attention towards the urgent need to develop a full early warning system (end-to-end). This has certainly contributed to accelerate project implementation. However the context has been even more affected by the earthquake of January 12, 2010 which coincided with the beginning of the technical installation of instruments. The situation resulted in a total chaos in public administration management and, as a result, attention has been much more focused on aspects of rehabilitation and reconstruction. This situation unmotivated international firms to participate in the process of implementation of components 3 and 5 respectively related to preparedness, response of population, public awareness and education.

This context has also created several opportunities related to the subject. For example, it promoted the creation of synergies, particularly with the arrival of several international cooperation initiatives that decided to coordinate and align their activities with PNAP for greater

effectiveness and complementarity. In the following months, the national and international attention bearing on prevention and preparedness had a positive influence on PNAP. This extreme situation has stressed the need to prepare for the worst scenarios and to develop approaches towards multi-hazard systems.

b. Borrower/Executing Agency Performance

Borrower/Executing Agency			
[ ] Highly Satisfactory (HS)	[X] Satisfactory (S)	[ ] Unsatisfactory (U)	[ ] Very Unsatisfactory (VU)

c. Bank Performance

Bank Performance			
[X] Highly Satisfactory (HS)	[ ] Satisfactory (S)	[ ] Unsatisfactory (U)	[ ] Very Unsatisfactory (VU)

V. Sustainability

a. Analysis of Critical Factors

The institutional base

The sustainability of the project is strongly conditioned by its institutional base, in particular by the immediate handover by the national authorities. The implementation process was characterized by a strong ad-hoc Technical Direction responsible for the coordination of all processes. Thus, at the end of the project, the image of PNAP was focused on the figure of the Technical Director, without a visible leadership of partner institutions.

The absence of a clear institutional framework, with institutional responsibilities defined for all processes, is a risk, not only for the future development, but also for the continuity of the current processes. The most important example is the pace of deterioration of the installed network. Towards the end of the project, almost 40% of the installed equipment was not operational (mainly due to vandalism and loss due to flooding). No additional resources have yet been mobilized to replace the lost equipment, minor reparations have been done using some element bought during program implementation and safely stored at the Ministry of Agriculture.

Consolidation of program main products

The program did develop a good capacity to collect data and produce information, and the sustainability of this aspect relies on the recognition, by other organizations, that it is one of the only entities producing standard and respectable quality technical information. In this sense, it is key continuing developing this capacity, which still requires a thorough technical work of calibration and maintenance of measuring equipment. In this sense it is important to carry out the "repatriation" of all the monitoring system from the company temporarily in charge of its maintenance (DSA) to national institutions which have to assume recurring costs.

The most important issue which affects sustainability concerns the institutional appropriation and handover of the system. It is still needed to establish a clear definition of responsibilities among institutions throughout the processes (collection, transmission, storage, processing and distribution). This implies a commitment of key ministries to mobilize the trained staff and to take in charge recurring costs. After the end of the project some contracts will still cover the costs of data transmission, storage and processing, but just for a determined period.

Program institutional handover and follow up of unconsolidated products

Program development was more effective in components 1 and 2, with the installation and operation of the equipment. On the other hand, the institutional part of the PNAP, which allows a true socio-institutional anchor of the program, was much less effective. These aspects are however compulsory in order to evolve from a monitoring system to a real warning system.

b. Potential Risks

The absence of a clear institutional handover for the system is a potential risk that could affect the sustainability of the project. A loss of leadership in the field may not only cause the destabilization of the system and its position among partners, but especially the loss of credibility at community level.

The lack of financial capacity to absorb operating costs is also one of the most important risks. Even if at the end of the project there are still valid contracts for the coming months, the budgetary decision-making process takes time, and is essential to internalize the costs on the basis of sustainability.

Another risk is related to the location and surveillance of the monitoring and alert equipment installed, which can be vandalized, stolen or destroyed. The solar panels are particularly attractive and need adequate surveillance mechanisms.

c. Institutional Capacity

In general, both partners - MARNDR and MICT - possess important capabilities for the absorption of the majority of processes developed by PNAP. The following table, recommended by the final evaluation team, shows a possible handover of responsibilities:

Ministry	Processes
MARNDR	1. Local data collection 2. Automatic data transmission 3. Data storage 4. Initial treatment and access E-Vigilance 5. Information analysis
MICT	5. Information analysis 6. Alarm launching 7. Departmental and municipal planning processes (general DRM processes including EWS).

