HAITI WINNER

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

PEA

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FINAL
HAITI WINNER

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

PEA

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LIST OF ACRONYMS

AWP	Annual Work Plan
BEO	Bureau Environmental Officer
CBO	community-based organization
CFR	Code of Federal Regulations
CRDD	Centre Rural de Développement Durable
DEED	Développement Economique pour L'Environnement Durable
EA	Environmental Assessment
EDD	Environmental Due Diligence
EMMP	Environmental Mitigation and Monitoring Plan
EMR	Environmental Mitigation Report
EMPR	Environmental Mitigation Plan and Report
GOH	Government of Haiti
IEE	Initial Environmental Examination
IHSI	Institut Haïtien de Statistiques et d'Informatique
LOP	Life of Project or Program
MARNDR	Ministry of Agriculture
NGO	non-governmental organization
NRM	natural resources management
PEA	Environmental Assessment
PEMP	Programmatic Environmental Management Plan
PERSUAP	Pesticide Evaluation Report-Safe Use Action Plan
PPPP	Public Private Producer Partnership
REA	Regional Environmental Advisor
REA	Responsables d'Encadrement Agricole (Rural Extension Agents)
SIEE	Supplemental IEE
SRI	Intensive Rice Production System (French acronym)
TA	Technical Assistance
TES	threatened and endangered species
USAID	U.S. Agency for International Development
WIF	Watershed Investment Fund
WINNER	Watershed Initiative for National Natural Environmental Resources

EXECUTIVE SUMMARY

Introduction to the Project

This Programmatic Environmental Assessment (PEA) is being conducted for the USAID/Haiti Watershed Initiative for National Natural Environmental Resources (WINNER). The purpose of the WINNER program is to implement broad-scale investments in sustainable natural resource management at the scale and density needed to produce future positive landscape level reductions in environmental, infrastructural, and economic vulnerability in the Cul-de-Sac (Riviere Grise and Riviere Blanche), Cabaret/Arcahaie (Matheux, Courjolle, Torcelle and Bretelle rivers), Gonaives (La Quinte river), and Mirebalais/Saut d'Eau (La Tombe, Gascogne, Janleba, Fer-à-cheval rivers of the Artibonite river system) watersheds.

The following are WINNER program components:

Component 1: Livelihoods of people living in the watershed improved through increased agricultural productivity and alternative income generation. Activities focus on improving the sustainability of agricultural practices within the four watersheds through a combination of technical assistance, training, physical infrastructure rehabilitation and extension and procurement of agricultural inputs (including pesticides and fertilizers) to improve yields.

Component 2: Critical infrastructure rebuilt and improved and threat of flooding reduced. Activities focus on the rehabilitation and extension of key watershed and livelihood improvement infrastructure, including erosion control structures, flood control structures, groundwater recharge infrastructure (i.e., catchment basins), and roads.

Component 3: Watershed governance strengthened. This component focuses on developing and/or strengthening institutional structures to support long-term and sustainable management of watersheds. Sustainable management of watersheds and their resources includes improving and protecting their environmental integrity, and their ability to productively serve the livelihood needs of their residents.

Component 4: Public-Private-Producer Partnerships established. Activities include technical assistance, training, grants, and sub-contracts supporting private sector investment in watershed management and enterprise development initiatives that support livelihood improvement.

Component 5: Earthquake recovery enhanced through job creation in rural areas and assistance to small business. Activities support a quick boost to increase agricultural production, provide assistance to small businesses, and promote the employment of day-labor in ways that benefit the rural economy.

Background on the Scoping Process and the PEA

An Initial Environmental Examination (IEE) recommended a Positive Determination for certain infrastructure activities that were to be implemented by WINNER. The IEE and the PEA Scoping Statement recommended a PEA because it is best suited to the ―rolling design" of WINNER. Besides the rationale provided in the IEE and Scoping Statement, a PEA makes sense at this stage in the project. With over one year of implementation experience, and several environmental management reports (EMR), environmental mitigation plan and reports (EMPR), and Environmental Assessments (EA) completed, sets of activities can be identified for which there are predictable impacts and standard mitigation measures.

Scoping activities in preparation for this PEA took place between December 2009 and May 2010. The scoping process was interrupted for two months by the January earthquake. For the scoping process, stakeholders who represented various interests and points of view were identified. Participants were drawn from national and local level governments, non-governmental organizations (NGO), including community-based organizations (CBO), from private sector firms, and individual residents in potential intervention zones.

The scoping process identified the following significant issues to be addressed in the PEA:

- Loss of local flora – tree cutting
- Loss of local fauna
- Sensitive terrestrial or marine ecosystems
- Air quality
- Soil erosion
- Water quality
- Water quantity
- Local labor
- Land acquisition and just compensation
- Community access to river water and other river resources
- Worker and public safety
- Solid, hazardous and special wastes

The PEA Team deviated from the Scoping Statement in two important ways:

(1) Given the programmatic nature of the PEA, the PEA Team, in collaboration with WINNER senior staff, broadened the scope of the PEA to include not only the physical interventions of concern (above) derived from Scoping,, but to also cover the full set of possible WINNER interventions, thereby better fulfilling the mandate of a Programmatic EA.

(2) In part because the scope of the PEA was expanded, and also from PEA Team meetings and site visits, the PEA Team adjusted the significant issues identified in the Scoping Statement accordingly.

Alternatives Comparison

Using the significant issues from the Scoping Statement and others derived from the PEA process, the PEA compares the environmental impacts of the following alternatives to the WINNER Program:

- No Program Alternative
- Biodiversity Conservation Program Alternative
- Economic Growth Program Alternative

The Affected Environment

The WINNER Program is being implemented in the following four watersheds:

(1) Cul-de-Sac Watershed (Rivière Grise and Rivière Blanche)
The *Environmental Vulnerability of Haiti* ranked the Cul-de-Sac watershed, among 54 watersheds, as the most important watershed in Haiti for *population vulnerability*, primarily due to the dense urban population in the Grise River floodplain. It also ranked highest in terms of the *road vulnerability index*. During the last decades, the Plaine du Cul-de-Sac has increasingly being urbanized, especially since the deterioration of the irrigation system.

(2) Cabaret/Arcahaie (Matheux, Courjolle, Torcelle and Bretelle Rivers)
The natural habitats that are found in the watersheds have been profoundly impacted by agriculture, urbanization, and other human activity. There is little remaining of the original ecosystems. In the Cabaret watershed, the most important remnants of mangroves and native coral reefs are found along the coast of Source Matelas on the way to Cabaret, and still constitute important marine wildlife habitat. There is a large sub-tropical forest parcel, estimated at approximately 100 hectares, in the area of Casale, near the watershed of the Torcelle River. These zones, as well as other biologically significant areas, particularly those with high concentrations of endemic species, merit particular attention in watershed management planning.

(3) Gonaives Watershed (La Quinte River)
The Gonaives watershed is exposed to climatic extremes such as hurricanes that bring heavy floods on one hand, and periods of severe drought on the other. Cyclones and tropical storms bring strong rains, which due to low vegetative cover and timing, generate flash floods. Frequently, these floods follow periods of severe drought. When drought is followed by heavy rains, fragile soils wash away and water rushes towards lowland areas with catastrophic impact, including loss of human life.

(4) Mirebalais/Saut d‘Eau (La Tombe, Gascogne, Janleba, Fer-à-cheval rivers of the Artibonite river system) watersheds
A number of water courses crisscross the commune of Mirebalais and have a sizable flow of water that can flood arable land during seasonal rains. Frequent and repeated flooding results in landslides and loss of human and animal life. In Saut d‘Eau, flooding has resulted in destruction of physical infrastructure, and even more serious destruction downstream in Cabaret and Arcahaie. Some farmland damaged by erosion is now completely unusable.

Potential Environmental Impacts, Recommended Mitigation Measures, and Environmental Management Plan

The PEA assesses environmental impacts at the programmatic level, comparing the impacts of the WINNER Program with the alternatives to WINNER. Then, the PEA assesses impacts of each WINNER component. Component-level Mitigation Plans are provided for Components 1, 3, 4, and 5; and for Component 2, *Critical Infrastructure Rebuilt and Improved and Threat of Flooding Reduced*, four Cluster-level Mitigation Plans are provided. The Programmatic Environmental Management Plan (PEMP) takes the Component/Cluster-level Mitigation Plans a step further, and lists all required mitigation measures from these plans, and adds monitoring indicators, methods of monitoring, and frequency of monitoring.

Major Conclusions, Areas of Controversy, Issues Remaining to be Resolved

All WINNER activities can be adequately mitigated by the mitigation measures recommended in this PEA. With regular monitoring, environmental impacts are expected to be negligible, and most WINNER activities are expected to have positive environmental effects.

Components 1 and 2 are expected to have the greatest extent of potential environmental impacts, and will require the closest scrutiny. Component 1 concerns include pesticide use, for which a separate USAID-required environmental review is being conducted. In addition to the mitigation measures in this PEA, the mitigation measures developed from that review are required to be implemented by WINNER. The PEA does not include an assessment of WINNER‘s pesticide use. Other Component 1 concerns, for which mitigation is included in the PEA, are primarily related to agricultural expansion into natural areas, and mitigation and monitoring are described in the Component 1 Mitigation Plan and in the PEMP.

Component 2 potential impacts are mainly related to the Construction Phase; however, if site selection, planning, and design fail to incorporate environmental concerns, the Operation and Maintenance Phase, as well as the Construction Phase, could result in serious adverse effects. If environmental concerns are incorporated early in the project, and potential adverse impacts mitigated, adverse impacts are less likely. Therefore, in addition to the mitigation measures proposed for Component 2 (Cluster Mitigation Plans), WINNER has hired a Biodiversity Specialist, who will participate in Component

2 site selection and planning, as well as design and feasibility activities. He will also oversee the monitoring of Construction Phase and Operation and Maintenance Phase mitigation measures for Component 2. If mitigation measures are successfully implemented, infrastructure improvements are expected to have positive effects on the environment and for Haiti as a whole.

WINNER‘s Biodiversity Specialist will also oversee implementation of the PEMP for all WINNER components. This is a program-level mitigation measure that is intended to minimize the potential for adverse environmental impacts and enhance positive effects across all components.

SECTION I: PROGRAMMATIC ENVIRONMENTAL ASSESSMENT: USAID/HAITI WINNER PROGRAM

Purpose of the Programmatic Environmental Assessment (PEA)

1.1 Background to the PEA: Purpose of the PEA and Methodology

USAID/Haiti conducted an Initial Environmental Examination (IEE, see Annex A) which covered WINNER and *Développement Economique pour L'Environnement Durable* (DEED). At the time the IEE was prepared, specific interventions under WINNER were still being designed. The IEE states that:

> …this IEE has identified the classes of activities. As specific activities are defined on a rolling basis throughout life of project, each one will be evaluated using the threshold decision table. All activities that are not clearly and entirely classified as a ~~"e~~ategorical exclusion" must be evaluated using the Environmental Mitigation Plan/Report screening system and templates included in Appendix A of the IEE.
>
> Further, per 22 CFR 216 a positive determination for River Basin Development is required. Per above, as specific interventions are as yet unidentified, a Programmatic Environmental Assessment will be conducted in order to evaluate all potential activities under the USAID Watershed Management Program. This PEA will inform decisions and the construction of appropriate EMPR development. The PEA will include River Basin Development and any river rechanneling and dredging actions.

The IEE recommended the following threshold decisions:

Physical Infrastructure Rehabilitation and Construction:

(a) Low or Moderate Risk Rehabilitation or Construction including road rehabilitation, sub grants with Watershed Investment Funds, and earthquake recovery actions including maintenance of tractors and use of fertilizers.

Negative Determination with Conditions – Preparation and implementation of Environmental Mitigation Plan and Reports.

(b) High Risk Rehabilitation or Construction

Positive Determination, 22 CFR §216.2(d)(1)(i, ii, iv, and v) – Environmental Assessment (EA) required.

River Basin Development including river rechanneling, dredging, and overall watershed development- Positive Determination and requires a Programmatic Environmental Assessment (PEA).

This PEA is being conducted in response to the Positive Determination in the IEE.

1.1.1 Rationale for the PEA Approach

Along with the IEE, the Scoping Statement (an excerpt of the Scoping Statement is included as Annex B) provides the rationale for conducting a PEA rather than an EA. In summary, the Scoping Statement states that a PEA is better suited for the evaluation of a program with a ―rolling" project design. A PEA is useful when there are specific program objectives but a number of possible interventions that would fulfill the objectives, where the specific interventions are not yet identified, but are determined as the project moves forward. It is also useful when general locations are known, but specific sites may not yet be identified. The PEA approach gives the flexibility to determine specific interventions and locations for these interventions on an ongoing basis.

The Scoping Statement makes it clear that the PEA approach should, to the extent practicable, follow the same path as a traditional project EA, covering all the steps in the process that are necessary to describe baseline conditions, assess impacts, and make recommendations to mitigate any potential negative impacts. This PEA follows the EA format as described in 22 CFR 216.6(c).

Besides the rationale provided in the Scoping Statement, a PEA makes sense at this stage in the project. With over one year of implementation experience, and several environmental management reports (EMR), environmental mitigation plan and reports (EMPR), and EAs completed, sets of activities can be identified for which there are predictable impacts and standard mitigation measures. Therefore, existing EMRs, EMPRs, and EAs were used as a foundation for this PEA.

1.1.2 PEA Methodology

This PEA was conducted by two consultants to WINNER, Yves Andre Wainright and Karen Menczer, over a period of six weeks. Annex C contains a brief bio of the two PEA authors.

The PEA was conducted using a mix of document review and online research; meetings with WINNER project staff, partners, stakeholders, and beneficiaries (see List of Contacts in Annex D); and field visits to current and proposed WINNER project sites and activities. While the Scoping Statement is the foundation of the PEA, as mentioned above, it also draws heavily on environmental documents previously produced for WINNER activities including the IEE and EAs, EMRs, and EMPRs. The PEA Team used the Annual Work Plan-AWP (March 2010-May 2011) to identify planned sets of activities and locations. Future activities were extrapolated from activities described in the AWP and by discussing expectations and implementation plans over the life of project (LOP) with WINNER staff.

The PEA Team met with WINNER staff in Port-au-Prince and in the field. The aims of these meetings were to gather more detail on current and proposed WINNER

interventions and to discuss LOP environmental review, mitigation options, monitoring, and reporting procedures.

Sites for PEA Team field visits were chosen with an aim to help the Team evaluate the range of possible interventions and environmental conditions of WINNER intervention zones. Key objectives of field visits were to clarify and gather details on the significant issues identified in the Scoping Statement; identify additional issues not described in the Scoping Statement or not previously encountered; and develop practicable mitigation measures, including measures not yet identified in already existing environmental documentation.

The PEA Team visited the following intervention sites:

Cul-de-Sac Watershed
River Grise, lower reaches: dredging, re-shaping, and placement of gabions between the Tabarre and Route Neuf bridges
Kenscoff: Centre Rural de Développement Durable (CRDD)-Kenscoff, demonstration farm at Wynn‘s, impluviums and cisterns, road rehabilitation, canal cleaning, irrigation pumping station, and CRDD on Bas Boen State farm

Gonaives Watershed
CRDD‘s satellite experimentation site at La Branle: demonstration site, impluvium and cistern, ravine treatment, irrigation canal-cleaning and lining with concrete
Dredging, re-shaping, and placement of gabions in River La Quinte downstream Pont Bigot

Ultimately, the information gathered by the PEA Team was used to prepare Mitigation Plans for sets of WINNER interventions and an overall Programmatic Environmental Management Plan (PEMP) for WINNER (Annex E).

1.2 Description of the Scoping Process

1.2.1 Stakeholder Identification

For the scoping process, stakeholders who represented various interests and points of view were identified. Participants were drawn from national and local level governments, non-governmental organizations (NGO), including community-based organizations (CBO), from private sector firms, and individual residents in potential intervention zones. A list of stakeholders with whom the Scoping Team met is included in Annex B.

1.2.2 Scoping Methodology

Scoping activities took place between December 2009 and May 2010 by a different team than the PEA Team. The scoping process was interrupted for two months by the January earthquake. Scoping meetings and consultations were held in Port-au-Prince, and in the project work areas within the Cul-de-¬Sac, Gonaives, Mirebalais/Saut d‘Eau, and Cabaret/Arcahaie watersheds.

The scoping process for the WINNER PEA was a participatory data collection exercise. The Scoping Team held structured meetings with stakeholders, during which they provided stakeholders with basic information about the project, proposed project activity types, and a brief description of the PEA process. Information was presented objectively and input from stakeholders was solicited in a way to minimize influence on stakeholder opinions and keep the discussions within the bounds of the PEA process (e.g. focused on environmental and cultural issues).

The Scoping Team used a standardized questionnaire (Annex A of the full Scoping Statement) to obtain information on relevant issues. The discussion was made as informal as possible, particularly when meeting with stakeholders who may have found the process intimidating, and/or would have been reticent to express their views. Information obtained from stakeholders was grouped into categories for preliminary analysis and decision making to determine its significance for deeper analysis during the PEA. Issues raised by the stakeholders that fall outside the scope of the PEA process were recorded separately for follow-up as deemed appropriate.

1.2.3 Description of Key Issues

Derived from the two-part analysis used in the scoping process, issues deemed significant and therefore, to be addressed in the PEA are:

- Loss of local flora – tree cutting
- Loss of local fauna
- Sensitive terrestrial or marine ecosystems
- Air quality
- Soil erosion
- Water quality
- Water quantity
- Local labor
- Land acquisition and just compensation
- Community access to river water and other river resources
- Worker and public safety
- Solid, hazardous and special wastes

Table 3.2 of the Scoping Statement (included in Annex B) provides details of these issues.

The scoping process eliminated the following issues from further consideration because they are either (a) not significant, (b) not relevant to the proposed project interventions or (c) both:

- Groundwater withdrawal or disruption
- Disruption of community livelihoods
- Noise

- Visual quality and viewscape
- Disruption of community livelihoods
- Traffic and transportation
- Cultural resources

In addition to identifying significant issues, the scoping process analysis (screening of stakeholder issues) identified the WINNER activities associated with the significant issues:

- Irrigation and drainage system improvement/rehabilitation
- Flood control and erosion control
- Potable water system improvement
- Feeder road rehabilitation

The PEA Team deviated from the Scoping Statement in two important ways:

(1) Given the programmatic nature of the PEA, the PEA Team, in collaboration with WINNER senior staff, broadened the scope of the PEA to include not only the physical interventions of concern (above) derived from Scoping, but to also cover the full set of possible WINNER interventions, thereby better fulfilling the mandate of a Programmatic EA.

(2) In part because the scope of the PEA was expanded, and also from PEA Team meetings and site visits, the PEA Team adjusted the significant issues accordingly (see Section 2.3).

SECTION 2: ALTERNATIVES INCLUDING THE PROPOSED PROGRAM AND THE NO ACTION ALTERNATIVES

2.1 Program-Level Alternatives

As required in a PEA, the PEA Team developed program-level alternatives which would meet the WINNER program vision and objectives, and that, where possible and practicable, address the significant issues identified in the Scoping Statement. The No Program alternative is also described and evaluated. The alternatives were developed from discussions with WINNER senior management and are derived from their experience working with various WINNER stakeholders, and suggestions put forth by them for program options.

2.2 Description of Program-level Alternatives

Alternative 1: Haiti WINNER Program

The purpose of the WINNER program is to implement broad-scale investments in sustainable natural resource management at the scale and density needed to produce future positive landscape level reductions in environmental, infrastructural, and economic vulnerability in the Cul-de-Sac (Riviere Grise and Riviere Blanche), Cabaret/Arcahaie (Matheux, Courjolle, Torcelle and Bretelle rivers), Gonaives (La Quinte river), and Mirebalais/Saut d'Eau (La Tombe, Gascogne, Janleba, Fer-à-cheval rivers of the Artibonite river system) watersheds.

The long-term vision of the WINNER program is: *People living within the targeted watersheds will have improved livelihoods, reduced threat from flooding, and have invested in sustainable economic growth and environmental protection in the watershed. Their experience will serve as a model approach to replicate both within and beyond the targeted watersheds*.

To achieve this vision, WINNER uses a farmer-centered approach aimed at reversing the course of economic and environmental decline in target watersheds. The approach derives from the fact that farmers have been the main actors of natural resource degradation in Haiti, yet if properly assisted, can become the driving force behind revitalization of watersheds. Therefore, WINNER aims to increase sustainable hillside agricultural production and income and productivity in lowland agricultural systems through the management of key resources

Haiti has among the highest population densities in the Caribbean. Growth rates currently approach 2.5% (http://www.indexmundi.com/haiti/population_growth_rate.html). This rate of growth, coupled with poor access to family planning, migration to urban areas and little alternative among rural inhabitants but to exploit what remains of the natural resource base, is perhaps the most serious challenge facing WINNER.

WINNER uses a _rolling-design' process that has overall goals, requirements, and results but does not follow a pre-determined or fixed implementation course for the LOP. In

developing new activities for each AWP at the watershed level, the WINNER team gathers information on-the-ground through meetings, workshops, and consultations with key stakeholders groups, and then discusses and agrees on specific activities in work planning workshop sessions. This process also allows for activities to be modified due to changes in beneficiary needs, partner availability, or other unforeseen circumstances.

The following are WINNER program components, with the WINNER Results Framework in Table 1.

Component 1: Livelihoods of people living in the watershed improved through increased agricultural productivity and alternative income generation. Activities focus on improving the sustainability of agricultural practices within the four watersheds through a combination of technical assistance, training, physical infrastructure rehabilitation and extension and procurement of agricultural inputs (including pesticides and fertilizers) to improve yields.

Component 2: Critical infrastructure rebuilt and improved and threat of flooding reduced. Activities focus on the rehabilitation and extension of key watershed and livelihood improvement infrastructure, including erosion control structures, flood control structures, irrigation and drainage systems groundwater recharge infrastructure (i.e., catchment basins), and roads.

Component 3: Watershed governance strengthened. This component focuses on developing and/or strengthening institutional structures to support long-term and sustainable management of watersheds. Sustainable management of watersheds and their resources includes improving and protecting their environmental integrity, and their ability to productively serve the livelihood needs of their residents.

Component 4: Public-Private-Producer Partnerships established. Activities include technical assistance, training, grants, and sub-contracts supporting private sector investment in watershed management and enterprise development initiatives that support livelihood improvement and rural development.

Component 5: Earthquake recovery enhanced through job creation in rural areas and assistance to small business. Activities support a quick boost to increase agricultural production, provide assistance to small businesses, and promote the employment of day-labor in ways that benefit the rural economy.

Table 1: WINNER Program Results Framework

Livelihoods of people living in the watershed improved through increased agricultural productivity and alternate income generation	Critical infrastructure rebuilt and improved and threat of flooding reduced	Watershed governance strengthened	Earthquake Recovery Enhanced
1.1: Sustainable hillside agricultural production increased	**2.1:** Structures that strategically stabilize hillsides & control floods in plains established	**3.1:** Watershed governance structures established	**5.1:** Emergency food provided
1.2: Alternative forms of non-farm livelihoods for hillside farmers identified	**2.2:** Irrigation systems restored	**3.2:** Costs of public works increasingly covered by the watershed population	**5.2:** Temporary shelter provided
1.3: Productivity through better land use management increased	**2.3:** Potable groundwater levels in watersheds increased	**3.3:** Representative governing bodies strengthened	**5.3:** Small business assisted and day labor employed in ways that benefit rural economy
1.4: Agreements between producer groups, MSMEs, and entrepreneurs signed	**2.4:** Critical transportation infrastructure rebuilt and repaired	**3.4:** Policy constraints identified, assessed, and recommendations made in a participatory manner	**5.4:** Quick boost in agricultural production supported
1.5: Income and productivity in lowland agricultural systems increased	**2.5:** Flood warning systems installed and maintained	**3.5:** Participatory watershed management plan created	
1.6: Local organizations strengthened		**3.6:** Sustainably financed, community based NRM of biologically significant sites implemented	
1.7: Competitiveness of value chains strengthened		**3.7:** Participatory disaster management plan for watershed developed	
1.8: Watershed biodiversity restored		**3.8:** Donor coordination in watersheds strengthened	
Public-Private Partnerships Established			
4.1: Public-Private Partnerships for the majority of watershed interventions leveraged			

*Under Component 5, Activity Clusters 5.3. and 5.4 are ongoing, while 5.1 and 5.2 are completed.

The WINNER program is the preferred alternative.

<u>Alternative 2: No Program</u>

In accordance with 22 CFR 216.6(c)(3), this section ―explores and evaluates" the No Program alternative. Without the WINNER Program, 160,000 households that are expected to directly benefit from the program will not receive this benefit. The income of these mostly rural households, which under WINNER is expected to increase by 100%, would remain the same, or may even decrease under this scenario. Given that many of these households rely on natural resources directly or indirectly for income generation,

and that environmental/watershed conditions would continue to deteriorate, agricultural production and incomes of these households would decrease, and rural development would stall or regress.

The 100,000 people who are expected to experience increased incomes from sustainable natural resources management (NRM) and conservation under WINNER would miss out on this benefit. Also, an opportunity to promote sustainable use (versus mining of natural resources), and environmental conservation would be lost under the No Program alternative.

Under the No Program alternative, 50,000 hectares under hillside agriculture that are expected to be under improved management would continue to be exploited using inappropriate agricultural practices. Erosion would continue without control/management measures, making it more difficult for households in upper reaches of watersheds to generate income from on-farm activities. The situation could deteriorate rapidly in severe weather, and erosion and flooding could cause landslides. Activities in the upper reaches of the watershed affect the condition of the lower reaches. The condition of Haiti‘s network of streams and rivers would continue to decline, siltation and debris would dam up streams and rivers, and regular flooding along waterways would result. Topsoil would be washed downstream, and already stressed land would be under additional pressure to produce crops. Yields would continue to decrease.