Specific technical procedures may be developed by other institutions, such as the Inter-ministerial Commission for Land Use (CIAT), the National Geospatial Information Center (CNIGS), the National Environment and Vulnerability Observatory (ONEV), among others.

In this objective, the most important action will be re-launching MICT/MARNDR coordination agreement, and establish an instance for coordination and implementation.

Sustainability Classification SU:			
[ ] Highly Probable (HP)	[X] Probable (P)	[ ] Low Probability (LP)	[ ] Improbable (I)

VI. Monitoring and Evaluation

a. Information on Results

The implementation modality was based on three major contracts. Given the technological complexity of the system, a firm has been hired to keep track of the work done by both other firms.

In general terms, the original project indicators were not easy to measure in a quantitative manner, especially because of the absence of a base line and a clear identification of means of verification. In a country such as Haiti and in the context in which the project was developed, it was not realistic to establish indicators such as *"Life losses reduced by 75%"* or even *"percentage of floods foreseen and communicated"*. In general, it is not easy to determine whether the difference of impact between two similar disasters can be granted to a particular technical solution, and in the case of Haiti it is still more difficult.

However, the monitoring and follow-up system allowed for observation of how the key products were obtained, and to identify deadlines or potential conflicts. In this way, it was clearly identified that the production, transmission and communication of information-related products were efficiently achieved.

The final evaluation conducted between June and November 2012 highlighted the almost systematic lack of baseline information necessary to measure the indicators initially planned. Thus, according to the team, it was difficult to comment, measure, or to carry out monitoring of the different results.

For example, in component 1 the percentage of floods foreseen and communicated cannot be measure due to the lack of statistical data about flooding by watershed.

For component 3, the PNAP provided technical assistance to the authorities and local disaster management committees to train population on behaviors and reactions in case of alert, particularly based on hazard maps, plans and evacuation scenarios. However, given that there was no survey at the beginning or at the end of the process, it has been difficult to measure the level of awareness achieved.

In addition to these difficulties regarding indicators measurement, the evaluators have identified a real lack of information of local actors on the warning systems and their functioning. This lack of information made it difficult to monitor and evaluate the system put in place.

VII. Lessons Learned

Lessons learned through this project that could be used for the preparation and implementation of future tasks, are classified according to three themes:

1. Transfer of experience and know-how

- Taking into account similar previous experiences facilitate overcoming obstacles and above all avoid repeating the same mistakes.
- Mobilize technical assistance from recognized and experienced firms is essential to implement such a system in a country with a sensitive lack of technical knowledge, but the transfer of knowledge and skills must be better planned and built on the long term.

- Attention and support provided by IDB experts to the MARNDR procurement team were extremely important and useful for the program given the complex context of the country, the specificity of required technical services and the small number of corresponding providers existing and willing to come to work in Haiti.
- Sharing information with other programs currently producing and utilizing similar data was essential and need to be continued.

2. Institutional capacities

A solid institutional anchoring should be considered a prerequisite for the implementation of a program of this scope and complexity. In fact:

- Entrusting program management to MARNDR was a good decision. Nevertheless the weak integration of SNRE, linked to its institutional weakness, complicated the handover of various processes and monitoring and maintenance of installed instruments.
- In order to make the MARNDR/MICT agreement leading to a real institutional collaboration process, it would be necessary that responsibilities would be better defined and assumed beforehand, and a mechanism for dialogue maintained in a more consistent manner.
- The participation and leadership of all relevant institutions are important for EWS institutional handover.

3. Community training and communication

Local anchoring of the program must be strengthened. Indeed, in cases where communal committees and local leaders have been more involved, ownership of the system is much more consolidated. The case of the town of Baraderes, where the local authorities use the system and trigger alerts in an autonomous way, represents a very good example on how to locally internalize a high technology system. Thus, responsibilities (ex: alerts process) should be transferred to local authorities so that the program can be effective in the long term. Similarly, the activities related to communication and population preparedness must be carried out by adopting a local strategy with the participation of people at local level.

Annexes:

1. Minutes from Program Closure Workshop
2. Borrower Evaluation
3. Power Point Presentation of Program Closure Workshop

Annex 1: Minutes from Program Closure Workshop

MINISTERE DE L'AGRICULTURE, DES RESSOURCES NATURELLES ET DU DEVELOPPEMENT RURAL

COMPTE RENDU DE L'ATELIER DE CLOTURE DU PNAP, 28 MAI 2013

Helliot AMILCAR

SOMMAIRE

I. INTRODUCTION

II.

Suivant les procédures de la BID, un atelier doit clôturer les opérations de tous les programmes et projets arrivés à terme, une fois les conditions d'évaluation remplies. Les activités du Programme National d'Alerte Précoce en cas d'inondation (PNAP) étant terminées depuis le 30 novembre 2012, il a été décidé que cet événement se tienne le 28 mai 2013 à la Salle de Conférence du Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural (MARNDR).

III. DEROULEMENT

IV.

L'atelier débute par les mots de bienvenue du Directeur technique du Programme National d'Alerte Précoce en cas d'inondation, Helliot AMILCAR. Une présentation intitulée « **Système d'Alerte Précoce aux inondations, Etat et Contraintes** » illustre pour les différents participants les aspects de ce programme.

Composé de 2 volets principaux, le SAP regroupe, u niveau de 13 bassins versants répartis sur des zones jugées inondables d'une trentaine de communes, *des équipements pluviométriques (18), limnimétriques (38) et des stations d'alerte (47)*. La localisation de ces derniers a été dictée par des *Plans Communaux d'Alerte et d'Evacuation (PCAE)* élaborés pour chacune des communes étudiées avec l'aide de membres de Comités Communaux de Protection Civile sous la responsabilité des maires.

Si les capteurs installés au niveau des stations de mesure et d'observations permettent d'avoir les informations de base, en temps réel, utilisant des vecteurs de communications satellitaires (Satellites Iridium et GPRS) pour anticiper l'arrivée des crues, les stations d'alerte munies de sirènes préviennent la population des zones vulnérables de l'imminence des inondations de sorte qu'elle puisse se refugier dans des abris mis à disposition, si nécessaire. Cette possibilité est mise en évidence dans les cartes d'alerte et d'évacuation où sont indiquées les zones inondables et la localisation des abris. Dans les zones où le nombre de refuges est insuffisant ou inexistant, des préconisations sont adressées aux décideurs en termes de situation et d'opportunités.

Mention a été faite, au cours de la présentation, des dernières installations de stations (21) aux Gonaïves et à Ennery par le Programme PIA/Ennery-Quinte en vue de gérer le risque Inondation dans la Cité de l'Indépendance. Ce qui renforce le Système d'Alerte à l'échelle nationale.

Les contraintes auxquelles fait face le Système d'Alerte ont été également mises en évidence. Elles consistent en : actes de vandalisme sur certaines stations (près de 12 stations d'alerte affectées par le vol des panneaux solaires…), couts récurrents élevés des services associés, obligation de mise en place d'une structure interministérielle pour la gestion du système, obligation de moyens humains, matériels et financiers…

Diverses questions et recommandations ont suivi la présentation :

- Installation des équipements dans des commissariats pour faire face au vandalisme ;
- Hébergement des serveurs à la Banque Nationale d'Haïti pour diminuer les couts d'hébergement actuel ;

- ❖ Renforcement des capacités des Comités de Protection Civile ;
- ❖ Implication des Coordonnateurs techniques de la Direction de la Protection Civile (DPC) et des Directions Départementales Agricoles.

Le Directeur général du MARNDR, l'agronome Pierre Guy LAFONTANT, l'agronome Louis BUTEAU de même que le chef de Cabinet du Ministre de l'Agriculture ont remercié l'assistance en général, de sa présence et les représentants de la BID, en particulier, pour l'appui de la Banque.
Une collation a été offerte à l'assistance, à l'occasion.