Under the *No Program* alternative, runoff in critical ravines would continue to get worse since there are few existing intact ravine protection structures. This would not only increase erosion and flooding, but lives, livelihoods, and property would be lost, and natural and cultural resources would also suffer. There would be no flood early warning systems, and the 400,000 people who would benefit from these systems would continue to suffer devastating tolls during floods for which they would remain unprepared.

Under this scenario, the 2000 households that would be assisted to generate income from non-farm activities under WINNER would not receive this assistance. They would not get this boost in income generation.

Significantly, under WINNER, the annual yield of select crops is expected to increase by 100%, which would reduce pressure on scarce agricultural land and reduce the need to convert scarce forest and other habitat to agriculture. Under the *No Program* alternative, conversion of forest and other ecologically important land to agriculture would continue. Under the *No Program* alternative, soil would continue to degrade (erosion and over-use), farmers could be forced to convert non-agricultural land to crop production, they would continue to grow crops on marginal land, eventually Haiti‘s growing population would not be able to be sustained—food insecurity would increase, and farmers would be unable to derive sufficient income from the agriculture sector. Yet alternatives to agriculture under this scenario would remain few.

Biodiversity would suffer in the *No Program* alternative. 75,000 hectares expected to be under improved natural resources management with WINNER would not benefit, and

would continue to deteriorate, and pressure to convert to other uses would continue. In addition, the prospect of bringing 1000 hectares of biologically significant land under improved management would be lost, and continued loss of biodiversity would be expected. Given that Haiti has already lost so much of its biodiversity, and the remaining is of critical importance –islands in a sea of development—this loss could be the tipping point. Concurrently, WINNER will train 1300 people in NRM/biodiversity conservation—building a cadre of conservation professionals; under the *No Program* alternative, Haitian natural resource professionals would remain in short supply.

Under the No Program alternative, biodiversity is particularly at risk. With agriculture activities increasingly taking place on marginal lands, and soil continuing to deteriorate, farmers may pressure government to allow appropriation of protected area lands. As is often the case, when it comes to income generation versus biodiversity protection, biodiversity suffers. This is likely to be the case in Haiti under the No Program alternative.

In the *No Program* alternative, infrastructure, including roads, irrigation and drainage systems, and flood control structures, would continue to deteriorate. 720,000 people that would have benefited from WINNER's infrastructure improvements would continue to deal with deteriorating infrastructure; in many cases, the infrastructure would no longer be useful or used. In the lower reaches of watersheds, floods would continue to damage property and put lives at risk. Irrigation would not be widely available to farmers, and effects of climate change could be exacerbated with farmers facing more frequent and intense droughts. Degraded roads would continue to make it difficult for farmers to reach markets, reducing their post-harvest yields and incomes. Haitians would continue to have shortages of clean, safe drinking water and water-borne diseases would continue to increase; whereas, under WINNER, 140,000 people would benefit from the provision of safe drinking water.

<u>Alternative 3: Biodiversity conservation program</u>
The PEA Team chose a biodiversity conservation alternative to evaluate in the alternatives comparison because it addresses the following issues identified in the Scoping Statement:

- Loss of local flora – tree cutting
- Loss of local fauna
- Sensitive terrestrial or marine ecosystems
- Cultural/historical resources

A secondary reason for evaluating this alternative is that, compared to other program alternatives, it would be expected to have the greatest biodiversity benefits, hence the least environmental impact.

As is common with USAID's biodiversity conservation programs, Alternative 3, the "Watershed Biodiversity Program," will invest funds mainly in protected areas, in other areas of high biodiversity significance, such as mangrove swamps and important bird

areas, and in buffer zones to these areas. Investments will be based on and prioritized by biodiversity significance of the area/site.

Rather than focusing on farmers to increase sustainable hillside and lowland agriculture and incomes (WINNER's approach), this program will focus on alternative income generation for farmers in buffer zones. It will encourage target farmers to move off the land and/or contribute to the protected area system by producing crafts or food, becoming guides for the tourism sector, or becoming security guards for the protected area.

This program will rehabilitate potable water systems in protected areas and in other locations that will serve international and Haitian tourists, and will prioritize watercourse erosion protection based on a waterway's importance for biodiversity. It will strengthen capacity of and procure equipment for protected area management staff, and will rehabilitate infrastructure in protected areas with the aim of attracting increased tourism. Ultimately, these interventions will not only conserve biodiversity, but will also increase economic growth and raise incomes of those associated with the tourism and biodiversity sectors.

Alternative 4: Economic growth program

This watershed management program was chosen as an alternative to evaluate in the comparison of alternatives section because while meeting WINNER's vision and objectives, it also addresses the need for significant job creation and income generation. Although this alternative does not address Scoping Statement-derived WINNER program issues, it addresses significant concerns of the public and the GOH—job creation and income generation.

The ―Economic Growth in Key Watersheds Program" will focus on raising incomes of residents in key watersheds that are prioritized by their capacity to act as engines of national economic growth. Through a competitiveness analysis, this program will identify value chains that, if strengthened, could result in significant, broad-based economic growth. Some value chains will likely be based on agricultural products and include a value-added/processing component. Others may be based on forest products, non-natural resources, or land-based products. Since the focus is job creation and income generation, labor may be hired to protect watersheds (erosion and flood control) especially to show economic growth results in the short-term.

2.3 Comparison of Alternatives

As required by 22 CFR 216.6(c)(3), Table 2 shows, in comparative form, impacts of the proposed WINNER program and its alternatives. Section 4, Environmental Consequences, provides the analytic basis of the alternatives comparison. In keeping with the nature of the PEA, the alternatives comparison (below) and the environmental consequences discussion (Section 4) are at the program level.

Table2: Comparison of Alternatives

(+) positive effect/beneficial; (-) negative effect/detrimental; (0) remains the same (i.e., no effect or same rate of change versus gets progressively worse or better)

Potential environmental issues (identified in the Scoping Statement + added by PEA Team)	Alternative 1: WINNER program, as planned		Alternative 2: No program	Alternative 3: Biodiversity conservation program		Alternative 4: Economic growth program	
	Short	Long		Short	Long	Short	Long
Loss of local flora, tree cutting	-	+	0	+	+	-	-
Loss of local fauna	-	+	0	+	+	-	-
Sensitive terrestrial or marine ecosystems	-	+	-	+	+	-	-
Air quality	-	0	0	-	0	-	-
Soil erosion	-	+	-	-	-	-	-
Water quality-ecosystems	-	+	-	-	+	-	-
Water quantity	-	+	0	0	+	-	-
Local labor	+	+	0	+	+	+	+
Land acquisition	-	0	0	-	+	0	0
Community access to river water and other river resources	-	0	0	-	-	-	-
Worker and public safety	-	+	0	-	0	-	-
Soil, hazardous, and special wastes	-	0	0	-	0	-	-
Water quality for potable water systems (PEA team addition)	0	-	0	0	0	0	-
Groundwater levels (re-inserted by PEA team as a potential issue for irrigation systems that pump groundwater)	0	-	0	0	0	0	(for process-ing, i.e., not for irrigation)
Gender (added by PEA Team: is a concern in most EMPRs)	-	+	0	-	+	-	+
Cultural/ Historical (added by PEA Team: a concern in many EMPRs, and without knowing intervention sites, it is impossible to know if cultural/ historical resources are a significant concern)	-	-	-	+	+	-	0
Maintenance Planning (added by PEA Team: is a concern in most EMPRs)	0	+	0	0	+	0	0

SECTION THREE: AFFECTED ENVIRONMENT

3.1 General

The information below is excerpted from the 2006 USAID/Haiti Country Analysis of Tropical Forestry and Biodiversity (118/119 Analysis), and is included here to give an overall picture of Haiti's biodiversity, as well as the ecosystem changes that have recently taken place. This, along with the watershed-specific baseline information in Section 3.2, is used to evaluate the environmental consequences of alternatives in Section 4.

3.1.1 Ecosystem Diversity

Haiti can be divided in five general ecoregions
(http://www.nationalgeographic.com/wildworld/terrestrial.html
(1) Hispaniolan moist forests
For all of Hispaniola = 17,800 square miles (46,000 km^2) -- about the size of Maryland and Massachusetts combined.
Status: Critical/Endangered
These wet forests originally occupied more than half (~60%) of the original vegetation on the island of Hispaniola, from the lowlands particularly on the eastern coast of the island to the valleys, plateaus, slopes and foothills of the many mountain ranges, up to an altitude of about 2,100 meters. Between the slopes of the eastern range and along the northern range in Haiti, the moist forests are found across the entire island of Hispaniola only lacking distinct presence in the southern extension of the island.

(2) Hispaniolan pine forests
For all of Hispaniola = 4,500 square miles (11,600 km^2- about the size of Connecticut
Status: Critical/Endangered
Pine forests are located on slopes with shallow soils and higher elevations of the mountain systems of Haiti. This ecoregion is mainly found in mountainous areas in small patches, among other areas, in the La Selle massif and in the La Hotte massif and on the Tiburón peninsula. Originally these forests occupied about 15% of the vegetation on the island of Hispaniola and were located primarily on the low montane, from 850 to 2200 meters elevation, and montane, from 2100 to 3175 meters, steppes of the island's principal mountain ranges. This vegetation maintains rich insular flora and fauna, with abundant endemism and relict taxons.

(3) Hispaniolan dry forests
For all of Hispaniola = 6,000 square miles (15,500 km^2) -- about the size of Hawaii
Status: Critical/Endangered
The remaining patches of the Hispaniolan dry forests include dwarf forest on the small northwest peninsula of Presqu'ile Mole St. Nicolas. This habitat has a rich variety of trees and shrubs, including mesquite, gumbo limbo, acacia, lantana, and tamarind marron.

(4) Amapa mangroves
For all of Hispaniola = 2,160 km^2 -- The ocean currents along the coast carrying sediments and fresh water, released by the numerous rivers deposit large quantities of fine grained clay and sediment. These form hundreds of islands and mudflats that are colonized by mangroves along a network of canals.

(5) Enriquillo wetlands
Flooded grasslands and savannas
For all of Hispaniola = 200 square miles (600 km^2) -- about four times the size of Washington DC
Status: Vulnerable
―Jewel from the Sea," known as one of the natural wonders of the West Indies, is a wetland ecoregion that occurs in and around Lake Etang Saumatre in Haiti. It is extremely high in salinity, with a salt concentration of 40 to 90 parts per million.

The nine Holdridge ecological life zones in Haiti are a result of the great variety in topography and climate. Holdridge ecological life zones represent the type of vegetation that would develop without the influence of humans. While human intervention has altered the vast majority of Haiti's ecosystems, life zones are still useful to indicate the general type of managed land use that would be feasible in a given area. The life zones found in Haiti are:

(1) Subtropical Thorn Woodland: Semi-desert conditions, 550 mm of rain, xerophytic forest dominated by dry species. This life zone is typical of the cacti formations of the northwestern peninsula. In the northwest, this life zone includes relatively large blocks of unassigned state land that are sparsely populated, marked by open range grazing, and mined for wood resources.

(2) Subtropical Dry Forest: This is Haiti‘s second largest life zone. It occurs below 400 meters in elevation and is characterized by seasonal drought. This zone can be highly productive where soils are deep and irrigation is available as in the Cul-de-Sac Plain near Port-au-Prince. Typical species are Antillean mahogany (Swietenia mahogany), hogplum (Spondias mombin), Phyllostylon brasilensis and lignum vitae (Guaiacum officinale). Other areas of Subtropical Dry Forest are found along the southern coast, the northwest, northeast, and lower Artibonite.

(3) Subtropical Moist Forest: This is the most extensive life zone in Haiti and supports the majority of small peasant farms and widespread cultivation of mangos and avocados. Almost no natural forest remains in this life zone, most of it having been converted for subsistence farming. Characteristic trees include mahogany, tropical oak (*Catalpa longissima*), and royal palm. This life zone prevails on the Central Plateau and alluvial plains in the north, center, and south.

(4) Subtropical Wet Forest: This zone is found on calcareous soils and covers low-altitude mountain ridges and small mountains along the northern and southern coasts of

Haiti and portions of the Central Plateau. This life zone supports coffee, cocoa, and rubber.

(5) Subtropical Rain Forest: Found on the lower altitudes of the Massif de la Hotte (southern peninsula), in areas of heavy rainfall but not productive for farming, although currently under pressure for conversion to agriculture. This area is highly susceptible to erosion.

(6) Subtropical Lower Montane Moist Forest: Found on mountainous areas such as Kenscoff, 800-2000 meters in elevation. This zone is well-suited for cultivation of potatoes and other vegetables when using hillside conservation structures.

(7) Subtropical Lower Montane Wet Forest: This zone includes most of the remaining pine forest in Haiti and should be protected and managed for sustained production of Pinus occidentalis.

(8) Subtropical Lower Montane Rain Forest: Limited area in the high ranges of La Selle including pines and evergreen broadleaf forest.

(9) Subtropical Montane Wet Forest: Similar to Life Zone number 8.

3.1.2 Forests and watersheds

Haïti is divided into 33 major catchment areas which include over 158 rivers. Among them, four are considered to be transboundary watersheds. The 2006 Biodiversity and Tropical Forest (118/119) Assessment states that the most spectacular watershed unit is represented by the Fleuve de l'Artibonite (the Artibonite River), a 9500 sq. km unit, which is a transboundary basin shared with the Dominican Republic. One of WINNER's target watersheds is a sub-watershed of the Artibonite River.

The 118/119 assessment further states that conservation outside of protected areas is one of the most crucial necessities in Haiti, if rural productivity is to be maintained, let alone increased. According to a national land use capability determination for Haiti, only 30% of Haiti's land area is appropriate for agriculture, and over half of that needs special conservation practices. Another 16% is appropriate for grazing of livestock. The 118/119 assessment also states that, considering soil, climatic, and slope characteristics, 55% of the land area of Haiti should be forested. In 1990, only 600 km^2 were under dense forest cover, which represented only 4% of what should be forested, or 2.2% of the land area. Sixteen years later, in 2006, only 338 km^2 were under dense forest cover. In 2006, 20% of the land area was under sylvo-pastoral conditions (grazed brush land and savanna), and being constantly degraded due to overgrazing and charcoal making. The 118/119 found that virtually no scientific management of forests is practiced in Haiti.

The 118/119 states that watersheds present a logical, topographically-defined land unit on which to base development activities. ―Social, biological and physical parameters interact within a watershed, and should be dealt with in an integrated fashion" (USAID, 2006).

3.1.3 Significant coastal habitats, ecosystems and wetlands

With a coastline of 1775 km, a coastal shelf of 5000 km^2 and five main offshore islands, Haïti's coastal and marine resources include examples of all types of life and geologic structures present in the Atlantic Ocean and the Caribbean Sea. Coastal ecosystems play a crucial role in the production and the maintenance of fisheries and other biological resources important for the human population of Haïti and surrounding islands. The seagrass beds, coral reefs, and forest mangroves constitute predominant features of the Haitian coastline.

Seagrass beds occur along the North Coast, Les Cayes in the South, Gonaives, Les Cayemites, and l'Ile à Vache areas, and are great sources of primary productivity providing oxygen and nutrients to marine species and a means of stabilizing substrates. Coral reefs are distributed along important coastal zones in Haïti. They provide food and shelter for resident and migratory species, provide protection for coastal property, and are a storehouse of potentially valuable species (pharmaceutical and commercial value). Mangrove forests (180 km^2 in 1983) occur on the north and northeast coast (Baie de Fort Liberté, Baie de Caracol and Baie de l'Acul) the Artibonite estuary, Les Cayes, L'Ile à Vache, Gonaives and the Grand Cayemites. They play an important role in the reproduction cycle of numerous coastal and pelagic fish species and provide shelter for their offspring. These species include the pike (*Centropomus undecimakis*) and crustacean species--the prawn and the lobster (*Penaeus* spp and *Panulirus argus*) and mollusks (*Strombus giga*). They are thus considered important from an economic perspective since they are at the center of the fishing industry's productivity.

The mangrove forest habitat holds a rich and diversified fauna of which some representatives are permanent residents while others are seasonal visitors. At least 13 species considered either threatened or seriously in danger of extinction inhabit mangrove forests and lagoons in the country. Among them are the West Indian manatee (*Trichelus manatus*), the American crocodile (*Crocodylus acutus*), the Atlantic sea turtle (*Eretmochelys imbricata*), and the flamingo (*Phaenicophilus palmarum*).

Deltas, estuaries, coastal plains, and coastal lagoons are found along the Haitian coastline. These wetlands provide diverse, renewable natural resources which support mixed traditional economies based on capture fisheries, the use of forest products, and gathering. Grasslands and mangrove forests support useful plants. Coastal lagoons and mangroves are the nursery grounds for many species, both benthic and pelagic. No wetlands have been set aside by the GOH for the purpose of preserving biological diversity.

The 118/119 assessment states that USAID must be vigilant not to indirectly put biodiversity-rich areas under threat by developing an economic base that could threaten them. One habitat particularly vulnerable to increased development is the mangrove and coastal wetland ecosystem. Careful attention must be paid to the possible effects of increased agricultural production (from sediment and chemicals) and exploitation for building materials and fuel. Many of Haiti's watersheds drain into these rich habitats and

development in lowlands, urban hot spots, and hillsides can have unintended impacts (USAID, 2006).

3.1.4 Fauna

Haiti has a rich fauna with more than 2000 species of vertebrates of which 75% are considered endemic. Two native mammals are known to occur in Haïti: the Haitian Hutia (*Plagiodontia aedium*) and the Giant Island Shrew: the Nez long (*Solenodon paradoxus*). Both are considered endangered and likely extirpated over much of their native range. Bats are the most diverse native mammals with 17 species. Aquatic mammals include the West Indian manatee (*Trichecus manatus*), the West Indian monk seal, the sperm whale, the pilot whale and dolphin species.

Very few current studies have been conducted in Haïti on the distribution of avifauna. Approximately 236 bird species are estimated to be present on Hispaniola; 25% are considered endemic. Two hundred seventeen species of reptiles and amphibians are known to occur on Hispaniola; approximately 70% of this diversity has been recorded in Haïti. Ninety-eight percent are endemic to Hispaniola with about 33% of the species occurring only in Haïti.

3.1.5 Haiti's Protected Areas

The decree of 1968 created ―Parcs Nationaux" and ―Sites Naturels" under joint administration by the Ministry of Agriculture (MARNDR) and the Office National du Tourisme (currently under the Ministry of Trade). The official creation of ―Parcs National Naturels" was a decree published on June 23, 1983, setting aside Morne La Visite du Massif de la Selle (3000 ha) and Morne Macaya du Massif de La Hotte (2000 ha). Six additional natural sites were later declared as ―Parcs National Naturels": The only national park within WINNER proposed intervention zones is La Visite National Park, comprising about 2,000 ha; Pic Macaya National Park covers about 5,500 ha; and La Citadelle, Sans Souci, and Ramiers National Parks have about 2,200 ha. The first two parks were declared because of their importance in protecting watersheds that are crucial to downstream agriculture, as well as to conserve Haiti's biological heritage. However, the GOH dedicates no budgetary resources to management of these parks.

The USAID/Haiti 118/119 analysis provides recommendations for biodiversity and tropical forest conservation, including a watershed-level recommendation which WINNER specifically addresses:

- Develop and implement planning and management tools/guidelines and other appropriate mechanisms to prepare integrated watershed and coastal area management plans and to promote environmentally sound practices and forms of land-use, watershed management, and coastal development
- Support and develop best practices or methods in forest management and create reforestation areas in strategic watersheds of the country;

- Promote sustainable management of inland water ecosystems and integrated watershed and coastal management; and
- Support catchment afforestation and revitalization of farming systems with an aim to increase forest cover and arrest soil degradation through production of seedlings, tree planting, agroforestry, and soil conservation practices with the full involvement of communities.

3.2 Physical, Biological, and Human Environment in the Proposed WINNER Intervention Zones

The affected environment/baseline discussion below is from WINNER's Work Plan, March 2010-May 2011, except where noted.

3.2.1 Cul-de-Sac Watershed (Riviere Grise and Riviere Blanche)

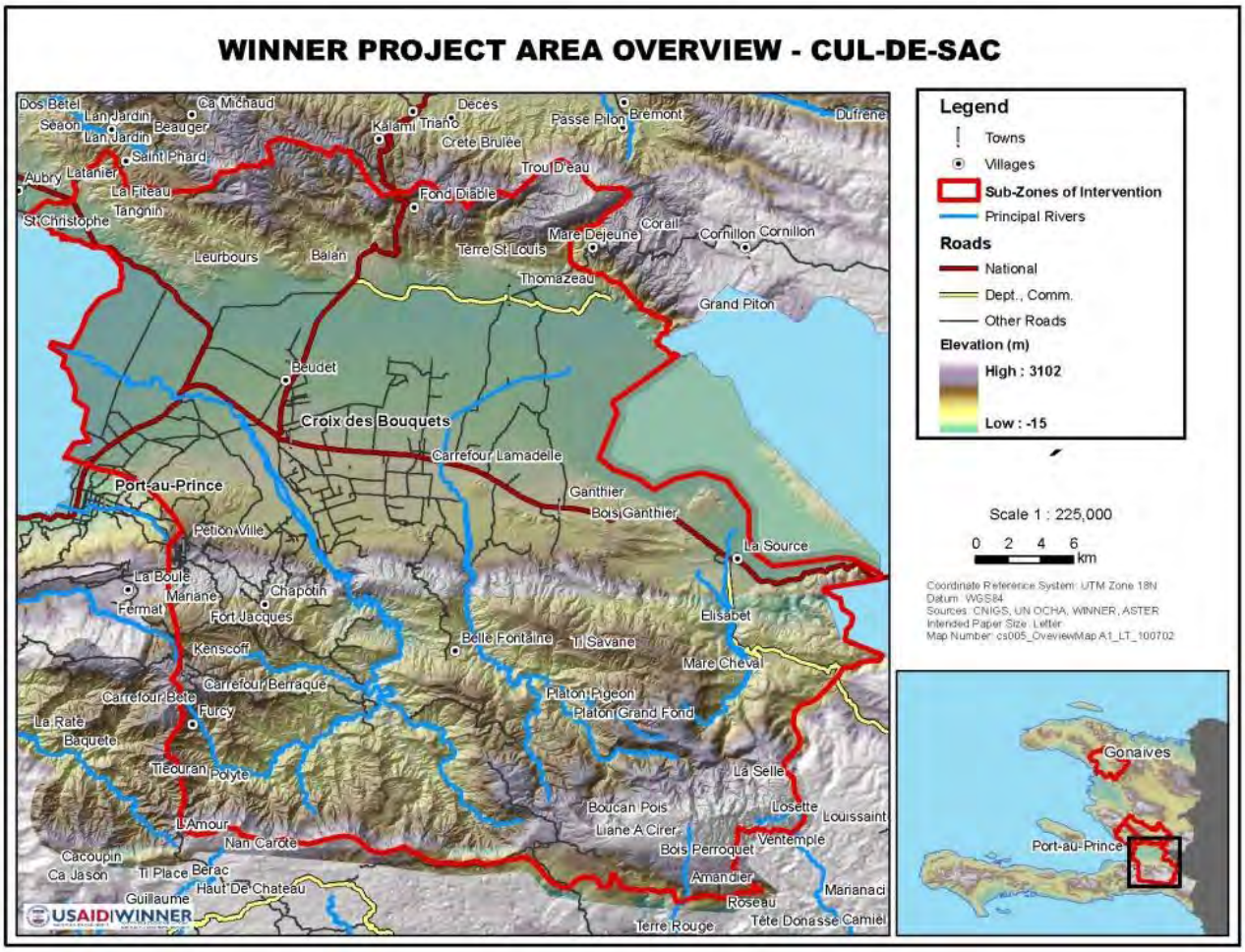

Figure 1: Map of Cul-de-Sac Watershed

The increasing threat and frequency of disastrous floods since 2004 has greatly influenced the development priorities of the GOH and foreign assistance by the major donors during this decade. The *Environmental Vulnerability of Haiti* ranked the Cul-de-

Sac watershed, among 54 watersheds, as the most important watershed in Haiti for *population vulnerability*, primarily due to the dense urban population in the Grise River floodplain. It also ranked highest in terms of the road vulnerability index.

Biophysical Context

Geography and topography. The Cul-de-Sac watershed extends to the east of the capital of Port-au-Prince. The northern divide is the Chaine of Matheux oriented northwest/southeast, and the southern one is the Massif de la Selle oriented in a west/east direction. The principal rivers that comprise the Cul-de-Sac watershed are the Rivière Grise and Rivière Blanche. The eastern limit of the watershed is Lac Azuei close to the Dominican Republic border.

The Cul-de-Sac watershed originates along the Chaine de Mathieu and Massif de la Selle. The high elevation areas of the La Selle chain are among the steepest slopes in Haiti and extremely vulnerable to soil erosion and landslides. These areas are being cultivated or exploited for wood resources that expose the slopes to increased rates of runoff and downstream flooding.

Climate. The climate is sub-tropical. Rainfall within the watershed is primarily influenced by both the orientation of the mountain ranges and their elevation. In general, the western and southern exposures are more arid (Cabaret, northern and western Cul-de-Sac) due to the rain shadow effect of the easterly trade winds. Rainfall ranges from 850 mm/year in the dry lowlands to 1700 mm/year in the upper elevations of the Massif de la Selle. Distribution of rainfall is bimodal, with most of the rain falling during the months of April-May and August-November.