Annex 2: Borrower Evaluation

Banque Interaméricaine de Développement
Rapport d'Achèvement de Projet
Accord de don 2389/GR-HA
Coopération Technique ATN/MD-11565-HA
Evaluation de la Banque par l'Emprunteur

Nom du Projet:Programme National d'Alerte Précoce en cas d'Inondation	
Organisme/s d'Exécution (OE/s): Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural	
Emprunteur: République d'Haïti	
Date d'Approbation par le Conseil d'Administration: 21 juillet 2005	Date d'Entrée en Vigueur du Contrat de Prêt: 26 janvier 2006
Date de l'Evaluation par l'Emprunteur: 5 février 2013	Date Prévue pour l'Atelier de Fermeture du Projet:

Classification de la Performance du Projet par L'emprunteur

Probabilité que le Projet Réalise son/ses Objectif/s de Développement:
[√] Hautement Probable (HP) [ ] Probable (P) [ ] Faible Probabilité (FP) [ ] Improbable (I)

Exécution du Projet (PE):
[√] Hautement Satisfaisante (HS) [] Satisfaisante (S) [ ] Insatisfaisante (I)[] Très Insatisfaisante(TI)

Durabilité des Résultats du Projet:
[√] Hautement Probable (HP) [Probable (P) [ ] Faible Probabilité (FP) [ ] Improbable (I)

Commentaires:

Performance Del'Emprunteur

Prière de qualifier votre performance globale au cours de la préparation et de l'exécution du projet:

[√] Hautement Satisfaisante (HS) [] Satisfaisante (S) [ ] Insatisfaisante (I) [ ] Très Insatisfaisante(TI)

Commentaires:

Performance de la Banque

Veuillez qualifier la performance globale de la Banque durant la préparation et l'exécution du projet. Les facteurs à prendre en considération comprennent la mesure selon laquelle la Banque a encouragé le recours à une dynamique participative pour la préparation du projet; a proposé des solutions techniques adéquates aux problèmes identifiés, a su répondre de façon opportune aux besoins spécifiques de l'Emprunteur (en termes de choix de l'instrument de prêt, d'assistance technique et de formation formelle et non formelle à l' Organisme Exécution), a fait montre de flexibilité en répondant à des situations d'urgence survenues en cours d'exécution. Vos commentaires seront ajoutés tels quels au PCR.

[√] Hautement Satisfaisante (HS) [] Satisfaisante (S) [ ] Insatisfaisante (I) [] Très Insatisfaisante(TI)

Commentaires:

Suggestions Additionnelles pour Améliorer la Performance de la Banque

Commentaires et suggestions additionnels pour améliorer la performance de la Banque dans le futur.

Annex 3: Power Point Presentation for Program Closure Workshop

LE SYSTÈME D'ALERTE, ETAT ET CONTRAINTES

BID

Atelier de cloture
PNAP, 28 mai 2013 Dr Helliot AMILCAR, MARNDR 1

SOMMAIRE

- Le système d'alerte: composantes
- Points de vue des évaluateurs
- La Structure de gestion
- Les contraintes

BID

Atelier de cloture
PNAP, 28 mai 2013 Dr Helliot AMILCAR, MARNDR 2

LE SYSTÈME D'ALERTE AUX INONDATIONS

I –Le Programme National d'Alerte aux inondations

1.1Objectifs :

- Appuyer la mise en œuvre de la première étape du Plan National de Gestion des Risques et Désastres,
- Renforcer la capacité des zones d'intervention à détecter les risques d'inondation en vue de diminuer les pertes en vies humaines et en biens.

1.2 Résultats attendus

- Système d'alerte installé et opérationnel
- Pertes de vies dues à des inondations réduites à plus de 75%
- Dispositifs d'alarme automatisés installés dans 31 communes à haut risque
- Réseau d'observation et de communication installés dans 13 BV/30?
- Comités locaux renforcés par mise à disposition d'un Plan d'Actions
- 95% des inondations imminentes dans les zones surveillées prévu et alerte communiquée aux bénéficiaires

BID

LE SYSTÈME D'ALERTE AUX INONDATIONS

- Rivières ciblées /Riverains à risques :

Artibonite, Trois Rivières, Grand'Anse, Rouyonne+Momance+Cormiers, Saint Marc, Grande Ravine du Sud+l'Acul+ Torbeck, Grande Rivière de Nippes, Serpente, Rivière des Baradères, Grande Rivière de Jacmel, Rivière Bras Gauche, La Gosseline, Orangers, Rivière Froide, Bois de Chêne, Riv. Grise, Rivière Caïman (Petit Goâve), Rivière Maniche/Cavaillon, Bretelle, Courjolle

BID

LE SYSTÈME D'ALERTE AUX INONDATIONS

1.4 Les communes

Port de Paix	Chambellan	Petit Goâve	Cayes	Baradères
Bassin Bleu	Port-au-Prince	Jacmel	Torbeck	L'Asile
Chansolme	Carrefour	Cabaret	Camp Perrin	Anse à Veau
Gros Morne	Tabarre	Arcahaie	Maniche	Gonaives *
Pilate	Cité Soleil	Saint Marc	Cavaillon	
Jérémie	Croix des Bouquets	Verrettes	Chantal	
Moron	Léogane	Grande Saline	Arniquet	

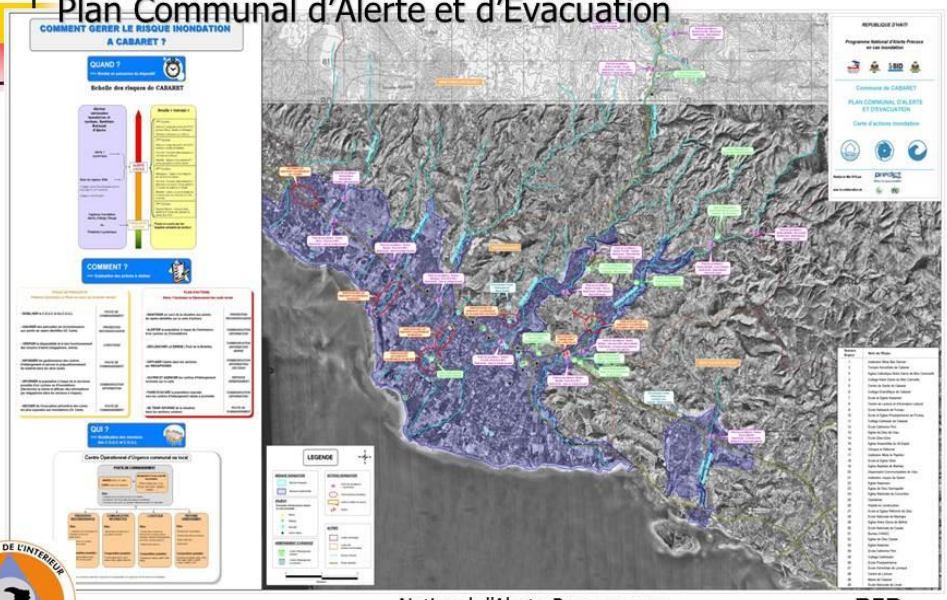
BID

LE SYSTÈME D'ALERTE AUX INONDATIONS

- **Stratégie**:
  - Identification et Organisation des communautés à risque
  - Collecte des données hydrométéorologiques
  - Renforcement des capacités
  - Sensibilisation
  - Déclenchement de l'alerte
  - Appropriation