The southern peninsula of Haiti is the most vulnerable region in the country due to hurricanes and tropical storms. The floods resulting from these storms caused the disasters of 2004-2008. Factors such as climate change that warm the ocean and affect sea levels, storm surge levels, rainfall amounts and hurricane intensities increase the danger of flooding and loss of life and infrastructure.

Soils and hydrology. Most of the soils in the watershed are derived from calcareous sedimentary rock of various geological age and time since emergence from the ocean floor. The alluvial plains are fertile, but vulnerable to salinization due to evapotranspiration exceeding rainfall, poor drainage and irrigation systems, and depletion of groundwater reserves. The flows of the major rivers have become more erratic with a marked increase in the frequency of disastrous flood conditions due to deforestation, urbanization, agriculture, mining of rock, sand, and soil for construction especially in high elevation and along rivers and other land uses that have increased runoff rates and decreased base flows. Soil erosion and sedimentation of water bodies, including the coastal marine environments, is extremely high. Furthermore, increased runoff rates negatively impact recharge of groundwater reserves.

The major hydrological features of the Cul-de-Sac watershed are the sub-watersheds of the Grise and Blanche rivers and the brackish lakes of Trou Caïman and Lac Azuei.

Additionally, there are minor watersheds that originate along the Chaine de Matheux and the eastern region of the Massif de la Selle.

Ecosystems and natural habitats. The drier ecosystems, characterized as subtropical dry forest and thorn scrub, are the most important vegetation types in the watershed. These are followed by subtropical moist forest and lower montane moist forests. The dry forest is characterized by *Bursera simaruba*, native thorny trees and shrubs, cacti, grasses and forbs on the slopes and *Prosopis juliflora*, Acacia, and cacti species in the plains. These forests transition to subtropical moist forests beginning at elevations 300-400 m on north facing slopes and at about 800 m on the drier south and east facing slopes. Dominant tree species are broad-leaved hardwoods such as *Catalpa longissima*, *Swietenia* mahogany, *Mangifera indica*, and *Persea americana*; the royal palm, *Roystonea borinquena*; and a high diversity of shrubs and forbs. Above elevations of 1000 m begins the lower montane moist forest as characterized by the native *Pinus occidentalis* mixed with hardwood species. Pine becomes the dominant species at the higher elevations above 1500 m. La Visite National Park, forming part of the southern boundary of the Cul-de-Sac watershed, is a remnant of the former vast range of *P. occidentalis* along the Massif de la Selle, extending eastward to the Dominican Republic.

The natural habitats of the watershed have been highly altered by agriculture, mining, urbanization and other forms of human activity. Very little of the original natural ecosystems remain – the patches that remain are highly fragmented and heavily impacted. The PEA Team witnessed the significant pollution and degradation of the Riviere Grise watershed during their site visits (see photo).

Riviere Grise section in Port-au-Prince

The most significant biological areas remaining within the Cul-de-Sac watershed are along the north-facing escarpment of the Massif de la Selle, Lac Azuei and its surrounding dry forest systems, and remnants of original forests on the steeper slopes along the tributaries of the Grise and Blanche rivers.

Among the numerous wildlife species represented in the watershed are the Hispaniolan Amazon, American crocodile, black-capped petrel, rhinocerus iguana, Caribbean coot, West Indian whistling duck, Hispaniolan parakeet, white-necked crow, palm crow, Hispaniolan crossbill, and the Hispaniolan hutia. Many of these species are threatened or endangered.

Deforestation. Data compiled by the Bureau of Mines and Energy show that charcoal is still the cooking source of energy for more than 90% of the families through the huge 1,800,000 inhabited metropolitan area. In the absence of a policy on land use and of environment enforcement police in the countryside, that creates an unregulated incentive to deforestation. Added to that, the widespread conversion of forests to agricultural, coupled with steep slopes, has resulted in unsustainable rates of soil erosion and extremely high rates of runoff. The slopes are chronically disturbed through grazing, fires to clear the land for annual gardens, and invasion of grasses. The conversion to lands dominated by grasses leads to increased fire frequencies, soil desertification, exhaustion of soil fertility, and irreversible biodiversity loss.

Socio-economic Context

Population size. The population of the Cul-de-Sac watershed, based on the most recent census and adjusted to watershed boundaries, is slightly greater than one million. From 1998 to 2003, the eastern Cul-de-Sac region lost about 35% of its population. Recent trends, based on 2008 data, indicate that the urban areas of the Cul-de-Sac watershed are expanding at annual growth rates of 6.1% and the rural areas are declining at annual rates of -2.4%. Following the earthquake in January 2010, there was significant shifting of the population, both within the watershed from urban to peri-urban and rural areas, and from the Cul-de-Sac watershed to other areas of Haiti.

Livelihoods. Income levels are very low by international standards due to a lack of income-generating jobs. Non-agricultural jobs are scarce due to the limited financial resources of business and the insolvency of the consumer base. Agriculture is one of the most important economic sectors, but a considerable number of other small enterprises exist within the watershed. The most common are small commerce (e.g., *madan sara*, grocers) and trades (carpentry, masonry, woodworkers, tailors, artists, taxi drivers and retailers). Unfortunately high demand for charcoal continues to increase the rates of tree cutting or deforestation in the target areas. Fishing is an important livelihood along the coast and at the two lakes within the watershed, Trou Caiman and Lac Azuei.

Crops. Agriculture and animal husbandry are the main economic activities of small farmers. Crop yields in the mid- to upper elevations of the watershed are low--less than 30% of the national average. The main agricultural crops of the foothills and the uplands are cereals (corn, sorghum), legumes, fruits, and vegetables. In the dry zones, the principal cash crops are beans, sweet potato, millet, and Congo peas. Vegetable production for the urban market (onion, cabbage, potato, carrots, beets, leeks, pepper) is an important feature of the wetter high elevation gardens. In general, livestock (mostly goats and cattle) and charcoal making are more important in the drier lowland areas.

Irrigated lowland crops are dominated by banana and vegetable staples such as spinach, okra, shallot and tomato.

Land tenure. The land tenure situation in the watershed is characterized by a mosaic of small private landholdings, generally less than one hectare. Most of the landholdings are not formally established.

Public infrastructure. The infrastructure necessary to improve economic development in the Cul-de-Sac watershed is either lacking or in a serious states of disrepair, particularly the roads and irrigation systems. Most of the rural areas of the watershed are completely inaccessible to feeder roads. The PEA Team travelled along many of these roads, and can verify that feeder roads are in poor shape; many villages are connected by trails rather than roads. Irrigation and drainage canals have suffered from decades of neglect, thus making it impossible to intensify agriculture, increase agricultural productivity, increase employment opportunities and offer opportunities for agribusiness in the Cul-de-Sac plain.

3.2.2 Cabaret/Arcahaie (Matheux, Courjolle, Torcelle and Bretelle Rivers)

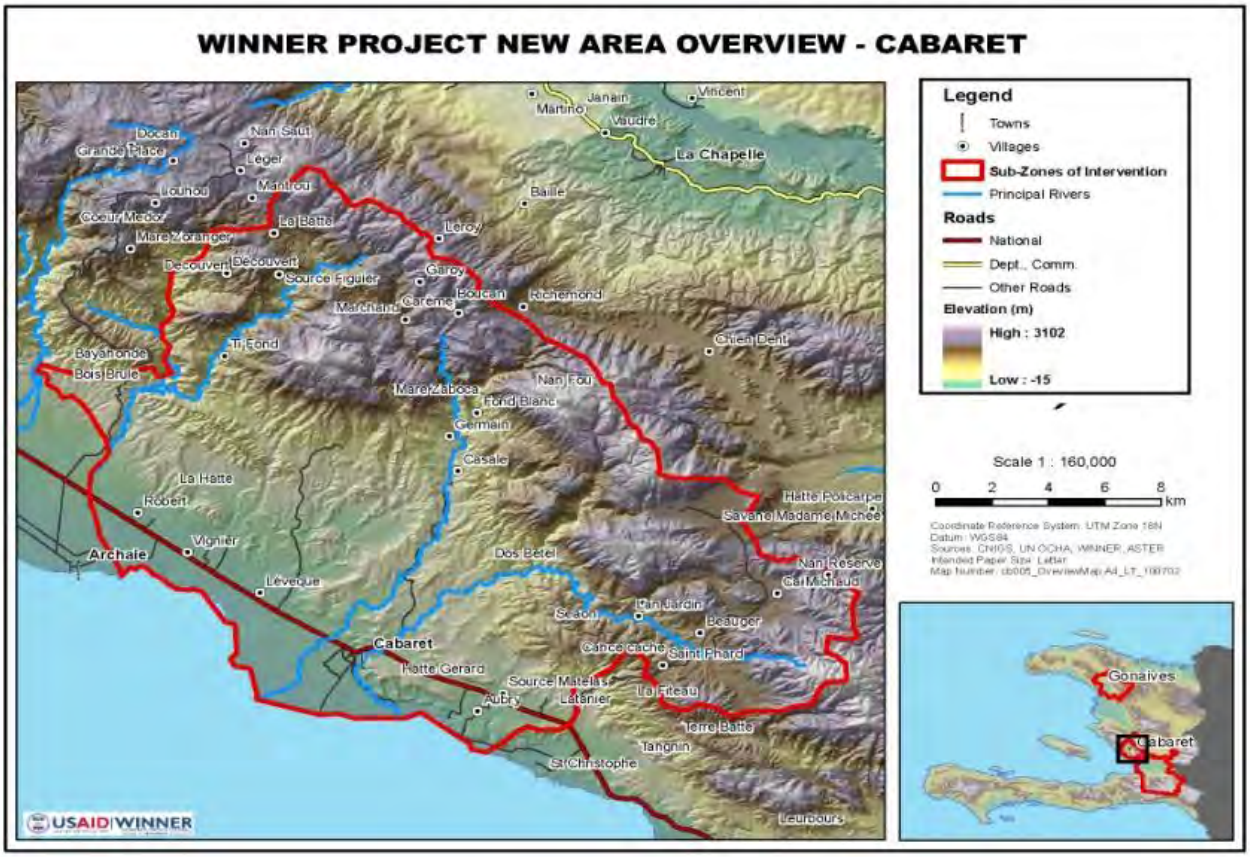

Figure 2: Cabaret Watershed

Bio-physical Context

Geography. The zone of intervention in Cabaret-Arcahaie is composed of two communes, Arcahaie and Cabaret; together these form the arrondissement of Arcahaie. The two communes share a geographic configuration as well: a coastal plain bordered by the Matheux mountain range. The Arcahaie arrondissement is situated 40 kilometers from Port-au-Prince. It is bordered on the northwest by the commune of Saint Marc, to the north by Verettes, and to the northeast by the commune of Mirebalais. To the east, Arcahaie is bordered by Croix des Bouquets and to the south and west by the sea. The dividing line between the two watersheds is the Matheux mountain range that runs northwest to southeast.

Climate. The climate is semi-arid with an average annual rainfall of 100 mm. There are two main seasons: a dry season running from the end of November to the middle of April, and a rainy season from April to November, with 80% of the annual rainfall coming in the rainy season. The average temperature is 27o C. The mountainous ecosystems receive a significantly higher rainfall and have lower average temperatures.

Soils and hydrology. The majority of soils in the watershed are composed of sedimentary limestone rock. The alluvial plains are fairly fertile. The area above the national highway includes more rock, which is deposited by water runoff. Below the national highway, the soils are finer, with more of a limestone/clay mix and a tendency for flooding closer to the coast due to poor drainage.

The watershed is characterized by a vast network of rivers and ravines concentrated in a relatively small area. The principal waterways are: Matheux, Courjolle, Torcelle, and Bretelle rivers. Each river has its source in the high reaches of the Matheux mountain range. These four main rivers and eight ravines form the watershed of Arcahaie, which is composed of several sub-basins. The flow of the rivers diminishes significantly in the dry season.

Inhabitants of the plains of Arcahaie and Cabaret live under the constant threat of flooding caused by hurricanes and tropical storms. The urban center of Cabaret was heavily damaged by recent disasters that have hit the country. The degradation of the Bretelle riverbanks from slash and burn agriculture has increased the risk of flooding.

Agro-ecological zones. There are three major agro-ecological zones in the watershed:

- An irrigated zone with heavy soil with a tendency for flooding in the coastal zones
- A dry zone composed of dry plains and dry piedmont including the valley zones between the mountains and the alluvial plain
- A humid zone consisting of the mountain peaks of the Matheux and the plateaus

The natural habitats that are found in the watersheds have been profoundly impacted by agriculture, urbanization, and other human activity. There is little remaining of the original ecosystems. In the Cabaret watershed, the most important remnants of mangroves and native coral reefs are found along the coast of Source Matelas on the way

to Cabaret, and still constitute important marine wildlife habitat. There is a large sub-tropical forest parcel, estimated at approximately 100 hectares, in the area of Casale, near the watershed of the Torcelle River. These zones, as well as other biologically significant areas, particularly those with high concentrations of endemic species, merit particular attention in watershed management planning.

Socio-economic Context
Population. According to the most recent census (published in 2003), the watershed has approximately 166,100 inhabitants, with close to 28% living in urban areas. The population density is 265 habitants per km^2. In 1982, the population was 106,822, an increase of 36%.

Livelihoods. Income is relatively low in the region. There are four main areas of economic activity in the watershed: agriculture, herding, commerce, and fishing. More than 80% of the population is involved in the agriculture sector, and pressure on the land is very high. Agriculture and livestock are the main economic activities of smallholders. The majority of farms are smallholders, more than 70% are less than one hectare, and 55% are less than 0.6 hectare. Employment in the agriculture sector is limited due to production techniques, erosion of hillside land, and little maintenance of agricultural infrastructure on the plain.

The irrigated perimeter in Arcahaie/Cabaret includes a potential 6600 hectares of land, with only 5800 currently irrigated. In the irrigated plain, plantain is the primary crop, usually planted in rotation or in association with other crops, such as beans, tomatoes, and manioc. In the drier areas, the main crops are cereals, such as maize and sorghum, Congo beans, potatoes, and melon. In more humid mountainous areas, market vegetables and beans are grown. Almost all commercial products are sold on the local market in Cabaret, Sources Matelas, or Arcahaie. The piedmont and mountainous zones have very low productivity.

There are many important small businesses in the watershed. The most common are petty traders such as *madan saras*, and tradesmen such as carpenters, masons, drivers, and artists. Fishing is also an important revenue source in the coastal areas.

3.2.3 Gonaives Watershed (La Quinte river)

Biophysical Context
Geography. The Gonaives Watershed covers an area of 692 km^2 and is situated in a relatively protected area south of the northern mountain ranges, west of the higher plateau and bordering the Gulf of La Gonâve. The major city of the region is the harbor town of Gonaives which lies 150 km north of Port-au-Prince. Administratively, the catchment area lies in the department of Artibonite and includes areas of the following communes: Gonaïves, Ennery, Gros Morne, l'Éstère, Marmelade, Saint Michel de l_Atalaye, and Terre Neuve. The highest point of the catchment area has an altitude of 1460 meters. The watershed is split into six main catchment areas: Ennery, La Branle, Bassin Mangnan, Bayonnais, and the plain of Gonaives, which includes the Savane Desolée. The plain of Gonaives is an alluvial plain created by the La Quinte river.

Climate. The watershed is classified as arid to semi-arid and the majority of the mountains are considered dry mountains. Rainfall is variable, ranging from a yearly average of about 500 mm around Gonaives to more than 1,900 mm in the mountains at the rainfall station of Plaisance. There are two dry seasons, from November through

April, when the rainy season starts sporadically and in July. Farmers in the area note patterns of drought every six years. The entire basin is undergoing a process of desertification and environmental degradation (soil erosion, particularly erosion of the critical topsoil layer, evaporation of surface water, and tremendous ravine expansion).

The Gonaives watershed is exposed to climatic extremes such as hurricanes and tropical storms that bring heavy floods on one hand, and periods of severe drought on the other. Cyclones bring strong rains, which due to low vegetative cover and timing, generate flash floods. Frequently, these floods follow periods of severe drought. When drought is followed by heavy rains, fragile soils wash away and water rushes towards lowland areas with catastrophic impact.

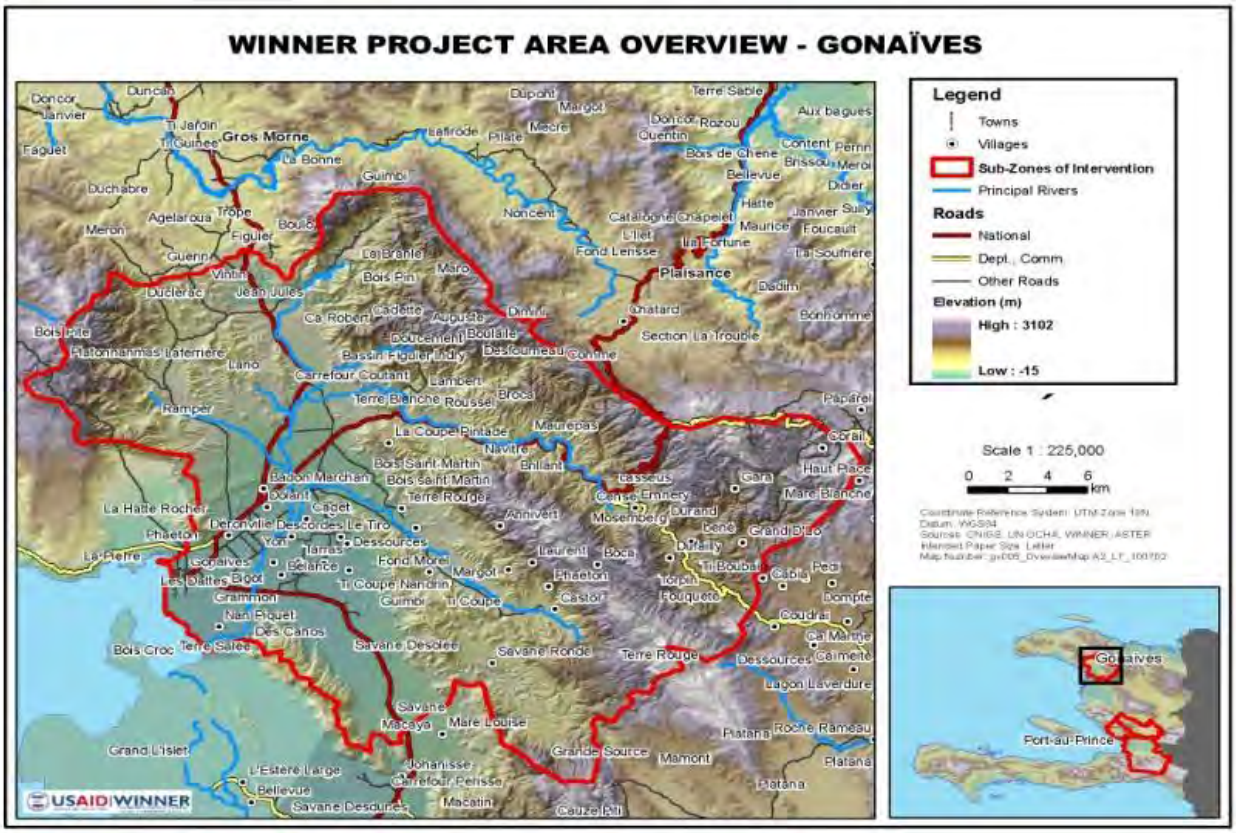

Figure 3: Gonaives Watershed

Soils and hydrology. The soils in the watershed have been developed from the two main geological formations found in Haiti: limestone and basalt. The soils on the hillsides are in general of little depth, but soils of the Gonaives plain, the river banks, and the Savane Carré are deeper and considered good for agriculture.

Runoff in the Gonaives catchment area has historically been relatively low compared to other areas of Haiti. This is probably because a large part of the watershed and most of the Ennery catchment area, sits on a karstic limestone which permits high infiltration.

La Quinte River has overflowed its banks several times during the last decades, especially during the extraordinary floods of September 2004 (Tropical Storm Jeanne) and September 2008 (Tropical Storms Hannah and Ike), which have caused significant losses in human lives (3,000 and 600 respectively) and infrastructure damage in the city of Gonaïves and surrounding areas. Twenty year estimates indicate 150 to 250 cubic meters per second flow from the various sub-watersheds to the Gulf of Gonaives. Minimal structures are in place along upstream ravines to slow down the flow of water to the plain and encourage water to percolate through the soil. Downstream, the sudden inundation can be life threatening, critical infrastructure can be wiped out, and sediment blocks irrigation canals—exacerbating the situation.

Ecosystems and natural habitats. A range of ecological zones are found across the watershed. At higher elevations, sparsely wooded areas and small arid woodlands are found; at low elevations, lowland plains and mangroves are present. About 92 species of trees, shrubs, and grasses are present. Common trees include prosopis, acacia, chêne, cassia, bois blanc, lucaena, and neem. Mango, avocado, citrus, chadek, and coconut palm are the most common fruit trees grown. Of note, widespread degradation of the landscape has left very few areas of natural habitat to support an already low species diversity and richness typical of arid regions.

The mangroves along the shoreline north and south of Gonaives are perhaps the most biologically significant habitat of the area, supporting estuaries vital to the health of local and national fishing industries. Rhizophora mangle and Avicenia germinans (red mangrove and black mangrove respectively) are the most common trees found in this zone.

Socio-economic Context

Population. Approximately 260,000 people live in the watershed—a population density of about 376 people/km^2, which is higher than the national average. The population growth rate is 2.5%/year. People live mainly in towns, near roads, and in areas favorable to agriculture; about half of the watershed is sparsely populated. There is a considerable amount of population movement and migration toward urban areas and the Dominican Republic, and sprawl on the agriculturally significant land on the outskirts of Gonaives.

Livelihoods. Gonaives and the surrounding watershed once had a thriving economy, based on coffee, cotton, and copper mining. But the economy has been severely affected due to physical disasters and the inability to keep up with market changes.

Agriculture and livestock are the main economic activities; other income generating activities include informal commerce, charcoal making, and small trades. In the humid mountain areas, the production system is agro-forestry, mostly based on coffee, staple crops (sorghum, corn, Congo peas), and vegetable gardens (garlic, shallot, hot pepper, eggplant, and spinach). In the dry mountains, the system includes arboriculture (mango, avocado), agro-sylviculture, and staple crops. Cattle production is found in the humid mountains whereas in the dry mountains and dry plains goat production predominates. Throughout most of the watershed, free-range cattle production is practiced. Agricultural

products are sold at either the dozen local markets or markets in Gonaïves, Cap Haïtien, Saint-Marc, and Port-au-Prince. Limited access to credit is a leading inhibitor to further economic growth.

Land tenure. The average size of land holdings is 1.42 ha. There are an estimated 2,500 ha of irrigated perimeters, which are situated in six communal sections. Farming by owners is more common than by renters and sharecroppers. Purchasing is the most common way of getting access to land, with 55% of land acquired this way, about 29% through inheritance, and 16% through joint ownership.

Basic services. Access to basic services is very limited in the communal sections of the watershed. Potable water systems have been repeatedly destroyed by flooding. In a few localities, people use spring water, but in many communal sections, people walk several kilometers to get water for drinking, cooking, bathing, and washing.

For the most part, communities do not have access to electricity. The main energy source is charcoal, which has played a major role in degradation of the natural resources and loss of biodiversity. Broken potable water systems and no electricity also create challenges to economic growth. Services such as health services, shelter, education, leisure, and sports are insufficient.

The road network serving communities in the watershed is in poor condition, often affected by landslides and rock slides. In several places, some sections of road are seriously threatened by ravines and rivers. The condition of farm-to-market roads is an extreme impediment to economic growth.

Destructive practices. Poor land use practices exacerbate effects of excessive runoff. Goats graze freely on the hill slopes eating newly planted trees; farmers slash and burn their land before cultivation, particularly on steep slopes, and do not use soil management systems, leading to low fertility; trees are burned for charcoal particularly on steep slopes which leads to more landslides and blocked irrigation canals.

The main causes of drainage problems are construction in low-lying areas (former marshlands); inadequate drain dimensions or no drains at all; obstruction of drains by uncontrolled construction; and sediment deposits where the drains enter the sea The PEA Team witnessed all of these. The drainage system across the watershed is also weak, as it consists of a mixture of ravines and rivers which are both subject to heavy erosion.

3.2.4 Mirebalais/Saut d'Eau (La Tombe, Gascogne, Janleba, Fer-à-cheval rivers of the Artibonite river system) watersheds

Geography. The communes of Mirebalais and Saut d'Eau, respectively 330.87 km^2 and 176.9 km^2, are located in the Center Department, Lower Central Plateau in the southeastern section of the Artibonite watershed. They are considered a crossroads linking various other communes of the Central Plateau with Port-au-Prince and the Artibonite Valley. Mirebalais is bordered on the west by the commune of Saut d'Eau, on

the east by the communes of Lascahobas and Savanette, on the north by the communes of La Chapelle and Thomonde, and on the south by Croix-des-Bouquets and Thomazeau. The watershed is composed of four communal sections: Crête-Brulée, Gascogne, Sarazin and Grand Boucan, and has a population density of 230 inhabitants per km^2.

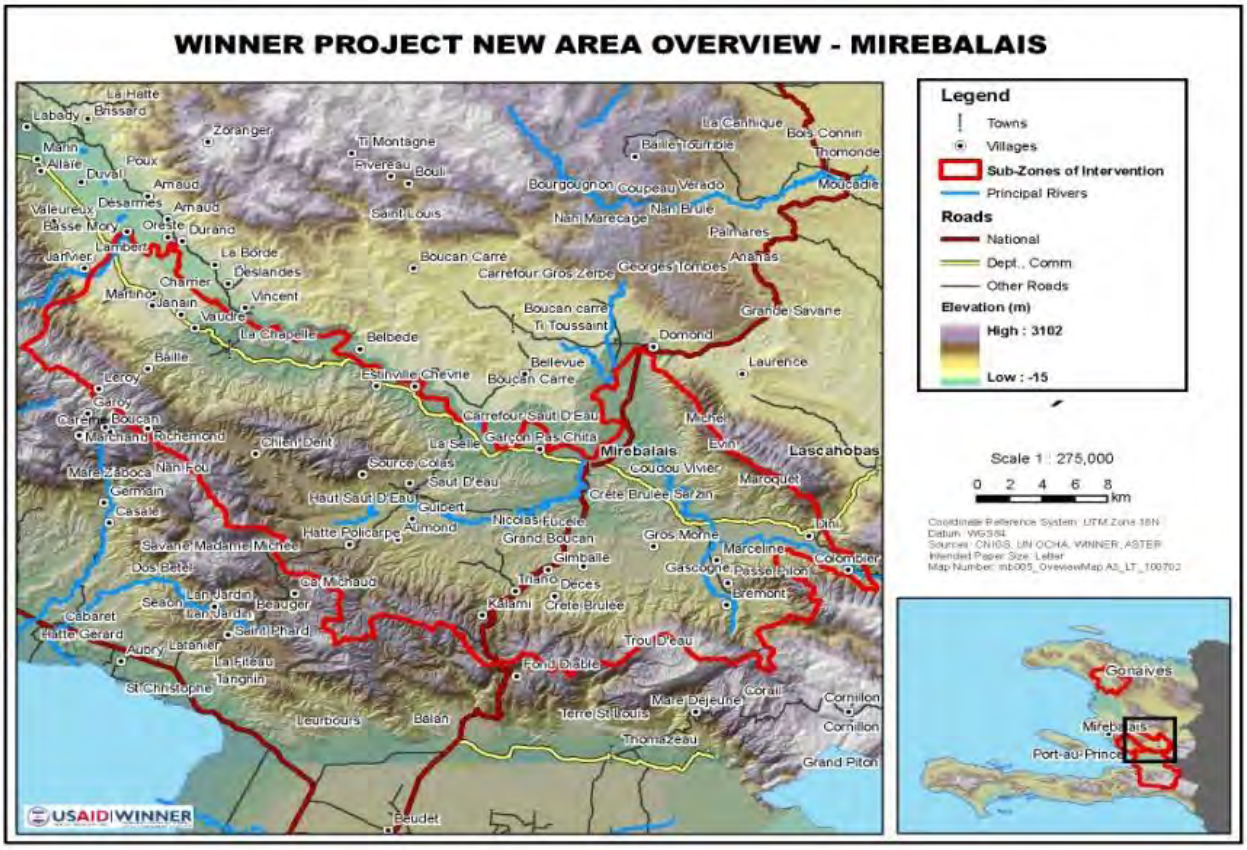

Figure 4: Mirebalais Watershed

Climate. Mirebalais has a relatively hot climate with an average annual temperature of 25oC and 1731 mm of rainfall. There is one rainy season from April to October (with a break in June) and one dry season from November to March. At a higher altitude, Saut d'Eau is cooler than Mirebalais but also has two distinct seasons: a rainy and a dry season, which occur at the same period as Mirebalais.

Soils and hydrology. Twenty-one streams and one river cross the commune of Mirebalais, the most important ones being La Tombe, Gascogne, Janleba, Fer-à-cheval, and the *Artibonite river*. The commune has 32 ponds, 126 springs, and four hillside lakes. Water shortages are common in areas like Fond Cheval in Grand Boucan, and Doco in Crete Brûlée since the few springs that exist are at some distance from the population. Saut d'Eau is crossed by one principal river, La Tombe. It also has several springs which irrigate hundreds of hectares of land.

A number of water courses crisscross the commune of Mirebalais and have a sizable flow of water that can flood arable land during seasonal rains. Frequent and repeated flooding results in landslides and loss of human and animal life. In Saut d'Eau, flooding has resulted in destruction of physical infrastructure, and even more serious destruction downstream in Cabaret and Arcahaie.

Agro-ecological Zones. The commune of Mirebalais has four large agro-ecological zones:

- A zone of semi-humid hills and foothills (Grand Boucan). There areas are at an altitude of 300 to 600 meters with slight to moderate slopes of 5 to 30% and annual rainfall between 800 and 1000 mm. The main crops are corn, sweet potato, and manioc.

- A zone of arid hills at an altitude of 300 to 600 meters and annual rainfall of 400-800 mm (Crête Brûlée). Vegetation adapted to the dry conditions includes plants such as bayahonde. The cropping systems involve corn during the rainy season and sorghum in the dry season.

- A zone of dry plains at an altitude of up to 200 meters and slopes of less than 5% (red pond/Sarazin). This region has the same vegetation as the arid hills. The main annual crops are corn, sorghum, and manioc.

- A zone of irrigated plains (Boyer, Desvarieux) at an altitude of less than 200 meters with modest slopes. These plains have a natural vegetation of forest trees (campeche, oak, etc.) and fruit trees (mango, avocado, etc.). The main annual crops are sugarcane, banana, plantain, and beans.

Some farmland damaged by erosion is now completely unusable. Erosion caused by hard seasonal rains widens riverbeds by creating silt deposits on cultivated land. The soil becomes less fertile, which leads to a considerable reduction in yields and soil productivity.

Deforestation. Intensive deforestation comes from the systematic cutting of trees for construction (especially young trees for scaffolding), furniture-making, and for firewood and construction. Charcoal production and use of wood as an energy source in the processing of spirit, artisanal sugar, or rapadou are among the main reasons for deforestation in Mirebalais and Saut d'Eau. This also affects most of the water sources. The Gascogne and Montagne Terrible sections benefit from more dense vegetation compared to other completely denuded sections of Grand Boucan, Crête Brulée, La Selle and Riviere Canot, but even there, deforestation will increase if no corrective measures are taken.

Socio-economic Context

Population. According to the *Institut Haïtien de Statistiques et d'Informatique* (IHSI) 2003 census (in the WINNER 2010-2011 AWP), Mirebalais has a population of 76,194

inhabitants. About 84.5% live in rural areas. The earthquake has created a large displaced population and severely disrupted the economic and social infrastructure. Hundreds of displaced people have moved to the area.

Livelihoods. Agriculture is one of the most important economic sectors for the communes of Mirebalais and Saut d'Eau. Specifically, crop and livestock production are the principal economic activities of small farmers. Livestock production is mainly at the household level and not integrated with agriculture, especially on the hillsides. In the plains, however, there is use of draught animals, manure as a fertilizer, and harvest residue for animal feed. Most farmers raise goats and the poorest use goats as savings accounts. Goats can be sold during food shortages, at the beginning of the school year, or to cover unforeseen expenses.

Agricultural processing and handicrafts are additional sources of income for many families in both communes. Small trades such as masonry, sewing, carpentry, sawmilling, welding, and blacksmithing are also practiced. Tourism is important in Saut d'Eau, where the waterfalls attract hundreds of thousands visitors (mostly nationals) every year, with a peak in July-August.

Land tenure. Land tenure is unstable in this area. More than 60% of land does not belong to those who work that land, which helps explain why anti-erosion practices are rarely used.

Services. Roads serving farming areas are very fragile and become impassable during the rainy season, increasing the risk of losses, especially for perishable products. The result is that the standard of living, which is already at a precarious level, is even lower during the rainy season.

3.3 Institutional & Legal Framework

3.3.1 Haitian National Legal and Administrative Framework

Land use regulations are scattered among many texts.

<u>At the regional level</u>:
An Outline decree on environment management adopted on October 12, 2005 prescribes that the government prepares and implements:

(i) a national land use scheme and
(ii) master plans for improving and managing the environment in each watershed or water district of the country (SDAGE, Schemas Directeurs d'Aménagement et de Gestion de l'Environnement).

These regulations must be established with due considerations to the economic, ecological, social and administrative conditions and policies. The watershed management master plans are legally binding once validated by the affected municipal assemblies (Article 31).

Since December 2005, the government is undertaking to structure a Biosphere Reserve to integrate (i) the biodiversity rich wetlands of the Cul-de-Sac Plain, (ii) a biological corridor that links the two protected areas of cloud forests of Massif La Selle to their counterparts on the other side of the frontier in the Bahoruco together with (iii) the rivers, waterfalls and beaches of the arrondissements of Belle-Anse and Jacmel, in the South-East department

For urban areas:
Article 39 of the same regulation states that there must be a national master plan for human settlements with a view to promote access to basic infrastructures and services for the population. This plan must give due consideration to environmental constraints.

Articles 41 and 42 establish that municipalities must, alone or in groups, prepare and implement urban development and sanitation master plans and that the government must provide them with all required assistance in preparing these regulations.

Unfortunately, no such documents have been prepared yet.

Any person who wants to lease a property or to build upon it must, according to the decree of March 1971, request a permit from the municipal administration. In such occasion, he has to submit the land surveyor report with information to identify the exact location of the site as well as detailed blueprint sets of the planned construction. It is stated that the municipalities have up to one month to assess the documents and that, in so doing, should request technical assistance from the Ministry of Public Works. There is significant evidence that this system does not function as proposed.

At the national level, there is an Office for Land Registry but it is under-equipped and not represented in some parts of the capital and, erratically - according to availability of funding provided by specific short-term projects - in some other places.

For rural areas:
According to The Rural Code of 1962, any deforestation or clearing of land is forbidden on lands with a slope of more than 30 degrees in arid areas (750 mm or less of mean annual rainfall), 40 degrees in semi-arid areas (between 750 and 1,350 mm of mean annual rainfall) and 50 degrees in moist areas (more than 1,350 mm of mean annual rainfall) and those that are found not in accordance to that norm, must be planted with forest, perennial cultures or pastures (Art.63,64).

It also states that:

- soil conservation structures must be established on all lands with a slope of more than 10 degrees to be planted for seasonal, annual or semi-perennial productions (Art.69),
- forest or perennial cultures must be established and maintained on a 15 meter wide buffer zone along all river and ravine banks and around all water springs. This is to be applied without consideration for land tenure (Art 76, 77 and 186)

The Outline Decree of October 2005 transfers to the National Police and to the Minister of Environment, the responsibility for managing the corps of forest rangers that was previously under the Ministry of Agriculture. It also transfers to the municipalities the responsibility of reporting petty offences related to bad management of solid wastes.

EIA requirements

The Outline Decree of October 2005 introduces in the Haitian legal corpus, the obligation to conduct environmental impact assessments for policies, plans, programs, projects and activities that could impact the environment and it states that the stakeholders must be informed and have the opportunity to express their opinion on the impacts and the mitigation measures contemplated. Besides that, it calls on another regulation to detail the procedures (Art.56 through 60).

Water quality

Quality of water offered as potable water is regulated by the newly established *Direction Nationale de l'Eau Potable et l'Assainissement* (DINEPA—Bureau for Potable Water and Sanitation). Currently, it refers to norms established by the World Health Organization.

3.3.2 USAID Environmental Procedures (22 CFR 216)

USAID activities are subject to environmental procedures (22 CFR 216) that are based on the EIA process mandated in the US National Environmental Policy Act (NEPA). These environmental procedures require preparation of an EA or PEA to assess potential adverse environmental impacts of USAID-funded activities for which an IEE includes a *positive determination*.

The purpose of a USAID EA (22 CFR 216.6(a)) is to ―provide the Agency and host country decision-makers with a full discussion of significant environmental effects of a proposed action. It includes alternatives which would avoid or minimize adverse effects or enhance the quality of the environment so that the expected benefits of development objectives can be weighed against any adverse impacts upon the human environment or any irreversible of irretrievable commitments of resources."

The EA (or PEA) is subject to the approval of the relevant Bureau's Environmental Officer, and once approved, conditions (mitigation measures) are required to be implemented and reported on by the proponent.

SECTION FOUR: ENVIRONMENTAL CONSEQUENCES

4.1 Environmental Consequences of Alternatives

In accordance with 22 CFR 216.6(c)(5), this section forms the analytic basis for the comparison of alternatives in Table 2. Based on their potential to cause environmental impacts, WINNER (the preferred alternative) is compared in the discussion below with the No Program alternative, the Biodiversity Conservation Program, and the Economic Growth Program. Section 4.2 is a detailed discussion of WINNER impacts at the activity level; while this comparison of the environmental consequences of the alternatives is at program level.

The comparison of alternatives discussion at the programmatic level fits the watershed approach, where activities are planned, designed, and implemented at the watershed level; each activity is part of, and contributes to a bigger ―whole." The program-level alternatives discussion and impact evaluation provides the big picture, rather than a piecemeal impact evaluation discussion.

WINNER, as planned vs. *No Program Alternative*:

Scoping Statement: Significant Issues	**WINNER as planned**	**No Program alternative**
Flora and fauna	Impacts to flora and fauna are mainly short-term, as a result of construction. Longer term impacts to flora and fauna are expected to be positive: • WINNER is expected to improve the condition of flora and fauna by protecting the upper and lower reaches of target watersheds from erosion and devastating floods (Cluster 2.1); by improving land use management (Cluster 1.3); and by restoring watershed biodiversity (Cluster 1.8), including facilitating PPPPs (Component 4) in areas of biodiversity importance, particularly the conversion program to LPG for bakeries and dry cleaners (activity 4.1.2).	Loss of flora and fauna will continue at a rate similar to the current rate and the condition of habitats and ecosystems will continue to decline until there are no viable habitats available for wildlife and there is no potential for sustainable use of natural resources (building material, fuelwood, charcoal, etc.).
Sensitive terrestrial and marine ecosystems	Could be affected in the short-term due to construction, mainly as a result of erosion along stream and riverbanks. Longer term effects are expected to be positive due to WINNER's erosion and flood control (Clusters 1.1 and 2.1) and watershed biodiversity restoration efforts (Cluster 1.8) and to the establishment of PPPPs (Component 4) that will support biodiversity. Sensitive ecosystems will also benefit by WINNER's support for alternative livelihoods (Cluster 1.2), which is expected to relieve some of the pressure on natural resources. Ultimately, participatory watershed management plans (Cluster 3.5), if implemented and provisions enforced, will help protect areas of significant/sensitive biodiversity.	are expected to suffer disproportionately to other ecosystems (agro-ecosystems and other already disturbed ecosystems): • Mangroves, marshes, and estuaries suffer from degradation (erosion, improper land use) in the upper reaches of the watersheds; • Intact tropical forest only exists in protected areas in the upper reaches. Except for some exceptions in protected areas, remaining ―sensitive" ecosystems are already fragmented, degraded, and polluted, and important biodiversity exists as islands. • With so many perturbations (pollution, erosion/sedimentation, fragmentation, over-harvesting, etc.) already compromising sensitive ecosystems

Scoping Statement: Significant Issues	WINNER as planned	No Program alternative
		(see Section 3), the rate of degradation would be expected to increase until the destruction of the ecosystem becomes inevitable.
Soil erosion and water quality (water available for ecosystems)	will improve under WINNER with only short-term impacts (construction phase) expected: • WINNER Components 1 and 2 will directly address soil erosion and water quality challenges. • Cluster 2.2, irrigation systems restored, directly addresses water quantity issues for crop production. • Component 2, cluster 2.3, potable groundwater levels in watersheds increased directly addresses water quantity for human consumption. • Component 3 will provide a framework that will help to sustain WINNER's efforts.	will continue to be a significant problem and water quality will continue to deteriorate: • currently there are few intact erosion control measures in place throughout the watersheds and this contributes to sedimentation, which degrades ecosystem water quality. • There will be no improvements in the availability of clean, safe drinking water. • no change in water availability for crop production, and Haitian farmers will be at the mercy of the weather, which, with global climate change, is expected to grow more unpredictable, and severe weather episodes are expected to increase, including droughts.
Local labor…	benefits from WINNER in the long and short-term: • Infrastructure improvements (Component 2) and earthquake recovery (Component 5) directly address the need to provide jobs to local people. • income generation opportunities at middle levels will also be made available: Cluster 1.2 (alternative forms of non-farm livelihoods), Cluster 5.3 (small businesses assisted, and Component 4, PPPs established address the need to create additional jobs beyond primary production and menial labor.	will not benefit. For the poor and less educated, very few jobs will be available—the existing condition will continue.
Groundwater levels	may decrease due to Cluster 2.2: irrigation systems restored. Restoring these systems may drawdown the groundwater levels (See Section 4.2 for an activity-level discussion). Although not directly addressing the same areas, groundwater levels will be increased by WINNER's Clusters 1.1 and 2.1, which will slow water flow, allowing more water to percolate to groundwater.	would remain unaffected.
Gender	would be positively affected under WINNER: • For infrastructure activities, many of the laborers are female (about 50%); for maintenance (long-term effects), the proportion of women to men laborers are expected to be the same as during construction. • Petty traders (madan sara) will benefit from the improvement of rural roads (cluster 2.4) and • Mothers and their kids will benefit from the	There would be no change

Scoping Statement: Significant Issues	WINNER as planned	No Program alternative
	increased availability of potable water (cluster 2.3)	
Cultural/historical resources	could be affected over the short and long-term of WINNER: • construction could damage or unearth resources, and without a plan to preserve them, they could be destroyed. Construction at a site of cultural/historical importance could permanently destroy the significance of the site. These potential impacts are described, and mitigation proposed under the activity-level discussion in Section 4.2	may be unaffected; although as with any infrastructure, there is a chance cultural/historical resources could deteriorate or be destroyed in severe flooding.
Hazardous and other waste material	Construction activities may unearth hazardous and other waste material: • Cluster 2.1, establishing structures to stabilize hillsides and control floods in plains, is especially of concern, in particular where work is being done in contaminated watercourses. Disturbance of bottom sediments could disturb hazardous substances that would otherwise remain bound to soil particles (under the *No Program* alternative). • Disturbance of areas adjacent to rivers and streams may also unearth hazardous substances. Other waste material will be generated by earthmoving involved in any construction of this type: • Cluster 2.4, critical transportation infrastructure rebuilt will create waste material. • Clusters 2.1, flood and erosion control structures, and 2.2, irrigation systems restored, involves cleaning canals/drainages, and waste material will result. • Besides proper disposal of waste material (Scoping Statement issue), the location where fill material is obtained is a concern under the WINNER program as planned.	this is not a concern under the *No Program* alternative
Potable water	Additional sources of potable water will be made available (Cluster 2.3), and the water quality of these can only be determined through testing and monitoring—without these measures, negative impacts could result (see Section 4.2 for the activity-level discussion and proposed mitigation).	Would be obtained from existing sources, and water-borne illnesses would continue.

The WINNER program proposes a significant amount of infrastructure rehabilitation; without a maintenance plan, infrastructure could rapidly deteriorate, and the situation could become made worse without WINNER (No Program alternative). Maintenance is already part of the WINNER design (Clusters 1.6, 3.1, 3.2, and 3.3); this is discussed in greater detail in Section 4.2.

WINNER program as planned and Alternative 3, Biodiversity Conservation Program: Under the Biodiversity Conservation Program, there would be less construction involved than under WINNER, and therefore, short-term negative impacts to flora, fauna, and sensitive ecosystems from construction activities would be minimal. From start-up of the Biodiversity Conservation Program, positive effects to these resources would be expected.

Groundwater levels under WINNER as planned could be negatively affected (as a result of Cluster 2.2); whereas under the Biodiversity Conservation Program, they would be unaffected. The illustrative Biodiversity Conservation Program would not restore irrigation systems, thus would not draw down groundwater levels.

Cultural/historical resources under the Biodiversity Conservation Program would be positively affected; whereas under WINNER as planned, negative impacts (discussed above under No Program) could result.

WINNER program as planned and Alternative 4, Economic Growth Program: Long-term negative effects from Alternative 4 on flora, fauna, sensitive ecosystems, soil erosion, air quality, and water quality could be expected to result from the focus on economic growth. These could be mitigated, and typically, in environmentally sound economic growth projects would be mitigated. However, the positive effects on the watershed from WINNER's interventions in erosion and flood control in particular would not result under Alternative 4—the positive effects on water quantity, quality, and soils would not accrue to the population under this alternative. For example, if economic growth includes agriculture production intensification without WINNER, agriculture is not likely to be sustainable. Soil and water resources necessary to support agriculture production will continue to be depleted at increasingly higher rates. The positive effects on local labor would probably be greater under Alternative 4 than under WINNER as planned, and a more affluent population could be expected to support environmental conservation, and importantly, would transition away from earning incomes from agriculture and natural resources, reducing some of the pressure. However, these types of attitude and behavior changes are slow to evolve; given the pressure on Haiti's resources, positive effects on biodiversity are needed in the immediate-term.

An additional alternative, a combination of economic growth and biodiversity conservation: From the above discussion, an additional alternative could be considered, a combination of biodiversity conservation and economic growth. This alternative would provide a balance—rather than a sole focus on economic growth or on biodiversity conservation. Essentially, this is WINNER, but WINNER has the overarching watershed focus and therefore approaches biodiversity conservation and economic growth from a watershed perspective. Without "fixing" the deterioration in watersheds, it is unlikely that biodiversity conservation alone, economic growth on its own, or in combination would be successful.

As shown above, under the *No Program* alternative, watersheds will continue to deteriorate, the population will continue to suffer from severe weather episodes, and employment will continue to be stagnant.

Under Alternative 3, biodiversity would be expected to be conserved, but benefits would likely not be sustained since the population would continue to suffer from flooding, hurricanes, and other climate-related affects; some may move to cities, but increased incursions into protected areas would be expected as people are forced to move or to obtain resources there. Section 3 lays out the big picture and the significant deterioration of Haiti‘s natural resource base, and its impact on livelihoods. That discussion emphasizes that without addressing livelihoods, it is unlikely that a focus on biodiversity conservation would be sustainable. The Biodiversity Conservation Program would be expected to *more positively* benefit biodiversity than the WINNER program as planned. However, in the current environment, a focus purely on biodiversity conservation in Haiti without seriously addressing livelihoods (income generation as well as erosion control and flood protection) may backfire, and may not have the long-term benefits that a more general approach, such as WINNER would have. An externality is that WINNER has a significant budget, and Haiti‘s biodiversity sector would be unlikely to absorb it over the LOP.

Alternative 4 would provide much-needed jobs, income, and economic growth, but biodiversity would continue to suffer, and watersheds would continue to deteriorate.

The preferred alternative, WINNER as planned, would result in some adverse impacts, most of which are short-term, and all of which could be mitigated. Given the above analysis, WINNER remains the preferred alternative, but mitigation must be incorporated. A cluster-by-cluster environmental impact assessment is included in Section 4.2, and mitigation is proposed to address the general concerns noted above and the activity-level impacts described below.

Cumulative Impacts
The Council on Environmental Quality (US) regulations defines cumulative impacts as ~~"th~~e impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…" (40 C.F.R. § 1508.7).

WINNER Activity Cluster 3.5, *Participatory watershed management plan created*, will help ensure that all activities within a watershed are included in and are in compliance with the plan. The plan will take into account past, present, and reasonably foreseeable future work in the watershed, and it will help ensure that cumulative impacts are positive with an overall benefit to the watershed and to the environment. Activity Cluster 3.8, *Donor coordination in watersheds strengthened*, will also help ensure present and reasonably foreseeable donor activities complement WINNER and vice versa; and that any past projects are taken into consideration in design, planning, and implementation. While donor coordination is already occurring, WINNER‘s support in this Cluster is expected to improve the current situation. For example, the cleaning and repairing of the Bigot and Bienac drainage canals (Gonaives watershed) was being undertaken by other donors; WINNER is now completing the project along downstream stretches. Without WINNER‘s intervention, the upstream work could have resulted in an increased risk of flooding (the drain would have been cleared to a point long the channel, and not below, so water, sediment, and trash would have had no outlet, would have backed up and flooded). When the other donors began this work, there was not enough funding to continue the work downstream. Donor coordination—within the auspices of the watershed management plan—will ensure that during project planning, activities proposed for the entire watershed are

discussed and coordinated, and where funds may be a constraint, other donors can be called upon to intervene so that projects are not left incomplete (as in the above example).

WINNER's support for participatory watershed management plans provides the framework for managing cumulative impacts; this should help ensure that even beyond WINNER's LOP, cumulative impacts on the environment will be positive.

In addition, WINNER has hired a Biodiversity Specialist, who will oversee implementation of the Programmatic Environmental Management Plan (PEMP for all WINNER components. This is a program-level mitigation measure that is intended to minimize the potential for adverse environmental impacts and enhance positive effects across all components.

4.2 Environmental Consequences of WINNER Activity Clusters

This section contains an assessment, by WINNER program component and activity cluster, of the expected impacts, including any adverse effects that cannot be avoided, short and long-term impacts, direct and indirect effects and their significance, and any irreversible or irretrievable commitments of resources. Mitigation measures to minimize adverse environmental impacts are described in the tables (Mitigation Plans) at the end of each component. WINNER Activity/Team Leaders are responsible for implementation of the Mitigation Plans.

The descriptions of the activity clusters cover ongoing activities (from the 2010-2011 AWP) and illustrative future activities to be implemented over the LOP of WINNER. The impact assessment draws heavily on existing EMRs, EMPRs, and EAs; several of these were ―ground-truthed" during the PEA Team's site visits. The activity clusters described below may be implemented in any or all four WINNER target watersheds over the LOP. Some of the activities fall under more than one cluster. For ease of assessment, activities under each cluster are categorized by (1) technical assistance, training, studies/assessments, procurement; (2) *infrastructure and other physical interventions*; and (3) other.

4.2.1 Component 1: Livelihoods of people living in the watershed improved through increased agricultural productivity and alternative income generation

This component supports Haiti's agricultural production intensification campaigns.