BID

ORGANISATION DES COMMUNAUTÉS A RISQUE:
Plan Communal d'Alerte et d'Évacuation



National d'Alerte Precoce aux inondations, MARNDR

BID

7

LE SYSTÈME D'ALERTE AUX INONDATIONS

ORGANISATION DES COMMUNAUTÉS A RISQUE:
Plan Communal d'Alerte et d'Évacuation

- ⇨ **Plan communal d'alerte et d'evacuation**
- ⇨ **l'Annuaire de crise**

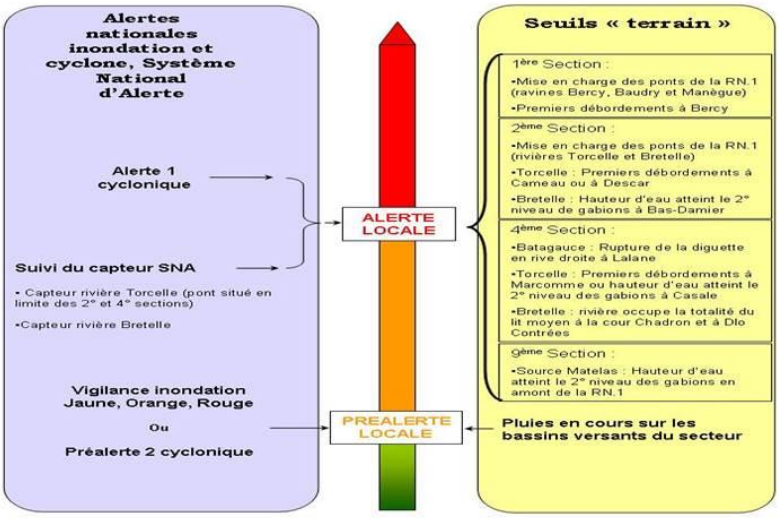
BID

Atelier de cloture
PNAP, 28 mai 2013

Dr Helliot AMILCAR, MARNDR

8

Echelle des risques de CABARET



BID

ANNUAIRES DE CRISE

BID

BID

Atelier de cloture
PNAP, 28 mai 2013 Dr Helliot AMILCAR, MARNDR 11

BID

PNAP, 28 mai 2013 Dr Helliot AMILCAR, MARNDR 12

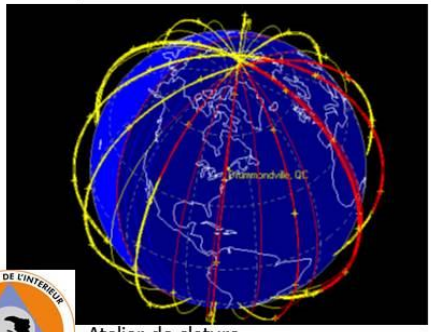
ORGANISATION DES COMMUNAUTÉS A RISQUE: Plan Communal d'Alerte et d'Évacuation

LE SYSTÈME D'ALERTE PRECOCE

- Composantes
  - Capteurs limnimétriques automatisés (38)
  - Échelles pluviométriques
  - Capteurs pluviométriques automatisés (18)
  - Sirènes automatisées (47)
  - Système d'exploitation (eVigilance; Banque de données hydrologiques)
  - Des Observateurs directs

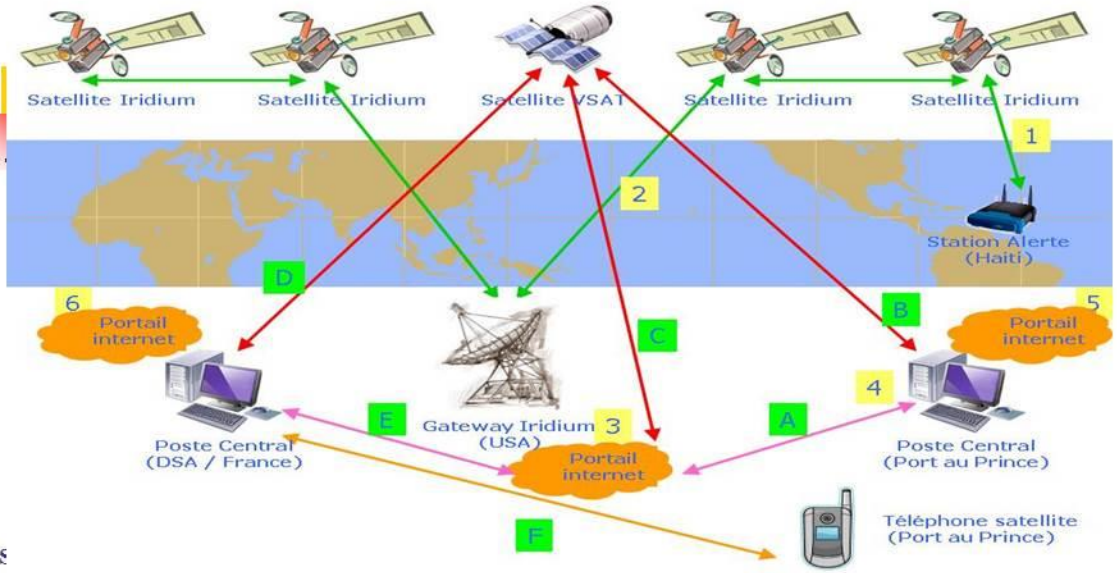
LE SYSTÈME D'ALERTE PRECOCE

- SYSTÈME DE COMMUNICATION
  - Satellites Iridium
  - GPRS



Le General Packet Radio Service ou **GPRS** est une norme pour la téléphonie mobile dérivée du GSM permettant un débit de données plus élevé.