Description of Cluster 1.1: Increase sustainable hillside agricultural production

Training, technical assistance, studies/assessments, and procurement: support the operation of CRDDs to serve as training centers; provide technical assistance, extension services, and training to farmer associations in support of agricultural campaigns; train master farmers to serve as the extension agents for farmer associations; train and provide technical assistance for Rural Extension Agents (REA) to carry out demonstrations in conjunction with master farmers; conduct studies on local producer groups' strengths and weaknesses; conduct assessments of local agronomy and land use practices; and procure soil testing kits, train in their use, and conduct soil testing for demonstration plots and master farmers' plots.

Infrastructure and other physical interventions: build or renovate structures to serve as CRDDs; and manage demonstrations sites to promote appropriate agricultural packages for farmer associations.

Environmental Consequences of Cluster 1.1: USAID's Environmental Procedures specify that training and technical assistance except to the extent they directly affect the environment may be categorically excluded from further environmental review; studies, analyses, and document transfers may also be categorically excluded. Procurement of soil fertility kits, training in their use, and conducting soil fertility testing will have no direct or indirect environmental effects, and therefore, no mitigation is needed. Other training and technical assistance (TA) under Cluster 1.1 may have environmental effects. Training and TA for master farmers and REAs to improve agricultural production on hillsides, by design, includes mitigation: training and TA includes information on best practices for soil conservation, good on-farm water management/drainage, and flood control. However, the training/TA could indirectly result in conversion of natural vegetation and ecosystems to agriculture, and could have other unintended consequences if appropriate safeguards are not included. Training and TA may also include provision of information on pesticides and fertilizers which could have health and environmental impacts; training/TA on these topics requires mitigation to ensure no adverse effects result.

CRDDs are relatively small buildings, usually less than 10,000 ft.^{2}, which will either be renovated to create a CRDD or a new structure will be built. Regardless, environmental impacts could result. Even though this would be considered small-scale construction, impacts depend in part on the location of the CRDD. Provision of water, sanitation facilities, and power may also result in environmental impacts. Already conducted EMPRs of CRDD rehabilitation and construction show that expected impacts from small-scale renovation and construction are minor and easily mitigated, and that there is a standard set of potential impacts and mitigation measures (these are standard for most small-scale construction that also involve provision of water, sanitation, and power). Besides the mitigation measures included in the EMPRs, USAID's Environmental Guidelines for Small-Scale Activities contains useful mitigation for small-scale construction (See Mitigation Plan, Table 3 below).

Managing CRDDs to serve as demonstration sites to promote appropriate agricultural packages could result in environmental impacts: while the impacts directly at the demo sites would be minor, the information provided, through appropriate agricultural packages, could have far-reaching results—and cumulative impacts. Mitigation is incorporated into this cluster (studies of local agronomy practices and land uses), and in cluster 1.3, which includes studies on appropriate land uses on hillsides. However, the agricultural packages must incorporate findings of these studies—the studies and clusters must be integrated, or environmental impacts could result from promoting agricultural practices without adequate safeguards.

Description of Cluster 1.2: Alternative forms of non-farm livelihoods for hillside farmers identified

Training, technical assistance, studies/assessments, and procurement: provide grants to new or existing input supply stores to procure agricultural supplies, materials, initial stocks of seeds, fertilizers, pesticides, and tools and light equipment; provide TA to input supply stores to

develop business plans; survey non-farm opportunities; and identify processing opportunities for local products.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 1.2: Grants to input supply stores to procure agricultural inputs, supplies and materials could have environmental impacts. Procurement of pesticides, including seeds treated with pesticides, could have health and environmental impacts at the shopkeeper level and for the farmers who procure the seeds and pesticides. Any procurement of treated seed and pesticide products requires mitigation (for USAID, a special environmental study is required, see Table 3). Procurement of fertilizer also could result in environmental and livelihood impacts. While USAID's Pesticide Procedures apply only to pesticides, not to fertilizers, agri-supply shops that will receive fertilizer, should be equipped to provide recommendations to farmers for safe use—mitigation is needed to minimize the potential of environmental and livelihood effects of fertilizer procurement and use.

TA to develop business plans, surveying non-farm opportunities for hillside farmers, and identifying processing opportunities will not have direct or indirect environmental impacts. Support for non-farm opportunities and for processing is discussed under component 4, Public-Private-Producer-Partnerships.

Description of Cluster 1.3: Productivity through better land use management increased

Training, technical assistance, studies/assessments, and procurement: conduct assessments/studies of appropriate zones for tree planting; train local producers and natural resources management organizations in appropriate land use management with the aim of increasing production while protecting natural resources; provide TA and training in the use of SRI (rice intensification system—has the potential to double yield with limited inputs and low water utilization); and provide technical assistance and training in the use of post-harvest equipment and technologies.

Infrastructure and other physical interventions: establish tree nurseries for distribution and planting and distribution by producer organizations; plant income generating trees and vegetables on agricultural land using seedlings from WINNER-supported nurseries; and establish vetiver nurseries.

Environmental Consequences of Cluster 1.3: Assessments and studies of appropriate zones for tree planting will have no direct environmental impacts. Tree planting is then expected to be undertaken in line with findings of the assessments; therefore, positive effects are expected—an indirect benefit of the assessments and studies.

Training in appropriate land use management including protection of natural resources is itself a mitigation measure (i.e., it is the mitigation measure recommended to minimize potential impacts of Activity Cluster 1.1, see Table 3 below).

Training in the use of SRI, however, could result in potential impacts, even with the safeguards included in the training (low water utilization, for example). Rice cultivation that results in conversion of natural areas (upland or lowland, including wetlands) to agriculture would have negative environmental impacts—natural habitat/ecosystems/vegetation would be converted to an agro-ecosystem, which is less diverse and less able to withstand perturbations. This converted land would no longer provide benefits that natural systems provide, especially to wildlife, but also to the environment in general, including the human environment. Mitigation is needed to ensure that this training activity does not lead to conversion of important habitats/ecosystems.

Training in post-harvest equipment and technologies could also have environmental effects—although many post-harvest technologies would be expected to be harmless to the environment, the use of pesticides as a post-harvest protection measure would have environmental and health effects, and mitigation is needed.

Tree nurseries are small-scale (they will be similar to the nursery the PEA Team visited in Kenscoff), and the small size of the nursery disturbs little if any natural vegetation. Tree seedlings produced will be based on assessments/studies of appropriate zones for tree planting (included in this cluster of activities)—essentially, the studies are the mitigation measures that will ensure seedlings produced by the nurseries are appropriate for the zone. These tree seedlings will be provided to farmer associations, who will be encouraged to plant and care for them. Nurseries and planting of tree seedlings produced by them should have only positive effects on the environment as long as the trees are appropriate—as WINNER intends through this cluster. Vetiver is also used as a mitigation measure, to minimize soil erosion along banks and on seriously eroded hillsides. WINNER encourages the planting of vetiver to reduce erosion, and uses it in riverbank stabilization activities. The establishment of vetiver nurseries, as with the tree seedling nurseries, will be small-scale and will disturb a very small area of, natural vegetation, if any. The use of vetiver is considered a mitigation measure to minimize soil erosion and to attenuate flooding.

If pesticides will be procured, used, or recommended at tree seedling and vetiver nurseries, human and environmental impacts could result. Mitigation is required prior to the procurement or use of pesticides (see Table 3).

Description of Cluster 1.4: Agreements between producer groups, MSMEs, and entrepreneurs signed

Training, technical assistance, studies/assessments, and procurement: provide technical assistance to support the establishment of agreements between shipping companies, processors, and producer groups.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 1.4: This activity cluster involves TA and training to strengthen key value chain components so that the producers, MSMEs, and entrepreneurs have the capacity to fulfill PPPP agreements. TA and training may be in business and financial planning, access to credit, etc.—this type of TA and training, focused on improving business

skills, will have no direct or indirect environmental effects. TA and training may also be in the use of improved technologies from production to harvest to processing. This type of TA and training could result in environmental impacts, for example, if pesticides and fertilizers are promoted, and if processing methods that are not environmentally sound are recommended. While the actual (and illustrative) PPPP agreements are described and impacts are assessed and mitigated under Component 4, when the actual agreements are formed, the preliminary TA and training (under this cluster of activities, before the agreements are signed) could have negative environmental impacts if environmental safeguards are not incorporated into this cluster.

Description of Cluster 1.5: Income and productivity in lowland agricultural systems increased

Training, technical assistance, studies/assessments, and procurement: operate CRDDs to serve as training centers to train master farmers, farmer associations, and REAs so that they are equipped to assist in the agricultural campaigns; provide testing kits, and train in soil survey and fertility tests; promote appropriate agricultural practices packages to farmer associations—packages may include provision of crops and/or systems-specific technical advisory services; establish community-based agri-supply stores including development of business management plans and procurement of quality seeds, fertilizer, and other inputs, equipment and material; and conduct diagnostic studies of producer groups, local agronomy, land use practices, crop cycles, etc.

Infrastructure and other physical interventions: build or renovate structures to serve as CRDDs; carry out demonstrations at the CRDDs.

Environmental Consequences of Cluster 1.5: As described for Cluster 1.1, which is similar to this cluster, but works with upland CRDDs and focuses on hillside agriculture systems, training and TA except to the extent they directly affect the environment is typically considered to have no direct effect on the environment, and no additional environmental review or mitigation is required. Studies, analyses, and document transfers are also treated in this fashion. As such, procurement of soil fertility kits, training in their use, and conducting soil fertility testing will have no direct or indirect negative environmental effects, and therefore, no mitigation is needed. Other training and TA under Cluster 1.5 may have direct environmental effects: training and TA for master farmers and farmer associations in appropriate agricultural practices will include mitigation messages such as best practices for soil conservation, good on-farm water management/drainage, and flood control and retention of natural vegetation. However, training/TA in appropriate agricultural practices could have other intended consequences if appropriate safeguards are not incorporated. This training and TA may also include provision of information on pesticides and fertilizers, which could have health, environmental, and livelihood impacts; training/TA on these topics requires mitigation.

Business plans and other assistance in financial and business management for agri-supply shops will have no direct or indirect environmental effects. However, procurement of seed, fertilizer, and other inputs, including equipment could affect the environment. Procurement of equipment that could be used to harvest trees could result in deforestation/timber harvesting, thus will be avoided; procurement of pesticides and fertilizer could have health, environmental, and livelihood impacts.

The CRDDs are relatively small buildings, usually under 10,000 ft^2; despite their small size, the renovation or the construction of these physical structures could have negative environmental impacts. Provision of water, sanitation, and power may also result in environmental impacts. Already conducted EMPRs of CRDD rehabilitation and construction show that impacts from small-scale renovation and construction are predictable, and easily mitigated.

As above (Cluster 1.1), managing CRDDs to serve as demonstration sites to promote appropriate agricultural packages could result in environmental impacts. Mitigation is incorporated into this cluster (studies of appropriate land uses). However, the agricultural packages must incorporate findings of these studies or environmental impacts could result from promoting agricultural practices without adequate safeguards.

Description of Cluster 1.6: Local organizations strengthened

Training, technical assistance, studies/assessments, and procurement: develop the Expert-Junior Program in Agronomy and Management by selecting and training young professionals who will be hired by private enterprises, NGOs, and farmer associations to fill technical or administrative gaps; implement scholarship program with University of Florida; establish and/or strengthen leadership of water user associations, who ensure the sound management of irrigation systems rehabilitated by WINNER; establish or strengthen potable water management committees to undertake maintenance, collect fees, and to manage the system; establish community-based feeder road management committees, and train members to maintain roads and collect fees; develop and distribute training and communication materials in irrigation, potable water, and agricultural supplies and feeder road management; expand and organize producer groups around WINNER objectives with environmentally conscious mandates; and raise awareness of farmer groups about WINNER principles of environmental protection.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 1.6: Development of the Expert-Junior Program and implementation of the University of Florida scholarship program will have no direct or indirect environmental impacts; no mitigation is needed.

To some extent, establishing or strengthening water use associations, potable water management committees, and feeder road management committees can be considered mitigation for the PEA Team's "lack of maintenance" concern (that renovated roads, potable water systems, and irrigation systems will not be maintained, which could result in greater environmental impacts than if rehabilitation or construction never took place). However, if the committees and associations are trained only in aspects of maintenance and not simultaneously trained in environmental and health safeguards, adverse effects could result. For example, if potable water committees are not trained in proper water quality monitoring and testing, the management of the system by the committee could have indirect effects on human health. This is also the case if they are not trained in water conservation methods and the implementation of these methods. For irrigation systems, without proper training in maintenance and water conservation, management of the system by the water user association could have indirect effects on the environment—

water will be wasted, fields could become waterlogged, resulting in increased incidence of pests and diseases, failed crops, and the need for pesticides to control disease and pests.

Production and distribution of training and communication material in irrigation, potable water, agricultural supplies, feeder road management, would be considered –document transfers," unlikely to have environmental impacts. But without appropriate safeguards, environmental and health impacts could result. In particular, for training and communication material about agricultural supplies, if information on pesticides and fertilizer use is included, indirectly, this could result in environmental and health effects; mitigation would minimize concerns (see Table 3).

Description of Cluster 1.7: Competitiveness of value chains strengthened

Training, technical assistance, studies/assessments, and procurement: survey value chains; provide technical assistance and training to improve efficiency of the value chain covering topics such as post-harvest handling, crop protection, processing, and waste reduction; improve organization of market vendors, including helping to develop a management plan that will address sanitary issues; set up an SMS extension and market information service to provide well-targeted and extension and market information on a continuous and timely basis; provide technical and financial support for small agricultural products processing units (see Component 4); and provide technical and financial support for animal production improvement in regions where cattle and goat production currently occur and is a traditional income generating activity (see Component 4).

Infrastructure and other physical interventions: rehabilitate rural markets

Environmental Consequences of Cluster 1.7: Surveying value chains and setting up an SMS extension and market information service will have no direct or indirect environmental impacts. No further environmental review or mitigation is needed.

Providing technical assistance and training on topics such as post-harvest handling, crop protection, processing, and waste reduction could have environmental impacts: if pesticides/fertilizers are recommended health, environmental, and livelihood impacts could result; TA and training in processing could indirectly result in the production of waste products; TA and training in waste reduction methodologies –an integral part of this cluster, would be expected to mitigate any effects from TA/training in processing, however it must be undertaken in conjunction with all TA/training on processing (see Table 3).

By itself, improving the organization of market vendors through TA to develop a management plan has no direct effects. Environmental effects of this action become apparent if WINNER supports rehabilitation of rural markets. Rural market infrastructure is fairly basic, and does not result in significant disturbance of earth. Markets are typically in city or village centers, where there is no quality wildlife habitat. However, waterways and wetlands could be affected directly if construction will infringe on these areas, or indirectly by disposal of construction material and other waste; and other impacts typical of small-scale construction could result. Existing WINNER EMPRs for market infrastructure rehabilitation indicate that a standard set of impacts

may occur, and standard best practices (mitigation measures for small-scale construction) are typically applied. In addition, USAID's Environmental Guidelines for Small-Scale Activities can provide useful mitigation measures to ensure potential adverse effects of construction and operation do not result from marketplace rehabilitation (see Table 3).

Description of Cluster 1.8: Watershed biodiversity restored

Training, technical assistance, studies/assessments, and procurement: conduct inventories to identify biologically significant areas to propose protection/restoration; promote appropriate production systems in buffer zones to biologically significant sites; work with producer organizations and master farmers to identify areas that could enter into agreements for payments for ecological services for farmers who put their land into conservation either as natural lands or as managed production under certain conditions; establish and manage tree nurseries suitable for agro-forestry/afforestation, and for fruit trees for target farmers; promote agro-forestry; identify non-farm income generating activities and alternative energy sources, including manufacturing stoves that use propane; and identify alternative products in order to reduce use of mangroves as a source of energy and building materials.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 1.8: Conducting inventories to identify biologically significant areas; identifying areas that could provide ecological services; identifying non-farm income generating activities and alternative energy sources; identifying alternative products to reduce use of mangroves: none of these would have direct environmental impacts. These activities all involve studies/assessment, and indirectly they will benefit the environment, and can be considered mitigation for other potential impacts of WINNER discussed in this cluster.

Promote appropriate production systems in buffer zones: this involves WINNER working directly with farmers in buffer zones to decrease their impact on important ecological areas. Positive environmental effects are expected, but there is a risk that TA and training on this topic could have unintended consequences. And given that buffer zones to biologically significant areas are so critical to maintaining biodiversity, WINNER will need to ensure that unintended consequences do not result. A regular monitoring plan will allow for early warning of unexpected and unpredicted environmental impacts—and may provide successful models for scaling up (see Table 3).

WINNER's efforts to establish tree nurseries and promote agroforestry are expected to have positive environmental effects. While the promotion of inappropriate species could affect native trees, vegetation, and wildlife, this is mitigated by Cluster 1.3 assessments of appropriate trees. The use of pesticides at tree nurseries could have health and environmental impacts, and require mitigation; and the use of fertilizers could affect the environment and livelihoods-mitigation is required. The strict compliance to the PERSUAP recommendations, including the use of IPM methods will contribute to address any potential negative impacts.

Table 3: Component 1 Mitigation Plan

Cluster	Activity	Potential Adverse Impacts	Mitigation Measures
1.1 Increase sustainable hillside agricultural production	TA/training to master farmers and extension agents in agricultural production on hillsides	Could indirectly result in conversion of natural vegetation and ecosystems to agriculture; this conversion could have other unintended consequences (increased soil erosion, flooding, and other impacts associated with loss of natural ecosystems).	TA/training shall incorporate conservation information, such as retaining natural vegetation, especially tree cover, planting trees, including for agro-forestry, and other conservation farming measures.
	TA/training to master farmers, farmer associations, and extension agents in fertilizer and pesticide use	Could indirectly result in impacts to human health and the environment associated with unsafe pesticide use; and environmental and livelihood impacts from misuse of fertilizer (eutrophication of waterways, poisoning of crops).	TA/training shall comply with the USAID/Haiti mission-wide PERSUAP TA/training shall incorporate information from the Fertilizer Factsheet (Annex F attached).
	Construction/ rehabilitation of CRDDs	Could result in short and long-term environmental impacts typical of small-scale rehabilitation and construction: destruction of vegetation, erosion/sedimentation of waterways, destruction/degradation of wildlife habitat	See Annex G for mitigation measures
	Operate demonstration sites to promote appropriate agricultural packages	Could have far reaching impacts if results of studies on land use (Cluster 1.3) and agronomy practices (Cluster 1.1) are not incorporated into agricultural packages	Ensure that agricultural packages incorporate safeguards to ensure appropriate land use and agronomy practices (as identified in Cluster1 1.1 and 1.3 studies) are integrated into the —packages."
1.2 Alternative forms of non-farm livelihoods for hillside farmers identified	Grants for the procurement of pesticides, including seed treated with pesticide	Could result in impacts to human health and the environment associated with unsafe pesticide use	All grants (including to agri-supply stores) that provide for the procurement of pesticides, and chemically treated seed, shall comply with the USAID/Haiti mission-wide PERSUAP, including using IPM methods. Provision of grants for pesticides procurement shall be last resort.
	Grants to procure fertilizer	Could result in environmental and livelihood impacts from misuse of fertilizer (eutrophication of waterways, poisoning of crops)	Grants shall include a condition to provide fertilizer best practices to clients, as described in the Fertilizer Fact Sheet (Annex F). Provision of grants for fertilizers procurement should be last resort
1.3 Productivity	Tree seedling and	If pesticides will be procured,	All pesticides procurement,

Cluster	Activity	Potential Adverse Impacts	Mitigation Measures
through better land use management increased	vetiver nurseries	used, or recommended, human health and environmental impacts could result. If only a small number of cultivars are offered, agri-biodiversity will suffer.	handling and use, as well as recommendation or training for procurement and use shall comply with the USAID approved PERSUAP.
1.4 Agreements between producer groups, MSMEs, and entrepreneurs signed (potential impacts and mitigation of PPPPs is discussed further in Component 4)	TA/training in pesticide use	If pesticides will be procured, used, or recommended, human health and environmental impacts could result.	TA/training shall comply with the USAID/Haiti mission-wide PERSUAP.
	TA/training in fertilizer use	Could indirectly result in environmental and livelihood impacts from misuse of fertilizer (eutrophication of waterways, poisoning of crops).	TA/training shall incorporate best practices from the attached Fertilizer Factsheet (Annex F).
	TA/training on improving production practices	Could indirectly result in conversion of natural ecosystems to agriculture, increased soil erosion and flooding.	TA/training for producers shall incorporate conservation farming technologies, including soil and water conservation, flood control measures, tree planting, etc.
	TA/training for processors	Could indirectly lead to increased pollution/waste at the facility and result in pollution of air, waterways, and land.	TA/training for processors shall incorporate cleaner production (reuse/recycling, waste minimization, environmentally sound disposal).
1.5 Income and productivity in lowland agricultural systems increased	TA/training to master farmers, farmer associations, and REAs in agricultural production in lowland ecosystems	Could have unintended consequences (conversion of natural ecosystems, increased soil erosion) if appropriate safeguards are not incorporated	TA/training shall incorporate organic farming techniques, conservation information, such as retaining natural vegetation, especially tree cover, planting trees, including for agro-forestry, and other conservation farming measures.
	TA/training to master farmers, farmer associations, and extension agents in pesticide and fertilizer use	TA/training may include information on pesticides and fertilizers, which could have health and environmental impacts.	TA/training shall comply with the USAID/Haiti mission-wide PERSUAP. TA/training shall incorporate best practices from the Fertilizer Factsheet (Annex F).

Cluster	Activity	Potential Adverse Impacts	Mitigation Measures
	Establish community-based agri-supply stores including procurement of quality seeds, fertilizer, and other inputs and equipment.	Procurement of seed, fertilizer, and other inputs, including equipment could affect the environment. Procurement of equipment that could be used to harvest trees could indirectly result in deforestation/timber harvesting; procurement of pesticides and fertilizer could have health, environmental, and livelihood impacts.	Funding for agri-supply stores shall not include procurement of equipment that could be used to harvest timber; this shall be included in agreements between WINNER and the dealer. Funding to agri-supply stores for the procurement of pesticides, and chemically treated seed, shall comply with the USAID/Haiti mission-wide PERSUAP. Funding for agri-supply stores may include procurement of fertilizer with the provision that agri-supply store displays fertilizer best practices from the Fertilizer Factsheet in Annex F (may be adapted for this use). WINNER shall promote the production and use of organic fertilizers, as appropriate.
	Construction/ rehabilitation of CRDDs	Could result in short and long-term environmental impacts typical of small-scale rehabilitation and construction: destruction of vegetation, erosion/sedimentation of waterways, destruction/ degradation of wildlife habitat.	See Annex G for mitigation measures.
	Demonstration sites to promote appropriate agricultural packages	Could have far reaching impacts if results of studies on land use (Cluster 1.3) are not incorporated into agricultural packages.	Ensure that agricultural packages incorporate safeguards to ensure appropriate land use and agronomy practices (as identified in Cluster 1.3).
1.6 Local organizations strengthened	Train new and existing water users associations, potable water management committees, and road rehabilitation committees in management and maintenance.	If committees and associations are not simultaneously trained in environmental and health safeguards, oversight/management of the systems and roads could have adverse environmental and human health effects.	For water users (irrigation) associations, include training in: • maintenance of the system • water conservation For potable water management committees train members in: • water quality monitoring and testing requirements • water conservation and

Cluster	Activity	Potential Adverse Impacts	Mitigation Measures
			implementation of water conservation measures For road rehabilitation committees, train members in: • maintenance, including clearing culverts to ensure water flows are maintained
	Production and distribution of material	If information on pesticides and fertilizers is included, indirectly, this information could result in environmental, health, and livelihood impacts.	All TA, training extension material on pesticide handling and use (including recommendations for specific pesticides) shall comply with the USAID/Haiti approved PERSUAP. Material on fertilizer use shall incorporate best practices from the Fertilizer Factsheet (Annex F).
Cluster 1.7 Competitiveness of VCs strengthened	Rehabilitation of rural markets	Potential impacts are typical of small-scale construction and rehabilitation including destruction/degradation of vegetation, erosion and sedimentation of waterways, disruption of wildlife.	See Annex G for mitigation measures.
Cluster 1.8 Watershed biodiversity restored	Promote appropriate production systems in buffer zones.	May have unintended consequences: may contribute to the degradation of biodiversity; may have no actual impact on biodiversity conservation (versus the positive effects that are expected).	Monitor to ensure that production systems that WINNER is promoting are actually reducing impacts on biologically significant sites.
	Establish tree nurseries and promote agro-forestry	Promotion of inappropriate species could affect native trees, vegetation, and wildlife; use of pesticides could have health and environmental impacts; use of fertilizers could have environmental and livelihood impacts.	Tree seedlings shall be appropriate for the zone (incorporating findings of WINNER assessments and studies). WINNER-supported nurseries pesticides procurement, handling and use shall comply with the USAID/Haiti approved PERSUAP. Use/recommendations for fertilizer use shall comply with the Fertilizer Factsheet (Annex F).

4.2 Component 2: Critical infrastructure rebuilt and improved and threat of flooding reduced.

The Scoping Statement identified the significant issues of Component 2 activities to be analyzed in the PEA. These issues form the framework of the environmental consequences discussions for each Component 2 activity cluster (Clusters 2.1-2.5). Any revisions from the Scoping Statement are documented below.

The No Program alternative was discussed in Sections 2 and 3. Based on potential environmental impacts, the comparison of alternatives discussion identified the preferred alternative as the WINNER Program. That discussion showed that more significant environmental impacts would result if No Program was chosen over the WINNER Program alternative; and that the WINNER Program alternative was the most likely alternative to produce positive, sustainable results.

Above, the comparison of alternatives was presented at the program level, not at the activity cluster level. This is because given the rolling design of WINNER, all practicable activity-level alternatives are evaluated during the Planning and Site Selection and Design and Feasibility Phases. For flood and erosion control projects (Cluster 2.1), a combination of physical and biological control measures will be used, and the types of structures and locations are identified on a site-specific basis during Planning and Site Selection and Design and Feasibility Phases. (For flood and erosion control, geo-textiles are a possible alternative, however, given the intensity of flooding, the expense and the maintenance required, they are not practicable.) Steps will be taken to use the most appropriate and cost effective erosion control methods. For irrigation system repair (Cluster 2.2) and potable water provision (Cluster 2.3), alternative sites are selected and capacity determined with the involvement of producer groups, communities, local government, and other stakeholders and beneficiaries during Planning and Site Selection and Design and Feasibility Phases. For Cluster 2.4, critical transportation infrastructure repaired, alternative roads, road alignments, and various types of surface materials—all considered alternatives—are evaluated with affected community groups, local government, and other stakeholders and beneficiaries during Planning and Site Selection and Design and Feasibility Phases. The Activity Cluster-level Mitigation Plans include an environmental due diligence process to ensure environmental impacts are taken into account during these phases when analyzing alternative sites and designs.

In addition, as discussed below, most potential environmental impacts are expected to occur during the construction phase. All practicable variations to the design will require similar mitigation measures to minimize impacts (i.e., all practicable alternatives have similar environmental impacts). The Mitigation Plan for each Activity Cluster includes measures to ensure that during planning, site selection, design, and feasibility, environmental criteria are considered and that the outcome does not result in adverse environmental impacts.

To ensure this, WINNER has hired a Biodiversity Specialist, who will participate in Component 2 site selection and planning, and design and feasibility activities. He will also oversee the monitoring of Construction Phase and Operation and Maintenance Phase mitigation measures for Component 2.

The Activity Cluster environmental impact assessments are presented as "pull-out," stand-alone documents for each activity cluster leader to use to guide implementation of mitigation measures for all phases of the project.

Description of Cluster 2.1: Establish structures that strategically stabilize hillsides and control floods in the plains.

Training, technical assistance, studies/assessments, and procurement: conduct inventories of infrastructure, including existing service providers, maintenance plans, and repairs that are underway; develop management plans that identify alternative watershed management strategies, including best management practices to protect watersheds; develop maps to identify sub-watersheds and to prioritize ravines for treatment; and train and raise awareness of flood and erosion control plans by working with community leaders and members, local authorities, and teachers.

Infrastructure and other physical interventions: treat ravines and drains and stabilize rivers (based on priorities in watershed management plans); and work with producer groups to install biological infrastructure along rivers, ravines, and drains.

Cluster 2.1 covers all activities directly and indirectly related to the construction and/or rehabilitation of flood control measures. Ravine and drain treatment and river stabilization are the Cluster 2.1 physical interventions that are directly aimed at reducing the frequency, magnitude, and impacts of flash floods in target areas. These physical interventions cover:

- cleaning and dredging rivers (also called re-shaping and re-profiling), drains, and ravines; constructing drains;
- constructing and placing gabions in rivers, ravines, and drains;
- placing stone and concrete in rivers, ravines, and drains (stonewalls, check dams); and
- re-vegetating banks.

Specific activities that will be conducted are described below.

Activities involved in drain and ravine treatment (the PEA Team visited sites at La Quinte River, downstream Pont Bigot and La Branle, Gonaives and Mahotières, Kenscoff):

1. Cleaning and disposing of drain and ravine debris: Cleaning drains and ravines is one of the primary ways to protect against floods yet drains and ravines have not been regularly maintained. Cleaning these structures can help reduce flood frequency and magnitude. Teams of workers will be organized and trained to remove debris from drains and ravines. Debris will be removed manually using shovels. In rare cases, heavy machinery will be used to remove debris that is impossible to remove manually. Debris will be transported by truck to an approved disposal site.

2. Dredging drains and ravines: In some cases, drains and ravines will not only need to be cleaned, but will also need to be deepened and/or widened (similar to work by WINNER already done at Savane Jonc and the Basse Plaine). Deepening and widening of drains

and ravines involves dredging material using heavy equipment, and either removing it to an approved disposal site or using it on agriculture plots, or placing it along the drain/ravine banks to stabilize them.

3. Constructing drains: In some cases, secondary drains will be constructed to improve drainage and relieve the threat of flooding along the primary drainage system. The work involved is similar to #2: excavating soil to create a drain, lining it with stream/river bed material and with additional erosion control structures (see #4).

4. Physical stabilization of drains and ravines involves placement or extension of cement reinforcement (stone walls), placement of gabions, and/or placement of check dams. Gabion baskets and check dams are constructed on site.

5. Rehabilitating or installing drainage structures (culverts, outlets). This involves placing new culverts and outlets or replacing damaged culverts and outlets to improve water flow. Heavy equipment is used to remove the damaged structure and to place or replace a new structure.

6. Re-vegetating: In all cases, physical stabilization is combined with biological stabilization of drains and ravines. This involves assisting community organizations to produce, multiply, plant, and maintain vetiver, bamboo, and elephant grass; and using seedlings from community organizations‘ nurseries that have received assistance from WINNER to re-vegetate banks.

7. Operation and maintenance: training community organizations/associations to maintain structures.

Activities involved in riverbank stabilization (the PEA Team visited R. Grise and R. La Quinte):

1. Dredging the river and banks: This is done with heavy equipment, and results in reshaping the river so it can better handle flood events. Material removed from the river is placed on the bank to stabilize it, or removed off-site, to an approved disposal area.

2. Grading the riverbank to create a foundation for the gabions.

3. Physical stabilization of riverbanks involves construction in-place of gabions, and lining weak and erosion-prone portions of the bank with them (see photo below).

4. Rehabilitating or installing drainage structures (culverts, outlets) is accomplished using heavy equipment to remove the damaged structure and placement of a new structure by dredging the area and backfilling to stabilize the culvert/outlet.

5. Re-vegetating riverbanks with vetiver, elephants grass, or bamboo (as above for ravines/drains).

6. Operation and maintenance: training community organizations/associations and local government to maintain structures.

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5. Re-vegetating riverbanks with vetiver, elephants grass, or bamboo (as above for ravines/drains).

6. Operation and maintenance: training community organizations/associations and local government to maintain structures.

Construction and placement of gabions on Riviere Grise

Many of the activities involved in drain/ravine treatment and in riverbank stabilization are the same and they are discussed together in the Environmental Consequences section below.

Project phases are common to all types of flood and erosion control projects (ravine/drain treatment and riverbank stabilization):

1. Planning and Site Selection: preparatory meetings with communities, local government, site visits, reports
2. Design and Feasibility: preparation of tender documents, review of proposals, and signing of engineering contract
3. Sourcing of construction materials
4. Construction: including constructing ancillary features such as access roadways and construction camps
5. Decommissioning of construction works, including site restoration
6. Operation and Maintenance

Environmental Consequences of Cluster 2.1: No environmental impacts will result from conducting inventories, developing plans and maps, and raising awareness in the communities; no mitigation is needed. Biological stabilization with bamboo, vetiver, or elephant grass is not expected to have negative environmental impacts. These non-invasive species will provide bank protection and wildlife habitat, and are complementary to proposed physical stabilization.

Ravine and drain treatment and riverbank stabilization could have adverse environmental impacts. The environmental impact assessment below is derived from PEA Team field visits, previous WINNER EMPRs and EAs for ravine/drain treatment and riverbank stabilization, and from document reviews (see References). The PEA Scoping Statement (with PEA Team additions/revisions documented below) is used as the framework for the discussion. Issues deemed significant in the Scoping Statement and by the PEA Team are in bold below.

(1) Potential impacts of Planning and Site Selection Phase
The Planning and Site Selection Phase will have indirect impacts only. No movement of earth or other activities that would have direct environmental effects will occur during this phase.

Project planning involves meetings and awareness raising among community members, identifying challenges, options, and project requirements, selecting counterparts, and other similar activities that are the foundation of project start-up. Selection of the sites where physical interventions will occur is also made during this phase. There is not yet an irreversible or irretrievable commitment of resources and sites that are selected can be changed during this and the following phase, the Design and Feasibility Phase. However, site selection must include environmental concerns in addition to engineering and livelihood concerns since environmental impacts are less complicated and more cost-effective to address at this early stage.

Incorporating an Environmental Due Diligence (EDD) test during this phase will help ensure that potential impacts do not occur in later project phases, when mitigation may be costly or too late. EDD during the Planning and Site Selection Phase will specifically address potential adverse impacts related to site selection: **important habitat, flora and fauna, sensitive ecosystems,**

threatened and endangered species and their habitat, cultural and historical assets, and protected areas (see Table 4.1, Mitigation Plan, below).

Since at the programmatic level of this PEA, specific intervention sites have yet to be identified, a process that can be used over the LOP of WINNER must be institutionalized. The EDD in Table 4.1 will ensure that during Planning and Site Selection Phase, environmental concerns will be considered in a timely manner and at the same level as other project concerns.

(2) Potential impacts of the Design and Feasibility Phase
During this phase, feasibility studies are undertaken by WINNER staff to test economical profitability; these studies include the environmental feasibility of the project. The Terms of Reference (TORs) is developed; designs are requested from qualified firms; proposals are evaluated based on the merits of the proposals; and an award is made. The flood and erosion control project is designed in detail during this phase—the extent of the cleaning, dredging, and stabilization, and the need for ancillary features (construction camps, access roadways, etc.) is described. The full area to be disturbed (project footprint), the target areas for various types of interventions, and the material and equipment to be used in construction is determined.

Once the project is designed, the extent of changes to the substrate of the river, ravine, or drain and the extent of dredging (re-shaping) of the waterway will be known. Changes in river, ravine, or drain substrate and profile could have adverse impacts on **aquatic resources and on terrestrial wildlife and humans** that rely on these resources, and on **downstream marine ecosystems**. The rocks contained within the gabions, rock walls, and check dams provide substrate for a wide variety of aquatic organisms—organisms that have adapted to living on and within rocks. But vegetation may be difficult to establish unless the voids between the rocks in the baskets are filled with soil. According to a report by Freeman and Fischenich (May, 2000), if large woody vegetation is allowed to grow in the gabions, there is a risk that the baskets will break if the vegetation is uprooted or as the root and trunk systems grow. Thus, it is normally not acceptable to allow large woody vegetation to grow in the baskets. The possibility of damage must be weighed against the desirability of vegetation on the area protected by gabions and the stability of the large woody vegetation. Freeman and Fischenich state that if large woody vegetation is kept out of the baskets, grasses and other desirable vegetation may be established and provide a more aesthetic and ecologically desirable project than gabions alone. WINNER‘s combination of structural erosion control and planting of elephant grass, bamboo, or vetiver is in line with this recommendation. However, even with combining biological and physical controls, there are potential impacts from transforming the substrate of rivers, ravines, and drains. These impacts are long-term. Mitigation measures should be incorporated into the Design Phase to ensure that placement of structures will not destroy or degrade aquatic and terrestrial resources and sensitive ecosystems.

Changes in substrate are best evaluated during design, when mitigation can be more easily incorporated. Possible mitigation measures include limiting substrate changes, using alternative flood/erosion control measures, or incorporating meanders into river systems to create aquatic habitat. Table 4.1 (Mitigation Plan) includes measures to be implemented during the Design and Feasibility Phase to ensure substrate changes and waterway profile changes are mitigated prior to

beginning construction; mitigation measures include revision of project design based on potential impacts.

Also during this phase, the extent of the physical interventions is determined, and the need to **acquire land** if necessary (relocate homes and other infrastructure, and acquire property, permanently or temporarily) is identified. During this phase, it will also become evident whether the local community will retain **access to the waterway and its resources**. These concerns could have social, cultural, and livelihood implications, and could determine whether or not the project is accepted by the local communities. These issues must be dealt with prior to construction. At the programmatic level, it is unclear if land acquisition and compensation will be necessary for flood/erosion control projects, and whether these projects will result in the exclusion of local communities from resources. Up to now, WINNER has managed to stay away from land acquisition and population relocation. Whenever they were identified as issues, the government usually takes this responsibility.

Assuming that the Rivière Grise situation documented in the EA (see Reference section) is typical, fair compensation is expected to resolve typical concerns. For the Rivière Grise project, people who lived within 10 m of the riverbank understood their vulnerability to floods; and that their relocation to non- or less- flood prone areas would protect them. The affected people (about 50) expressed no disagreement as long as they received fair compensation. They had requested that their homes be rebuilt in appropriate locations. This should serve as a model for future WINNER flood and erosion control works. Table 4.1 describes mitigation to be implemented, based on the Rivière Grise experience, during the Design and Feasibility Phase to ensure land acquisition and just compensation is considered as early as practicable in the design.

The mitigation measures described for the Design and Feasibility Phase will help ensure that no irreversible or irretrievable commitments are made to a project that then turns out to be socially and environmentally unacceptable. Other potential impacts—described below—can be mitigated during the follow-on project phases, usually by what are termed ~~"b~~est engineering practices"—practices that protect the physical and biological environment and that have become a standard part of construction projects. Regardless of how standard and common they are—best engineering practices, and other mitigation measures—must be identified and included in engineering contracts; the Mitigation Plan requires this as a Design Phase mitigation measure.

(3) Potential impacts of sourcing construction materials

The location where stone is obtained and the method for obtaining material for gabions, stone walls, and check dams could have an effect on **aesthetics, on surface water quality and quantity at the quarry location, and of flora and fauna in the vicinity of the quarry, and could also create safety risks** to workers and the public (these potential impacts were not included in the Scoping Statement). Obtaining material from steep slopes could increase soil erosion (this was included in the Scoping Statement). From observing some quarries along the road, the PEA Team determined that these potentially adverse impacts require evaluation and mitigation in the PEA.

Stones may be obtained from the ravine or river where the gabions, check dams, or stone walls will be placed, or in some cases, they are obtained from other streams and rivers at distant

locations. At the programmatic level, quarry locations are not yet identified; location where materials are sourced will become known once an engineering contract is signed, and the engineering firm then evaluates bids and enters into agreements to procure materials. However, WINNER has an opportunity to promote the sustainable sourcing of construction material and to ensure that material is obtained in a manner that is environmentally sound. Table 4.1 includes mitigation measures to ensure that sourcing of construction material will have no adverse effects.

(4) Potential impacts of the Construction Phase

Construction of ancillary features (staff housing, latrines, kitchen areas, storage areas, access roads):

Construction could affect **native flora, fauna, result in tree cutting, could affect sensitive ecosystems and cultural/historical resources, and could impact surface, groundwater, require land acquisition, and require the disposal of solid, hazardous, and special wastes**. The PEA Scoping Statement did not consider this issue separately from the overall flood and erosion control project. However, mitigation for typical ancillary features must be integrated into the design, specified in engineering contracts, and requires some measures specific to ancillary features (water and sewage, access roads). Mitigation is required in Table 4.1 and is described in detail in Annex G-Mitigation Plan for Small-Scale construction.

Cleaning and disposal of drain and ravine debris. (This may be a stand-alone activity or may be combined with dredging and placement of physical and/or biological controls measures described below.):

a) Cleaning may affect vegetation (**native or local flora-tree cutting, terrestrial ecosystems**) along the banks, and thereby may affect wildlife (**native fauna**). This may occur because the vegetation is removed as part of flood/erosion control work or it could occur from trampling from staff working their way along the bank or from movement and storage of equipment. Even direct removal of vegetation along the banks will be a temporary, short-term impact; vegetation is expected to grow back. But if this is healthy riparian habitat that provides cover, feed, and/or nesting for wildlife, the concern is greater. Timing of the work may also be critical. Mitigation is needed to minimize potential impacts to riparian/streamside vegetation (see Table 4.1).

b) If material that is removed from the waterways is left on the banks, it will only end up clogging the waterway again. If **waste material (solid, hazardous, and special waste)** is disposed of unsoundly, it could create problems at the disposal site. Depending on disposal methods, impacts could be long-term, going beyond the end of the activity. Mitigation is needed to minimize possible impacts of improper disposal.

Dredging drains, ravines and riverbanks, construction of drains, placement of culverts/outlets, and physical and biological stabilization of drains, ravines, and riverbanks: (These are considered together because dredging is always accompanied by physical and biological stabilization and by placement or rehabilitation of culverts (when needed), and potential impacts are similar for work done in rivers, ravines, or drains, only the potential significance of impacts is greater when working in river systems as opposed to ravine and drain.)

a) Vegetation and sensitive ecosystems (local flora and fauna) could be affected directly by dredging (to widen and/or deepen) and by placement of physical structures (gabions, concrete walls, check dams). These activities will result in removal of vegetation along the banks of the river, ravine, or drain, and in some cases, the impact is permanent (irreversible, irretrievable and long-term)—the natural vegetation is replaced with rock or concrete. In other cases, vegetation may only be temporarily damaged by workers trampling the area and by movement of equipment. Mitigation for long-term impacts from placing erosion/flood control structures is discussed under the Design and Feasibility Phase. Direct impacts to vegetation, wildlife, and sensitive ecosystems from the construction phase can be mitigated with measures described in Table 4.1

b) Potential impacts to **cultural/historical resources** were found by the PEA Scoping Team not to be significant or relevant. However, from on-site meetings the PEA Team held, where the existence of cultural/historical resources was discussed; and because at the programmatic level, sites are not yet identified, and cultural/historical resources could exist at a proposed intervention site, the PEA Team decided to include this issue in the PEA. Cultural/historical resources may be found during the construction phase that were not identified during the Planning & Site Selection Phase. In this case, contingency plans are needed to ensure there are no adverse effects if these resources are found on-site or are found to be affected by construction activities. See Table 4.1 for mitigation measures.

c) Potential impacts to **threatened and endangered species, and other sensitive species, and their habitat** are expected to be mitigated by measures implemented during the Planning and Site Selection Phase. However, as above, even with mitigation measures, species and habitat may be found once construction begins that were not identified during Planning and Site Selection. Dredging and placement of structures (gabions, concrete walls, check dams, and culverts) could potentially impact threatened or endangered species or other sensitive wildlife species. Movement of soil could degrade water quality and put threatened and endangered species (TES) at risk, presence of construction workers and equipment could disturb species during breeding seasons, and critical riparian habitat may be degraded or destroyed by the presence of workers, equipment, or as part of the construction process. In addition, noise from heavy equipment and presence of workers could disrupt TES and sensitive species, even off-site. Table 4.1 contains mitigation measures to minimize risk to these resources if they are found to be affected by construction work.

d) The construction process typically results in increased **erosion** and sedimentation, resulting in increased turbidity and decreased **water quality**. This could affect aquatic resources—fish, other aquatic vertebrates and invertebrates, and aquatic vegetation (**native flora and fauna and sensitive ecosystems**); and could also affect wildlife throughout the food chain, including birds and mammals that rely on aquatic resources (**native or terrestrial fauna**). Placement of temporary erosion control measures during the Construction Phase will minimize concerns.

Impacts are expected to be short-term, and once the construction phase is complete, water quality should return to pre-construction condition, and may even improve due to cleaning and the

improved water flow that will result from this intervention. However even short-term changes in water quality could have adverse impacts on aquatic and terrestrial resources and terrestrial and avian wildlife and humans that may rely on these resources. The use of erosion control measures during the construction phase should be adequate to safeguard against adverse impacts. These are described in Table 4.1.

The potential for **erosion** is greater when heavy equipment is used, which is more typical of work in rivers than work in ravines and drains. If heavy equipment is used improperly along riverbanks, the bank could collapse. This potential adverse impact is easily mitigated with proper use of erosion control measures and with areas delineated where heavy equipment should not be used.

e) Movement of material and placement of physical structures may change the hydrology (**water quantity**) of the river, ravine, or drain. Over the long-term, this is expected to have a positive effect on livelihoods and on the well-being of local people; however, changes in hydrology could affect aquatic resources and the terrestrial wildlife and humans that rely on them. Impacts to water quantity may be construction-related and design-related. Design-related hydrology changes are mitigated during the Design and Feasibility Phase. However, short-term impacts to hydrology may also result from construction activities, and these can be mitigated by commonly used best engineering practices that are described in Table 4.1.

f) Disposal of **waste** material that is dredged from rivers, ravines, and drains could impact the environment as described above for cleaning of drainages/ravines. Potential adverse impacts from improper disposal can be mitigated as described in the Cluster 2.1 Mitigation Plan (Table 4.1).

g) The use of heavy equipment (more common for work in rivers than for work in ravines and drains) could contaminate **surface and groundwater and terrestrial resources** due to the potential for oil and fuel leakages; Table 2.1 describes mitigation. **Hazardous and other "special" waste** could be unearthed during dredging. Given the often highly contaminated nature of the waterways where WINNER will work, contaminants that have been buried or that may have adhered to soil could be dislodged and will need to be handled separately to ensure environmentally sound disposal. Table 4.1 provides for mitigation.

h) Although the Scoping Statement excluded noise from consideration, noise was noted as an issue in all WINNER ravine treatment EMPRs. Therefore, the PEA Team retained **noise** as a potential significant issue for consideration in the PEA. Noise is especially a concern if heavy equipment is used. Noise could affect human welfare and wildlife. However, WINNER flood and erosion control work will only take place during daylight and normal work hours, and impacts to the human environment will only last as long as the construction phase, and would not be considered significant. For certain wildlife, noise could disrupt nesting and feeding behavior, and for more sensitive wildlife species, this could have a detrimental effect. The effects of noise on sensitive wildlife is considered and mitigated during the Planning and Site Selection Phase, but a contingency plan may be needed in case sensitive species are found on-site during construction (see Table 4.1).

i) During the Construction Phase, there could be a short-term increase in emissions and dust as a result of exhaust from heavy equipment used to dredge and from trucks carrying supplies. Impacts of emissions and dust on **air quality** will be short-term and minor, and no additional mitigation is needed.

j) As with any construction project, **public and worker safety** is a concern. Normal precautions should be taken, typical of work at any construction site, to minimize risks to the public and workers. These are described in the Mitigation Plan (Table 4.1) and if implemented, are expected to be adequate to eliminate concerns regarding public and worker safety.

k) All WINNER flood and erosion control project EMPRs included **gender** as a concern (although this was excluded in the PEA Scoping Statement). For construction activities, a gender ratio of 1:1 will be strived for, but in cases where special expertise or skills are needed, the ratio may vary, favoring one gender over another. As the PEA Team witnessed when visiting construction sites at Kenscoff and Gonaives, typically, WINNER makes every attempt to ensure gender equity in staffing. This is included in Table 4.1 to mitigate any concerns regarding gender.

Flood and erosion control projects are expected to benefit both genders equally. Men and women will benefit from the reduced risk to life, possessions, and livelihoods resulting from flood and erosion control projects.

l) If labor is brought in from outside the general area where the flood and erosion control works will be constructed, the project may lose support of the local community. To the greatest extent feasible, **local labor** shall be used to construct flood and erosion control measures. This will also minimize the need for construction staff camps.

(4) Potential impacts of the Decommissioning Phase

a) If construction camps have been built for staff, decommissioning may involve removal of material—solid waste, buildings, etc. Alternatively, the construction camp and other ancillary features may be turned over to the municipality. Regardless if the camp is small or large, if it included latrines and kitchen areas, if it will be dismantled or turned over, the camp should be left in environmentally sound condition. Excess material that is not properly disposed of could result in environmental impacts: liquid and solid waste could degrade **water quality**, affect aquatic resources (**flora and fauna**), and terrestrial ecosystems. **Water quantity** (**hydrology-flood regime**) could be affected if trash is left behind to clog waterways and wetlands. Mitigation, requiring the removal of buildings and other ancillary features, or as an alternative, for a sound hand-over plan, is included in the Mitigation Plan (Table 4.1).

b) Construction equipment that is left on-site after construction is complete could affect the environment. Fuel and oil leaks, rust from equipment, and equipment parts could degrade water quality, and affect flora and fauna; and could have an impact on hydrology and flood regime (water quantity) if equipment clogs waterways. Decommissioning may require the disposal of solid, hazardous, or special wastes. There could also be public safety risks if

people can enter the site to dismantle abandoned equipment. Mitigation, involving removal of all equipment and supplies, is described in the Mitigation Plan.

(5) Potential impacts of Operation and Maintenance Phase

a) Without a practical maintenance plan in place, placement of gabions, check dams, or stone walls could result in greater impacts than if the structures had never been placed. If the wire baskets break, either through corrosion, vandalism, or damage from debris or bed load, the rock fill in the basket can be lost and the protective value lost as well. Rocks could block water flow, and floods of greater magnitude would be expected (**water quantity**), riverine wetland systems and aquatic habitat (**flora and fauna**) could be damaged, and **terrestrial ecosystems** could also be affected. If concrete walls break, slabs of concrete could block watercourses. **Public safety** could also be put at risk. From the purely human standpoint, the failure of what may be considered a ~~"d~~evelopment" or ~~"a~~id" project could undermine USAID's reputation, and could have far-reaching long-term impacts if local people become discouraged about the utility of flood and erosion control measures. A maintenance plan, including training for those responsible for implementation, should minimize these concerns, and is included in Table 4.1

b) Other concerns of the Operation and Maintenance Phase involve the accuracy of the predictions made in the Planning and Site Selection and Design and Feasibility Phases. The Mitigation Plan is intended to minimize any potential adverse environmental and social impacts over the LOP. The result should be the ~~"e~~stablishment of structures that strategically stabilize hillsides and control floods in plains"—not at the expense of valuable environmental resources. Monitoring over the LOP—as required in the Programmatic Environmental Management Plan (see Annex E) up to WINNER hand-over, will allow for adaptive management. Implementation of the PEMP will allow WINNER to quickly identify when predictions are incorrect and/or if required mitigation is unsuccessful in halting environmental damage. And in a timely manner, alternative mitigation measures can be applied and monitored.