BID

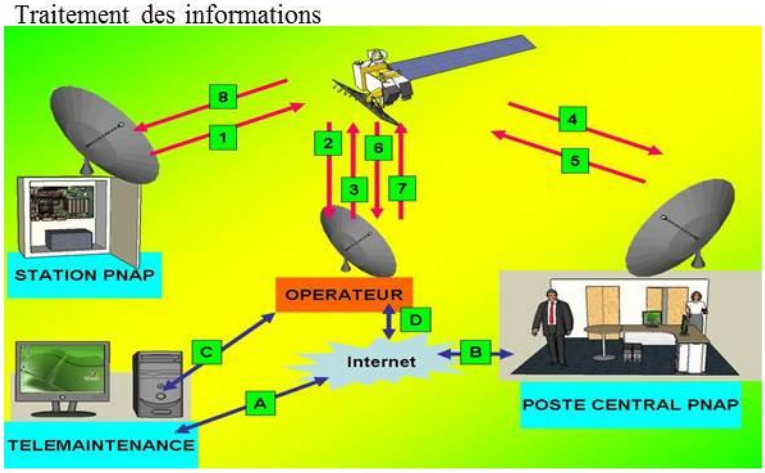


1. les stations hydrométriques et stations d'alerte communiquent en mode bidirectionnel avec la flotte de satellites Iridium,
2. les satellites renvoient les informations transmises vers la Gateway Iridium installée aux États-unis.
3. la Gateway met à disposition les informations via un serveur de données accessibles depuis Internet (mode sécurisé).
4. le poste central collecte les données sur la Gateway et les met à disposition de l'opérateur sur le superviseur du poste central PNAP
5. en fonctionnement normal, via la liaison (A), le poste central PNAP (Port au Prince) accède à la Gateway Iridium via Internet (ADSL) en mode sécurisé. Le poste central PNAP rend accessible les données via son serveur Web

Pour l'envoi des données à destination des stations hydrométriques et stations d'alerte, le fonctionnement suit le cheminement inverse (Gateway vers satellites puis stations) [6].

Prévisions des inondations

- Installation de stations météorologiques et hydrologiques
- Mise en place de connexions automatisées
- Traitement des informations



LES CAPTEURS LIMNIMETRIQUES

Des signaux radar sont émis sous forme de courtes impulsions d'une durée de 1 ns par l'antenne du capteur.

Après avoir été réfléchies par la surface du produit, ces impulsions sont réceptionnées à nouveau par l'antenne sous forme d'échos.

Le temps de propagation des impulsions radar est directement proportionnel à la distance entre capteur et produit et donc à la hauteur de remplissage.

BID

CAPTEURS PLUVIOMETRIQUES

- - Vitesse du vent.
- - Direction du vent.
- - Précipitations (pluie).
- - Pression barométrique
- - Température.
- - Humidité relative.