Table 4.1: Mitigation Plan for Cluster 2.1. *Establish structures that strategically stabilize hillsides and control floods in the plains*

Cluster/ Project phase	Activity	Potential Adverse Impacts	Mitigation Measures
Cluster 2.1: Planning & Site Selection	Identification of project site: WINNER staff in collaboration with communities and local government	At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to livelihood and other issues. Important habitat or ecosystems sensitive to disturbances may be located within project site boundaries or may be affected by the project.	WINNER Biodiversity Specialist shall be involved in planning and site selection. **Environmental Due Diligence shall be conducted at Planning &Site Selection Phase, as follows.** WINNER Biodiversity Specialist shall ensure that the Mitigation Plan for the Construction Phase is adequate so that: (1) any important habitat or ecosystems that

Cluster/ Project phase	Activity	Potential Adverse Impacts	Mitigation Measures
		Habitat for threatened or endangered species and/or threatened or endangered species may be found within project site boundaries or may be affected by the project. At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to livelihood and other issues.	are located within project boundaries (project boundaries include all ancillary features) will be protected. (2) any important habitat or ecosystems that may be affected by the project (affected may be temporary/short-term or long-term, direct or indirect, and —project" includes ancillary features) will be protected. (3) any cultural or historical assets that are within project boundaries or that may be affected by the project will be protected. If WINNER Biodiversity Specialist determines that the Construction Phase Mitigation Plan is not adequate to protect flora, fauna, and sensitive ecosystems), and cultural/historical resources, an alternative site must be chosen. **Environmental Due Diligence shall also ensure that:** If any threatened, endangered, or other sensitive species, or habitat for threatened, endangered, or other sensitive species is within project boundaries or may be affected by the project, an alternative site shall be chosen. If protected areas are within project boundaries or may be affected by the project, an alternative site shall be chosen (*unless this activity is part of Cluster 1.8, watershed biodiversity restored-see Mitigation Plan for Cluster 1.8*). The flood and erosion control project is in line with the Participatory Watershed Management Plan. A Maintenance Plan for the Operation and Maintenance Phase is developed in consultation with relevant community members and government authorities. All relevant GOH and local legislation is complied with including, as necessary, land acquisition and compensation procedures outlined in relevant GOH legislation (also see Design and Feasibility Phase. Any social and environmental concerns that cannot be mitigated by the measures in this Mitigation Plan shall be brought to the attention of WINNER senior management for action. An alternative site shall be chosen or an amended EA must be prepared.
Design & Feasibility	Preparation of tender documents: Engineering firm provides specifications	If tender documents do not include mitigation measures and a budget to implement them, the project could result in adverse environmental impacts (see below for Construction Phase).	Mitigation measures described for the Construction Phase and Decommissioning Phase shall be incorporated into tender documents; costs for environmental management shall be included in overall project budget.

Cluster/ Project phase	Activity	Potential Adverse Impacts	Mitigation Measures
	for flood and erosion control measures.	If tender documents do not include mitigation for ancillary features, and a budget to implement them, adverse environmental impacts could result.	Tender documents shall include a requirement to discuss environmental implications of changes in substrate of the river/ravine/drain and of changes in waterway profile; and how public access to the river will be affected by the design, in the short and long-term. In addition to mitigation measures required for the Construction Phase and the Decommissioning Phase, tender documents should include a requirement for a re-use/recycle and waste segregation plan. Incorporate relevant mitigation measures from Annex G (small-scale construction guidelines); and from Road Rehabilitation Mitigation Plan (Cluster 2.4) into tender documents and engineering contract; and address the following in tender documents/engineering contract: • Providing existing off-site accommodation for crew. • Keeping camp size to a minimum. Require that crew preserve as much vegetation as possible, e.g., by creating defined footpaths. • Providing temporary sanitation on site, e.g., pit latrine (assuming the water table is low enough, with soil and geology of appropriate composition)
	Proposal review	Proposals that fail to incorporate environmental concerns could result in adverse environmental impacts (see below, Construction and Decommissioning Phases).	WINNER Biodiversity Specialist shall be involved in proposal review process to ensure that the proposed flood/erosion control project is environmentally sound. Based on the discussion of substrate changes (presented in the tender document), revisions shall be made to the design to ensure adverse environmental impacts do not result. Construction plans must be approved by a certified engineer, and construction works must be performed by a qualified and experienced contractor.
	Negotiations and award of engineering contract	If engineering contract does not include mitigation measures and a budget to implement them, the project could result in adverse environmental impacts (see below).	Mitigation measures described for the Construction and Decommissioning Phases shall be incorporated into contracts; costs for environmental management shall be included as a specific line item in the Bill of Quantities. Revisions to the engineering design to take into account concerns regarding substrate changes (from the tender document) shall be incorporated into engineering contract. In addition to Construction Phase and Decommissioning Phase mitigation measures,

Cluster/ Project phase	Activity	Potential Adverse Impacts	Mitigation Measures
			contracts shall include a re-use/recycle and waste segregation plan for the Construction and Decommissioning Phases.
	Feasibility studies	Feasibility studies on the design of flood and erosion control measures may fail to incorporate environmental concerns.	Along with economic, social, engineering, and cost issues typically included in feasibility studies, the ecology and hydrology (as it relates to ecosystem requirements) of the watershed/river-ravine-drain system shall be taken into account when designing specific flood and erosion controls measures.
	Feasibility studies	If inundation, destruction, or degradation of infrastructure and/or privately held or community owned land may result from the project, community and political acceptance may be compromised.	As part of determining the feasibility of the project, the engineering/design firm shall: Delineate a logical area with a well-defined boundary within which the owners of land, buildings or other infrastructure will be compensated. Monitor the implementation of a transparent and fair compensation plan by the Haitian government, as appropriate, any permanent or temporary loss incurred (e.g. buildings, infrastructure, land, crops, gardens, plantations). Ensure that the plan allows affected people to maintain their current housing condition or better.
Sourcing of construction materials	Engineering firm enters into a contract with company(ies) to obtain material for flood/erosion control project.	Location where fill material is obtained may not be environmentally sound, and mining of fill may result in ecological, hydrological, aesthetic, and land use impacts. Other material used for the flood/erosion control project may not be sourced sustainably, resulting in adverse environmental impacts. Location from which construction company obtains rocks for gabions, stonewalls, and check dams may damage hydrology and ecology of source waterway.	WINNER shall ensure that all material is sourced in an environmentally sound and sustainable manner. Cluster 3 Manager shall cooperate with Bureau for Mines and Energy to develop a strategic plan for construction rocks and sand established for each of the watershed where the WINNER project works
			The following mitigation measures shall be incorporated into tender documents and the engineering contract/contract specifications.
Construct-ion Phase	Construct ancillary features such as staff camps, access roads, storage	Construction of ancillary features could result in environmental impacts similar to other small-scale construction projects (loss or degradation of vegetation, wildlife habitat and species, changes in hydrology, impacts to cultural resources, etc).	Implement relevant mitigation measures from Annex G (small-scale construction guidelines); and from Road Rehabilitation Mitigation Plan (Cluster 2.4) as specified in the engineering contract.

Cluster/ Project phase	Activity	Potential Adverse Impacts	Mitigation Measures
	areas, and equipment maintenance areas.		
	Construct flood and erosion control structures	Flora (including trees), fauna, and sensitive ecosystems could be destroyed or degraded.	Identify areas to be cleared and limit vegetation and tree removal to only the vegetation and trees needed to construct flood and erosion control and provide ancillary features. Limit encroachment into riparian areas. Delineate sensitive and/or high quality habitat and keep all foot and motorized traffic and equipment out; where riparian habitat/vegetation is of good quality, limit worker traffic. Do not remove or disturb any mangroves. Save vegetation removed for replacement during De-commissioning Phase (as practicable). Material removed in cleaning and dredging operations and any construction or other excess material from the construction process (fill, rocks, etc.) shall not be stockpiled temporarily or permanently in wetlands or waterways or in a manner that will damage vegetation or soil.
		Cultural/historical resources could be destroyed or degraded.	Delineate cultural/historical resources to be protected, and keep all foot and motorized traffic and equipment out.
		During construction, TES and other sensitive species and/or habitats and cultural resources could be found within project boundaries or that are being affected by the project.	Educate workers about procedures to be implemented in case protected species or artifacts are found on-site. Engineering contract shall include a stop-work clause that requires project work to stop if these resources are found on site or found to be affected by the project. Work shall resume once collaboration with WINNER senior management and USAID is complete.
		If mitigation measures are not in place to ensure timely and safe removal of waste (from dredging or from cleaning), water quality could be degraded at the project site and hazardous and other waste could contaminate the disposal site.	Dispose of material removed from rivers, ravines, and drains in a timely manner and dispose of it at an approved location that uses environmentally sound practices. Disposal of hazardous or other —special wastes" that are dredged from waterways should be handled separately from regular solid waste, only by staff trained to handle toxic waste material, and should be disposed of at a State approved hazardous waste disposal site. In the absence of a State-approved hazardous waste disposal site in the country, materials shall be brought to Truitier site in safe containers and handled by trained staff.
		Erosion could result in increased turbidity, decreased water quality, and a degraded aquatic	Use erosion control measures during construction such as geotextiles, jersey barriers, haybales, siltscreens (or other

Cluster/ Project phase	Activity	Potential Adverse Impacts	Mitigation Measures
		ecosystem. This could have impacts on wildlife and humans that rely on these resources.	appropriate and obtainable material). Place erosion control barriers prior to starting construction (dredging, re-shaping, placement of structures). Do not remove erosion control barriers until construction is complete and permanent erosion/flood control measures are in place.
		Dredging could result in changes in hydrology of the river, ravine, and drain, which could affect fish and other aquatic resources, riparian vegetation, and mangroves and estuaries; and could have impacts on wildlife and humans that rely on these resources.	Limit dredging to removal of sediment deposited as a direct result of upstream watershed erosion and only dredge to the extent needed to return the bed to its natural condition and depth. Limit bank reshaping to what is needed to stabilize banks. Work shall not permanently alter the water course. Maintain natural flow by using temporary trenches or ditches to ensure water flows downstream at adequate rate to retain watercourse hydrology. As appropriate, set up a water quality monitoring system to monitor sedimentation rate and water quality along waterway and/or at mouth of river to detect changes that could result in adverse environmental impacts.
		Dredging and use of heavy equipment could damage river/ravine/drain banks.	Keep in place erosion control measures and temporary bank stabilization while heavy equipment is being used on the banks.
		Heavy equipment that is not well-maintained and stored properly could degrade water quality.	Provide a maintenance area that is adequate distance (at least 50 meters) from waterways and any sensitive terrestrial habitat, and require that all equipment maintenance take place there. Keep emergency response equipment on work sites to deal with hazardous or other spills.
		Noise from the use of heavy equipment and other construction equipment could affect breeding and feeding and other wildlife behavior. Noise could affect the human environment.	If during environmental monitoring, noise is found to disrupt breeding, feeding, or other wildlife behavior, limits shall be placed on use of heavy equipment, movement of personnel, or other noise-producing construction phase activities. These limits shall remain in place until determined by the WINNER Biodiversity Specialist that they may be removed. Limit noise from construction activities to daylight hours.
		Public and worker safety could be compromised without adequate mitigation in place.	To ensure the safety of the public: Restrict access of the public to hazard areas. Hold meetings to educate and inform residents of the work to be carried out. Reduce vehicle speed in work zone.

Cluster/ Project phase	Activity	Potential Adverse Impacts	Mitigation Measures
			Implement a communication plan for regular public awareness of project activities. To ensure the safety of employees: Provide adequate training of personnel in safety procedures. Provide appropriate safety equipment (including for noise protection, as needed). Post proper signage. Enforce safety zones and procedures Implement a work place health and safety plan, which should include employee training.
		Gender concerns and local labor	A gender ratio for project staff of as close to 1:1 shall be strived for. Local sources of labor should be used to the greatest extent possible.
Decommis-sioning		If construction camps and other ancillary features are not dismantled or if other provisions are not made for them, they will degrade over time, and could impact water quality, degrade soils, and create a public hazard.	Unless other provisions are made, staff construction camps shall be removed once construction is complete. Removal shall include disposal of solid waste, buildings, etc. A provision shall be included in the engineering contract to allow for WINNER inspection prior to finalizing payment.
		Leaks or spills that are not cleaned up can continue to contaminate the environment.	Any areas where leaks or spills have occurred that were not previously cleaned up, shall be cleaned prior to completing Decommissioning Phase.
		If hydrology and grade are not restored, flooding, ponding, and destruction of vegetation and other aquatic and terrestrial resources could result.	Once construction work is complete, restore hydrology and grade to pre-construction condition (or improved drainage) on work sites and adjacent affected areas.
		If vegetation is not restored, and soil is left bare, erosion and landslides could result.	Re-vegetate areas disturbed with naturally occurring vegetation, if possible with vegetation retained from on-site; and/or with erosion control vegetation (vetiver, bamboo, elephant grass).
Operation and Maintenance		If a practical maintenance plan is not in place, funded, and if those responsible are not trained, it is unlikely the infrastructure will be maintained.	Starting during the planning phase, WINNER shall support the development of, training in, and implementation of a maintenance plan. This shall be coordinated with WINNER Component 3, Clusters 3.1 and 3.2.
		If community access is restricted, public and political support could be compromised.	Community access to the waterway/project site shall be retained to the degree feasible so as not to damage construction works or put them or to put the public at risk.

Description of Cluster 2.2: Restore irrigation systems.

Training, technical assistance, studies/assessments, and procurement: study existing irrigation system to identify additional irrigation needs; provide technical assistance and training to water users associations to manage and operate irrigation systems; and purchase diesel to power systems during transition period before water user associations are able to take over payments.

Infrastructure and other physical interventions: clean drainage structures; repair irrigation pumping and power stations that pump groundwater to holding ponds or water towers for irrigation; replace/repair irrigation intakes and diversion structures (irrigation canals) that provide irrigation water to agricultural land; and develop ponds (*lacs collinaires*) to hold and regulate water and to provide water for crop production and livestock.

Cluster 2.2 covers all activities directly and indirectly related to the construction and/or rehabilitation of irrigation systems. The purpose of this cluster of activities is to improve agricultural production by providing a predictable water supply to expand the variety of crops that can be grown, and to contribute to the development of a market agriculture system. In general, irrigated areas are 2.5 times more productive than rain-fed agricultural land (Stockle, undated). WINNER target watersheds lack the basic agricultural infrastructure necessary to support agricultural production. Where irrigation systems exist, irrigation is either by gravity (direct intakes from the river) or by pumping groundwater, and they are either inefficient or in a state of disrepair.

Three general types of repairs of irrigation systems will take place under this component, as described below:

(1) Activities involved in the repair of pumping stations (similar to the work at Bas Boen, which the PEA Team visited): These irrigation systems use groundwater, which is pumped to a holding tank and then dispersed through an underground pipe network. At target sites, the generator and pump are usually no longer working, but some of the infrastructure may remain, including the pump house and irrigation pipe network, which may need to be rehabilitated. Physical activities typically involve:

a. Rehabilitation of the existing pumping station, a small unit that houses the pump: This is a structure usually under 400 ft^2, constructed out of concrete that protects the pump (see photo below). The pump and generator may need to be repaired or replaced.

Irrigation pumping station

b. Construction of the hydraulic network: pipes are laid below ground surface to irrigated fields.

c. Installation of water towers (on average, 3200 gallon capacity) which involves construction of a metal tower with a water tank mounted on top; or construction of holding ponds, which involves dredging an area, lining it with concrete, and piping irrigation water from it to agriculture plots.

d. Fees are collected for irrigation water, and payment is made to the committee responsible for the system. Irrigation repair projects usually also include the construction and installation of kiosks for the sale of potable water, if the water is safe for drinking

(2) Repair and replacement of irrigation intakes and diversion structures: The PEA Team visited Dubedou, where this type of project was being undertaken). There are many earthen irrigation water intakes (*prises sur berge*) along river banks. These are gravity-fed systems, providing irrigation water by direct intake from the river or canal. Most of the intakes feed into dirt canals; very few are lined with concrete. Generally, because of the topography and land/water level difference, it is difficult to irrigate by gravity directly from the river using artisanal water intakes. Existing irrigation canals and secondary intake structures are in need of rehabilitation. Canal walls are disintegrating, intake structures are absent or there is leakage, and they are not capable of regulating water flow into the secondary irrigation canals or onto farmer fields. This results in water wastage, and inefficient irrigation.

Physical activities involved in replacement of irrigation intakes and diversion structures are:

1. Clean and dredge existing irrigation canals: as above for flood and erosion control

2. Repair or construct intake structure: Repair involves removing concrete lining, if present, and re-lining with concrete. Construction involves dredging a new irrigation canal and lining with concrete.

3. Place a gate or culvert from the main irrigation canal to the secondary canal to regulate water flow, and backfill with soil that had been removed.

(3) Construct or rehabilitate irrigation ponds (holding ponds): This will eliminate water wastage by providing a holding area where irrigation water can be drawn from on an as-needed basis, especially during drought. Holding ponds will also allow farmers to grow crops more reliably, and decrease risk of farming especially given the expected impacts of climate change.

Construction of an irrigation pond involves:

1. Dredging the existing holding pond or constructing a new pond by excavating soil
2. Lining pond with concrete, if necessary
3. Constructing intake/outlet structures

Project phases are common to all types of irrigation system repair projects (groundwater pumping, surface water diversion, and holding ponds):

1. Planning and Site Selection: preparatory meetings with communities, local government, site visits, reports
2. Design and Feasibility: preparation of tender documents, review of proposals, and signing of engineering contract
3. Sourcing of construction materials
4. Construction: including constructing ancillary features such as access roadways and construction camps
5. Decommissioning of construction works, including site restoration
6. Operation and Maintenance

Besides the above project phases, all irrigation activities also involve technical assistance and training, as described in Cluster 2.2 and in Component 3 so that community members and/or local government can take over the collection of fees for services and the maintenance role.

Environmental Consequences of Cluster 2.2: The proposed technical assistance, training, studies and assessments in Cluster 2.1, and procurement of diesel fuel will have no environmental effects; no mitigation is necessary.

Cleaning and dredging is discussed in Cluster 2.1, and the mitigation measures described for these Cluster 2.1 activities also apply to Cluster 2.2, cleaning and dredging of irrigation canals. These mitigation measures are included in the Mitigation Plan (Table 4.2).

Irrigation system repair could have adverse environmental impacts. The environmental consequences of the three types of irrigation system repairs (groundwater pumping, surface water diversion, and holding ponds) are discussed below by project phase. The environmental impact assessment below is derived from PEA Team field visits, and previous WINNER EMPRs for irrigation repair projects. The PEA Scoping Statement (with PEA Team additions/revisions documented below) is used as the framework for the discussion. Scoping Statement concerns, and issues raised in WINNER EMPRs provide the framework for the environmental consequences discussion. Issues deemed significant in the Scoping Statement and by the PEA Team are in bold below.

(1) Potential impacts of the Planning and Site Selection Phase

This phase will have indirect impacts only. No movement of earth or other activities that would have direct environmental effects will take place. Project planning involves meetings and awareness raising among community members, identifying challenges, options, and project requirements, selecting counterparts, and other similar activities that are the foundation of project start-up. Also during this phase, locations of pumping stations, irrigation canals, and holding ponds to rehabilitate/construct and associated agricultural fields to provide water to will be identified. For groundwater pumping, existing structures will be rehabilitated rather than constructing new systems. For surface water diversion systems, in some cases, new irrigation diversion canals will be constructed to provide water for existing agricultural fields.

There is not yet an irreversible or irretrievable commitment of resources and sites that are selected can be changed during this and the following phase, the Design and Feasibility Phase. However, site selection must include environmental concerns in addition to engineering and livelihood concerns since environmental impacts are easiest and most cost-effective to address at this early stage.

Incorporating an Environmental Due Diligence (EDD) test during this phase will help ensure that potential impacts do not occur in later project phases, when mitigation may be costly or too late. EDD during the Planning and Site Selection Phase will specifically address potential adverse impacts related to site selection for irrigation repair work: **important habitat, flora and fauna, sensitive ecosystems, threatened and endangered species and their habitat, cultural and historical assets, and protected areas** (see Table 4.2, Mitigation Plan, below for details of the EDD). In addition, where irrigation water will also be used for drinking water, washing water, and for watering livestock, there could be health impacts. At the planning phase, decisions will be made on whether the system will serve multiple uses; and appropriate due diligence should be implemented at this phase (Table 4.2).

Since at the programmatic level of this PEA, specific intervention sites have yet to be identified, a process that can be used over the LOP of WINNER must be institutionalized. The EDD in Table 4.2 will ensure that during the Planning and Site Selection Phase, environmental concerns will be considered in a timely manner and at the same level as other project concerns.

At the Planning and Site Selection Phase, additional aspects to consider are the long-term effects on the environment of providing irrigation water for agriculture. The EDD test at the Planning and Site Selection Phase can address some of these aspects; this will require analyses and predictions to determine long-term social and environmental impacts of irrigation, such as:

- Provision of irrigation can result in expansion of agriculture to areas that were not previously under agricultural production. This could include natural areas, such as wetlands, forested areas, brush/shrub areas, some of which may provide habitat for wildlife and other ecological services.
- Provision of irrigation water will help intensify agriculture, could transform the area into a market agriculture economy, and could result in increased use of pesticides.
- Provision of irrigation water by groundwater pumping could affect groundwater levels; this would affect the availability of groundwater for uses other than agriculture.
- Diversion of water from streams and rivers to agricultural fields will result in less water availability downstream for ecosystems, wildlife, and other downstream users.

The EDD in Table 4.2 (Planning and Site Selection Phase) addresses these aspects of irrigation provision projects.

In addition, water conservation and management should be well-integrated into the Planning and Site Selection Phase. Measures should be appropriate for the location and community and in line with legal frameworks, but some possibilities may include introducing water pricing that fairly represents the market value of water; and setting limits for allowable groundwater use and introducing penalties for exceeding these limits.

(2) Potential impacts of the Design and Feasibility Phase
During this phase, feasibility studies are undertaken by WINNER staff to test economical profitability; these studies include the environmental feasibility of the project. The Terms of Reference (TORs) is developed; designs are requested from qualified firms; proposals are evaluated based on the merits of the proposals; and an award is made. The project is designed in detail during this phase—the extent of repairs needed, the irrigable area, the amount of water available for irrigation, and the material and equipment to be used in the construction. Ancillary features will also be identified during this phase—the need for construction staff housing, access roads, storage areas. Most of the irrigation repairs are small-scale and will not require extensive ancillary features; however even for small-scale construction, safeguards must be in place to ensure no adverse environmental impacts occur (Table 4.2).

Certain impacts will not become apparent until the Design and Feasibility Phase, and are best mitigated during this phase. Depending on the source of the water, the soils in the area, and the amount of irrigation water to be made available, salinity build up may be a concern—this could affect **water quality** and could impact **local flora** downstream.

Salinization, a common effect of irrigation, can occur from the weathering of parent material, and irrigated water with high salt content can affect crop growth. These salts are generally in very low concentration in the water itself. However, evaporation of water from the dry surface of the soil leaves the salts behind. Salinization can also be a concern where, for lack of infrastructures and/or lack of understanding of consequences, people from the community commonly bath and have grey water from their laundry (even water from washing trucks and vehicles) percolate in the irrigation canals. Salinization is especially likely to become a problem on poorly drained soils when the groundwater is within three meters or less of the surface (depending on the soil type). Salinization is a worldwide problem, particularly acute in semi-arid areas, which use large amounts of irrigation water and are poorly drained. Salinization reduces crop productivity and in some cases, agricultural land has to be abandoned.

While in part, salinization is related to on-farm water management, the engineering design could also affect the potential for salt build-up, and therefore, the design should include mitigation to ensure that the irrigation works do not contribute to salinity buildup on irrigated land (see Table 4.2).

The amount of groundwater to be pumped is a design feature. Withdrawing groundwater (pumping stations) may cause the land to subside, aquifers to become saline, or may accelerate other types of groundwater pollution. This could affect **water quality and quantity, local flora, fauna, and sensitive terrestrial ecosystems, and could increase soil erosion**. Design measures must be in place to ensure groundwater extraction rates be kept at or below recharge rates to prevent drawdown and related subsidence and habitat destruction (see Table 4.2).

Withdrawing surface water (irrigation canals) can change the natural hydrology (**water quality and quantity**) of rivers and streams, can change water temperature, and result in other alterations to natural conditions, sometimes significantly affecting the aquatic ecosystems associated with these water bodies. In extreme cases, so much water may be withdrawn that a

river no longer drains to the sea. Surface water withdrawal is a design feature, and a feature that is best considered and mitigated during the Design Phase (Table 4.2).

Water quality is also affected by agricultural chemicals—pesticides and fertilizers. Design parameters can mitigate the potential impacts by providing for the runoff to be managed in an environmentally sound manner (see Table 4.2).

Some water conservation (**water quantity**) aspects were included as mitigation in the Planning and Site Selection Phase. Some are more appropriately addressed during the Design and Feasibility Phase and are included in Table 4.2.