BID

LES STATIONS D'ALERTE

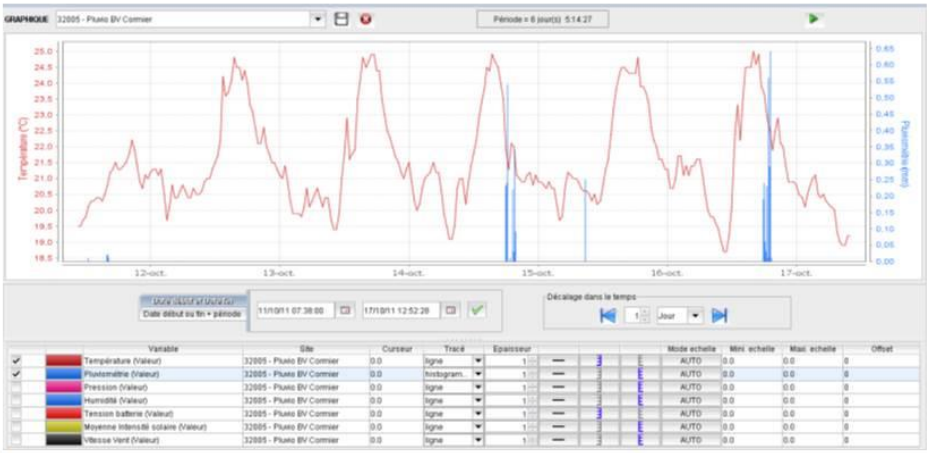
- **Les stations d'alerte sont constituées :**
- **- D'un mât équipé de deux pavillons doubles.**
- **- De deux panneaux solaires d'une puissance crête de 50 watts.**
- **- De deux batteries 12 V / 65 Ah/C20.**
- **- D'un coffret électronique.**
- **- D'une armature mécanique.**
- **- Éventuellement d'une plate-forme.**
- **- D'un coffret de commande.**
- **- D'un lampadaire.**

BID

COLLECTE DE DONNEES HYDROMETEOROLOGIQUES

BID

VISUALISATION DES DONNEES



INSTRUMENTATION DES BASSINS VERSANTS POUR COLLECTER DES INFORMATIONS

- ÉTAT ACTUEL
  - Système mis en place
  - Prise en compte de 13 Bassins Versants sur 30
  - « Feed Back » positif auprès de la population
- LA SUITE?
  - Assurer la Durabilité du Système a partir de son Appropriation par les Institutions et la Population
  - Étendre la Couverture à d'autres Bassins Versants

Conclusions des Evaluateurs sur le Système

- Cohérent et pertinent
- Bonne fonctionnalité technique
  - Nécessité importante de suivi = entretiens des matériels, formation de technicien locaux pour entretien et utilisation des données
- Besoin de plus grand ancrage social
  - Appropriation de haut niveau
  - Institutionnel (pour la reprise et maintien de ce qui est en place)
  - Local (autorités et populations)

Structure devant assurer la gestion du système

- * Direction de la Protection Civile (DPC, MICT) pour la gestion de l'alerte
- * Service National des Ressources en Eau (SNRE, MARNDR) pour les paramètres hydrologiques (pluviométrie, hauteur d'eau)
- * Centre National de Météorologie (CNM, MARNDR) pour les paramètres météorologiques
- * L'Université d'Haïti (Faculté des Sciences notamment) pour le développement du sous secteur « Recherche et Développement » y relatif
- * Le Ministère de la Planification, à travers le CNIGS
- * Le Ministère de l'Environnement, à travers l'ONEV

Le système est un réseau comportant une centaine d'équipements. Il est impératif que ce réseau soit géré par un personnel compétent disposant du matériel et de facilités appropriés pour assurer la surveillance 7 jours sur 7 et 24 heures sur 24.

Responsabilités à court terme

Ministère	Processus
MARNDR	1. Collecte local des donnés 2. Transmission automatique des donnés 3. Stockage des donnés 4. Traitement initial et accès eVigilance 5. Analyse d'information
MICT	5. Analyse d'information 6. Déclenchement des alarmes Processus de planification départemental et communal (processus générale de GRD qui inclut le SAP).

Responsabilités et élargissement à moyen terme

- MARNDR à titre de ministère de tutelle du PNAP, du SNRE et du CNM
- MICT comme ministère de tutelle de la DPC et des collectivités territoriales et comme responsable délégué du SNGRD.
- MPCE comme ministère de tutelle du CNIGS
- MTPTC comme ministère de tutelle du CONATEL et du Bureau des Mines
- MDE comme ministère de tutelle de l'ONEV
- SPGRD
- DPC
- CIAT
- Université de l'État
- Croix Rouge Haïtienne

LES CONTRAINTES

- Vandalisme
  - Panneaux solaires prés de 12 stations alerte voles
  - 4 stations hydro. affectées
  - 3 stations hydro emportées par les eaux
- Changements de maires
- Ancrage institutionnel
- Couts récurrents de fonctionnement élevés
- Compétence locale insuffisante