Also during this phase, the extent of the physical interventions is determined, and the need to **acquire land** (relocate homes and other infrastructure, and acquire property, permanently or temporarily) is identified. These concerns could have social, cultural, and livelihood implications, and could determine whether or not the project is accepted by the local communities. These issues must be dealt with prior to construction. At the programmatic level, it is unclear if land acquisition and compensation will be necessary for irrigation repair projects. In cases where land acquisition will be necessary, Table 4.2 describes mitigation to be implemented during the Design and Feasibility Phase to ensure land acquisition and just compensation is considered as early as practicable in the design.

The mitigation measures described for the Design and Feasibility Phase will help ensure that no irreversible or irretrievable commitments are made to a project that then turns out to be socially and environmentally unacceptable. Other potential impacts—described below—can be mitigated during the follow-on project phases, usually by what are termed ―best engineering practices"—practices that protect the physical and biological environment and that have become a standard part of construction projects. Regardless of how standard and common they are—best engineering practices, and other mitigation measures—must be identified and included in engineering contracts; the Mitigation Plan requires this as a Design Phase mitigation measure.

(3) Potential impacts of sourcing construction materials

Much of the material needed for irrigation repair--PVC pipe, water tanks, concrete, and lining for ponds, inlet and outlet structures for irrigation canals—are standard construction materials; procuring them will not result in foreseeable environmental impacts. For pump houses, material such as cement and galvanized steel roofing will be needed. Procuring these materials will result in no environmental impacts.

Fill may have to be brought in to build up irrigation canals, to backfill irrigation outlet structures, or to build up the foundation for the pump house and water tower, or for ancillary features (construction camps, access ways). Only small amounts of fill are expected to be needed for irrigation repair projects, and it may be available onsite. However, if fill will be obtained from a quarry, environmental impacts (**flora, fauna, soil erosion, water quality, aesthetics**) could result if not obtained from a permitted, environmentally sound location (see Table 4.2).

(4) Potential impacts of the Construction Phase
Impacts and mitigation measures from cleaning of ravines and drains also apply to irrigation canals. These are discussed in Cluster 2.1, and mitigation is included in Table 4.2.

Construction of ancillary features (staff housing, latrines, kitchen areas, storage areas, access roads):
Construction could affect **native flora, fauna, result in tree cutting, could affect sensitive ecosystems and cultural/historical resources, and could impact surface, groundwater, require land acquisition, and require the disposal of solid, hazardous, and special wastes**. The PEA Scoping Statement did not consider this issue separately from the overall flood and erosion control project. However, mitigation for typical ancillary features must be integrated into the design, specified in engineering contracts, and requires some measures specific to ancillary features (water and sewage, access roads). Mitigation is required in Table 4.2 and is described in detail in Annex G-Mitigation Plan for Small-Scale construction.

Repair of irrigation systems (groundwater pumping systems, surface water diversion, and holding ponds):

a) Much of the actual construction involved in irrigation system repair projects is small-scale: repair of the pumping house/power station (approximately 400 ft^2); laying the irrigation pipe network (trenches are dug and pipe is laid and soil is backfilled to cover the pipe); for repair of irrigation canals, these are already existing canals, some dirt lined, some lined with concrete that has been disintegrating; for construction of irrigation diversion canals, narrow trenches are excavated to divert water; and to create a holding pond, soil is excavated on an area no larger than 30,000 ft^2). While the construction process inherently can impact **vegetation (flora and fauna)**, and sensitive ecosystems, it is unlikely this will be a major impact. However, typical best engineering practices should be incorporated (Table 4.2).

b) Potential impacts to **cultural/historical resources** were found by the PEA Scoping Team not to be significant or relevant. Irrigation repair will not disturb large areas, but the locations for this work are currently unknown, and therefore, cultural/historical resources could be found while working at the site that were not identified during the Planning & Site Selection Phase. In this case, contingency plans are needed to ensure there are no adverse effects if these resources are found on-site or are found to be affected by construction activities. See Table 4.2 for mitigation measures.

c) Potential impacts to **threatened and endangered species, and other sensitive species, and their habitat** are expected to be mitigated by measures implemented during the Planning and Site Selection Phase. However, as above, even with mitigation measures, species and habitat may be found once construction begins that were not identified during Planning and Site Selection. In addition, noise from heavy equipment and presence of workers could disrupt TES and sensitive species, even off-site. Table 4.2 contains mitigation measures to minimize risk to these resources if they are found to be affected by construction work.

d) The construction process could result in increased erosion and sedimentation, resulting in increased turbidity and decreased **water quali**ty. This could affect aquatic resources—fish,

other aquatic vertebrates and invertebrates, and aquatic vegetation (**native flora and fauna and sensitive ecosystems**); and could also affect wildlife throughout the food chain, including birds and mammals that rely on aquatic resources (**native or terrestrial fauna**). Erosion control measures kept in place throughout the Construction Phase are expected to mitigate concerns.

e) The use of heavy equipment could contaminate **surface and groundwater quality and terrestrial resources** due to the potential for oil and fuel leakages; Table 4.2 describes mitigation.

f) Although the Scoping Statement excluded noise from consideration, noise is noted as an issue in WINNER EMPRs where heavy equipment is used. Therefore, the PEA Team retained **noise** as a potential significant impact for consideration in the PEA. Noise could affect human welfare and wildlife. However, WINNER irrigation repair work will only take place during daylight and normal work hours, and impacts to the human environment will only last as long as the construction phase, and would not be considered significant. For certain wildlife, noise could disrupt nesting and feeding behavior, and for more sensitive wildlife species, this could have a detrimental effect. The effects of noise on sensitive wildlife is considered and mitigated during the Planning and Site Selection Phase, but a contingency plan may be needed during construction in case sensitive species are found on-site (see Table 4.2).

g) During the Construction Phase, there could be a short-term increase in emissions and dust as a result of exhaust from heavy equipment used to dredge and trucks carrying in supplies. Impacts of emissions and dust on **air quality** and the human environment should be short-term and minor, and no additional mitigation is needed.

h) As with any construction project, public and worker safety is a concern. Normal precautions should be taken, typical of work at any construction site, to minimize risks to the public and workers. These are described in the Mitigation Plan (Table 4.2) and if implemented, are expected to be adequate to eliminate concerns regarding public and worker safety.

i) All WINNER EMPRs included **gender** as a concern. For construction activities, a gender ratio of 1:1 will be strived for, but in cases where special expertise or skills are needed, the ratio may vary, favoring one gender over another. As the PEA Team witnessed when visiting construction sites at Kenscoff and Gonaives, WINNER makes every attempt to ensure gender equity. This is included in Table 4.2 to mitigate any concerns regarding gender.

Irrigation repair projects are expected to benefit men and women equally. Women, along with men, perform many agricultural tasks; provision of irrigation water will ease that burden. Having the capacity to produce a greater variety, a more consistent crop, and having the potential to commercialize will benefit both genders.

j) If labor is brought in from outside the general area where irrigation systems will be repaired, the project may lose support of the local community. To the greatest extent feasible,

local labor shall be used to repair irrigation systems. This will also minimize the need for construction staff camps.

k) A concern not identified by the PEA Scoping Team, but one noted by the PEA Team during site visits is **that irrigation water is being used for drinking and bathing water**, yet there is no provision to test the water for human consumption. WINNER should work with community members to determine if the water will serve multiple purposes, and to implement appropriate precautions, such as community awareness campaign, signage, fencing to exclude people from the area, or water quality testing (see Table 4.2).

(5) Potential impacts of the Decommissioning Phase

(a) If construction camps have been built for staff, decommissioning may involve removal of material—solid waste, buildings, etc. Alternatively, the construction camp and other ancillary features may be turned over to the municipality. Regardless if the camp is small or large, if it included latrines and kitchen areas, if it will be dismantled or turned over, the camp should be left in environmentally sound condition. Excess material that is not properly disposed of could result in environmental impacts: liquid and solid waste could degrade water quality, affect aquatic resources (**flora and fauna**), and **terrestrial ecosystems. Water quantity** (hydrology-flood regime) could be affected if trash is left behind to clog waterways and wetlands. Mitigation, requiring the removal of buildings and other ancillary features, or as an alternative, for a sound hand-over plan, is included in the Mitigation Plan (Table 4.2).

(b) Construction equipment that is left on-site after construction is complete could affect the environment. Fuel and oil leaks, rust from equipment, and equipment parts could degrade **water quality**, and affect **flora and fauna**; and could have an impact on hydrology and flood regime (**water quantity**) if equipment clogs waterways. Decommissioning may require the disposal of **solid, hazardous, or special wastes**. There could also be public safety risks if people can enter the site to dismantle abandoned equipment. Mitigation, involving removal of all equipment and supplies, is described in the Mitigation Plan.

(6) Potential impacts of the Operation and Maintenance Phase

(a) Without a practical maintenance plan in place, irrigation works will degrade. Impacts of this would be mainly social and livelihood-related. If farmers have adjusted to market agriculture systems, yet irrigation systems are no longer working, they could lose their livelihoods. From the purely human standpoint, the failure of what may be considered a ~~"d~~evelopment" or ~~"a~~id" project could undermine USAID's reputation, and could have far-reaching long-term impacts if local people become discouraged about the utility of irrigated agriculture and a market economy. A maintenance plan, including training for those responsible for implementation, is expected to minimize concerns, and is included in Table 4.2.

b) Other concerns of the Operation and Maintenance Phase involve the accuracy of the predictions made in the Planning and Site Selection and Design and Feasibility Phases. The Mitigation Plan is intended to minimize any potential adverse environmental and social impacts over the LOP. The result should be the ~~"r~~estoration of irrigation systems" —not at the expense of valuable environmental resources. Monitoring over the LOP—as required in

the Programmatic Environmental Management Plan (see Annex E), up to WINNER hand-over in the Decommissioning Phase, will allow for adaptive management. Implementation of the PEMP will allow WINNER to quickly identify when predictions are incorrect and/or if required mitigation is unsuccessful in halting environmental damage. And in a timely manner, alternative mitigation measures can be applied and monitored.

Table 4.2: Mitigation Plan for Cluster 2.2. *Irrigation System Repair*

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
Cluster 2.2: Planning & Site Selection	Identification of project site: WINNER staff in collaboration with communities and local government	At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to livelihood and other issues. Important habitat or ecosystems sensitive to disturbances may be located within project site boundaries or may be affected by the project. Habitat for threatened or endangered species and/or threatened or endangered species may be found within project site boundaries or may be affected by the project. At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to livelihood and other issues.	WINNER Biodiversity Specialist shall be involved in planning and site selection. **Environmental Due Diligence shall be conducted at Planning & Site Selection Phase, as follows.** WINNER Biodiversity Specialist shall ensure that the Mitigation Plan for the Construction Phase is adequate so that: (1) any important habitat or ecosystems that are located within project boundaries (project boundaries include all ancillary features) will be protected. (2) any important habitat or ecosystems that may be affected by the project (affected may be temporary/short-term or long-term, direct or indirect, and —project" includes ancillary features) will be protected. (3) any cultural or historical assets that are within project boundaries or that may be affected by the project will be protected. (4) other domestic needs for the same source of water are addressed and precautions are taken so that they do not become sources of pollution and causes of soil salinization or degradation If WINNER Biodiversity Specialist determines that the Construction Phase Mitigation Plan is not adequate to protect flora, fauna, and sensitive ecosystems), and cultural/historical resources, an alternative site must be chosen. **Environmental Due Diligence shall also ensure that:** If any threatened, endangered, or other sensitive species, or habitat for threatened, endangered, or other sensitive species is within project boundaries or may be affected by the project, an alternative site shall be chosen. If protected areas are within project boundaries or may be affected by the project, an alternative site shall be chosen. The irrigation repair project is in line with the Participatory Watershed Management Plan. A Maintenance Plan for the Operation and Maintenance Phase is developed in consultation with relevant community members and government authorities. All relevant GOH and local legislation is complied with including, as necessary, land acquisition and compensation procedures outlined in relevant GOH legislation (also see

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			Design and Feasibility Phase). Any social and environmental concerns that cannot be mitigated by the measures in this Mitigation Plan shall be brought to the attention of WINNER senior management for action. An alternative site shall be chosen or an amended EA must be prepared. **At Site Selection and Planning Phase, WINNER shall, in collaboration with Component 3, identify measures and an implementation plan for:** 1. Promoting the introduction of water pricing that represents the market value of water. 2. Setting limits for allowable irrigation water use and introduce penalties for exceeding these limits. 3. Water conservation other than the above. 4. Land reclamation incentives. **At Site Selection and Planning Phase, WINNER shall, in collaboration with Component 1, identify measures and an implementation plan for:** 1. Limiting pesticide, herbicide, and petroleum-based fertilizer use. 2. Minimizing water losses in the on-farm distribution system. 3. Promoting crop rotation and less-water demanding crops, more drought- and salt-tolerant crops. 4. Ensuring and promoting agricultural intensification, not expansion of land under agriculture. 5. Promoting on-farm water management. **At site selection and planning phase, if the water is intended for drinking (by humans or livestock), in addition to irrigation, WINNER shall, in collaboration with Component 3, identify measures and an implementation plan for:** Developing a water quality monitoring and testing plan (in conformance with DINEPA requirements, Annex H), responsible parties; and training needed to implement it.
Design & Feasibility	Preparation of tender documents: Engineering firm provides specifications for irrigation repair.	If tender documents do not include mitigation measures and a budget to implement them, the project could result in adverse environmental impacts (see below, Construction Phase).	Mitigation measures described for the Construction Phase and Decommissioning Phase shall be incorporated into tender documents; costs for environmental management shall be included in overall project budget. Tender documents shall include a requirement to discuss the following: 1. What are the provisions in the engineering design to ensure that the quality of the supplied water does not contribute to salinity buildup on the irrigated land?

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			1. For groundwater pumping irrigation systems: What are the measures to ensure groundwater extraction rates will be kept at or below recharge rates to prevent drawdown and related subsidence and habitat destruction? 2. For irrigation canal systems: Will surface water diversion reduce groundwater discharge?; Will the diversion rate have an adverse effect on downstream flow rates or downstream water temperature?; How will canal seepage be prevented or reduced(i.e., using lining)? 3. How will water distribution systems and management be conducive to the implementation by farmers of sound irrigation and agronomic practices? 4. How will agricultural runoff be managed to prevent impacts from excess nutrients and chemical pesticides and herbicides? 5. Will the drainage water be reclaimed and reused?
		If tender documents do not include mitigation for ancillary features, and a budget to implement them, adverse environmental impacts could result.	In addition to Construction Phase and Decommissioning Phase mitigation measures, contracts shall include a re-use/recycle and waste segregation plan for the Construction and Decommissioning Phases. Incorporate relevant mitigation measures from Annex G (small-scale construction guidelines); and from Road Rehabilitation Mitigation Plan (Cluster 2.4) into tender documents and engineering contract; and address the following in tender documents/engineering contract: • Providing existing off-site accommodation for crew. • Keeping camp size to a minimum. Require that crew preserve as much vegetation as possible, e.g., by creating defined footpaths. • Providing temporary sanitation on site, e.g., pit latrine (assuming the water table is low enough, with soil and geology of appropriate composition) If water will also be used as drinking water source for livestock and/or humans, tender documents shall include a requirement to discuss initial water quality testing and alternative plans if water quality does not meet GOH requirements (see Annex H).
	Proposal review	Proposals that fail to incorporate environmental concerns could result in adverse environmental impacts (see below, Construction and Decommissioning Phases).	WINNER Biodiversity Specialist shall be involved in proposal review process to ensure that the proposed irrigation repair project is environmentally sound. Based on the discussion of irrigation impacts

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			(presented in the tender document), revisions shall be made to the design to ensure adverse environmental impacts do not result. Construction plans must be approved by a certified engineer, and construction works must be performed by a qualified and experienced contractor.
	Negotiations and award of engineering contract	If engineering contract does not include mitigation measures and a budget to implement them, the project could result in adverse environmental impacts (see below).	Mitigation measures described for the Construction and Decommissioning Phases shall be incorporated into contracts; costs for environmental management shall be included as a specific line item in the Bill of Quantities. Revisions to the engineering design to account for surface and groundwater concerns shall be incorporated into engineering contract. In addition to Construction Phase and Decommissioning Phase mitigation measures, contracts shall include a re-use/recycle and waste segregation plan for construction phase.
	Feasibility Studies	If destruction or degradation of infrastructure and/or privately held or community owned land may result from the project, community and political acceptance may be compromised.	As part of determining the feasibility of the project, the engineering/design firm shall: Delineate a logical area with a well-defined boundary within which the owners of land, buildings or other infrastructure will be compensated. Monitor the implementation of a transparent and fair compensation plan by the Haitian government, as appropriate, in order to provide fair compensation for any permanent or temporary loss incurred (e.g. buildings, infrastructure, land, crops, gardens, plantations). Ensure that the plan allows affected people to maintain their current housing condition or better.
Sourcing of construc-tion materials	Engineering firm enters into a contract with company(ies) to obtain material for irrigation repair.	Location from which construction company obtains erosion control material, fill material, and other construction material may not be environmentally sound or sourced sustainably, and obtaining these materials may result in ecological, hydrological, aesthetic, and land use impacts.	WINNER shall ensure that all material to be used in construction is sourced in an environmentally sound and sustainable manner.
			The following mitigation measures shall be incorporated into tender documents and the engineering contract/contract specifications.
Construc-tion Phase	Construct ancillary features such as construction	Although ancillary features for irrigation repair projects are likely to be minimal, they could result in environmental impacts similar to other small-scale construction	Implement relevant mitigation measures from Annex G (small-scale construction guidelines); and from Road Rehabilitation Mitigation Plan (Cluster 2.4) as specified in the engineering contract.

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
	camps, storage areas and equipment maintenance areas.	projects (loss or degradation of vegetation, wildlife habitat and species, changes in hydrology, impacts to cultural resources, etc).	
	Repair or construct irrigation systems.	Flora (including trees), fauna, and sensitive ecosystems could be destroyed or degraded.	Identify areas to be cleared and limit vegetation and tree removal to only the vegetation and trees needed to repair irrigation system and provide ancillary features. Limit encroachment into riparian areas. Delineate sensitive and/or high quality habitat and keep all foot and motorized traffic and equipment out; where riparian habitat/vegetation is of good quality, limit worker traffic. Do not remove or disturb any mangroves. Save vegetation removed for replacement during Decommissioning Phase (as practicable). Material removed from irrigation canals and any construction or excess material from the construction process (fill, rocks, etc.) shall not be stockpiled temporarily or permanently in wetlands or waterways or in a manner that will damage vegetation or soil.
		Cultural/historical resources could be destroyed or degraded.	Delineate cultural/historical resources to be protected, and keep all foot and motorized traffic and equipment out.
		During construction, TES and other sensitive species and/or habitats and cultural resources could be found within project boundaries or that are being affected by the project.	Educate workers about procedures to be implemented in case protected species or artifacts are found on-site. Engineering contract shall include a stop-work clause that requires project work to stop if these resources are found on site or found to be affected by the project. Work shall resume once collaboration with WINNER senior management and USAID is complete.
		If mitigation measures are not in place to ensure timely and safe removal of waste (from cleaning and construction works), water quality could be degraded at the project site, and hazardous and other waste could contaminate the disposal site.	Dispose of material removed from irrigation canals and construction waste in a timely manner and at an approved location that uses environmentally sound practices.
		Erosion could result in increased turbidity, decreased water quality, and a degraded aquatic ecosystem. This could have impacts on wildlife and humans that rely on these resources.	Use erosion control measures during construction such as geotextiles, jersey barriers, haybales, siltscreens (or other appropriate and obtainable material). Place erosion control barriers prior to starting construction, and do not remove erosion control barriers until construction is complete, and vegetation is established. Replace soil and return land to pre-construction

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			condition after laying irrigation pipe network.
		Use of heavy equipment could damage riverbanks or canal system.	Keep in place erosion control measures and temporary bank stabilization while heavy equipment is being used on the banks.
		Heavy equipment that is not well-maintained and stored properly could degrade water quality.	Provide a maintenance area that is adequate distance (at least 50 meters) from waterways and any sensitive terrestrial habitat, and require that all equipment maintenance take place there. Keep emergency response equipment on work sites to deal with hazardous or other spills.
	Clean irrigation canals and repair or construct irrigation systems.	Noise from the use of heavy equipment and other construction equipment could affect breeding and feeding and other wildlife behavior. Noise could affect the human environment.	If during environmental monitoring, noise is found to disrupt breeding, feeding, or other wildlife behavior, limits shall be placed on use of heavy equipment, movement of personnel, or other noise-producing construction phase activities. These limits shall remain in place until determined by the WINNER Biodiversity Specialist that they may be removed. Limit noise from construction activities to daylight hours.
	Clean irrigation canals and repair or construct irrigation systems.	Public and worker safety could be compromised without adequate mitigation in place.	To ensure safety of the public: For projects that involve pumping station/bore hole or holding ponds, determine whether irrigation water will also be used as a potable water source or for bathing, and post appropriate signs, and conduct water quality testing as necessary (see Cluster 2.3 Mitigation Plan). Restrict access of the public to hazard areas. Hold meetings to educate and inform residents of the work to be carried out. Reduce vehicle speed in work zone. Implement a communication plan for regular public awareness of project activities. To ensure the safety of employees: Provide adequate training of personnel in safety procedures. Provide appropriate safety equipment (including for noise protection, as needed). Post proper signage. Enforce safety zones and procedures. Implement a work place health and safety plan, which should include employee training.
		Gender concerns and local labor	A gender ratio for project staff of as close to 1:1 shall be strived for. Local sources of labor should be used to the greatest extent possible
Decommissioning		If construction camps and other ancillary features are not dismantled or if other provisions are not made for them, they will degrade over	Unless other provisions are made, staff construction camps and other ancillary features shall be removed once construction is complete. Removal shall include disposal of

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
		time, and could impact water quality, degrade soils, and create a public hazard.	solid waste, buildings, etc. A provision shall be included in the engineering contract to allow for WINNER inspection prior to finalizing payment.
		Leaks or spills that are not cleaned up can continue to contaminate the environment.	Any areas where leaks or spills have occurred that were not previously cleaned up during construction phase shall be cleaned prior to completing decommissioning phase.
		If hydrology and grade are not restored, flooding, ponding, and destruction of vegetation and other terrestrial resources could result.	Once construction work is complete, restore hydrology and grade to pre-construction condition (or improved drainage) on work sites and adjacent affected areas.
		If vegetation is not restored, and soil is left bare, erosion and landslides could result.	Re-vegetate areas disturbed with naturally occurring vegetation, if possible with vegetation retained from site; and/or with erosion control vegetation (vetiver, bamboo, elephant grass).
Operation and Maintenance		If a practical maintenance plan is not in place, funded, and if those responsible, including the water users associations who will oversee the irrigation system, are not trained, it is unlikely the infrastructure will be maintained.	Starting during the planning phase, WINNER shall support the development of, training in, and implementation of a maintenance plan. This shall be coordinated with WINNER Component 3, Clusters 3.1 and 3.2. If irrigation water will also be used as a drinking water source for livestock and/or humans, WINNER shall provide training and technical assistance for water association members who will be responsible for water quality monitoring and testing; and with the user association, a water conservation plan and a water quality monitoring protocol shall be developed.

Description of Cluster 2.3: Increase potable groundwater levels in watershed

Training, technical assistance, studies/assessments, and procurement: Develop plans to construct/rehabilitate potable water systems; and identify additional sites for impluviums (rainwater catchments).

Infrastructure and other physical interventions: build hillside impluviums and cisterns (average capacity 40,000 gallons) to collect rainwater (this also serves to reduce runoff on hillsides, contributing to Cluster 2.1 above) and provide potable water; and develop potable water systems (by capping and piping springs) and constructing or rehabilitating reservoirs (i.e., holding ponds, retention ponds), pumping stations, treatment, distribution pipes, and public fountains.

The over-arching goal of Cluster 2.3 activities is to improve the living conditions for area residents by building water catchment and supply systems capable of meeting water needs especially during periods of drought. Cluster 2.3 covers all activities directly and indirectly related to the construction and/or rehabilitation of potable water systems. The physical interventions include construction of hillside impluviums and cisterns (retention basins), and construction of water distribution networks, placement of pumping systems, and water pump shelters.

Construction of hillside impluvium and cisterns (see photo below) involves the following steps. The PEA Team visited these at Kenscoff and La Branle:
1. Excavation of soil on the hillside

2. Placement of concrete to line the cistern and impluvium

3. Building of cover for the cistern. This cover will be made of concrete in the case of newly built impluviums, or of tin roof in case of rehabilitated ones whose structure can't support a concrete roof.

Impluvium for rain water collection before completion with the cover for the cistern

Developing piped potable water systems using underground springs (retention ponds, pumping stations, and water distribution networks) involves:

a. Put a spring catchment in place

b. Excavate and install the pipeline and backfill with soil that had been removed

c. Excavate soil and place concrete to construct a holding pond; or remove broken concrete and replace to rehabilitate pond (see above for irrigation system repair).

d. Reconstruct or construct pump house (see above for irrigation system repair)

The project phases are common to all types of potable water provision projects:

1. Planning and Site Selection: preparatory meetings with communities, local government, site visits, and reports

2. Design and Feasibility: preparation of tender documents, review of proposals, and signing of engineering contract

3. Sourcing of construction materials

4. Construction: including constructing ancillary features such as access roadways and construction camps

5. Decommissioning of construction works, including site restoration

6. Operation and Maintenance

Environmental Consequences of Cluster 2.3: No environmental impacts are caused by the development of plans to construct/rehabilitate potable water systems; no mitigation is needed.

Potable water provision could have adverse environmental impacts. The environmental consequences of the two main types of potable water provision projects (rainwater capture--impluvium and cisterns; and capped spring with holding pond and piped water system) are discussed below by project phase (Construction/rehabilitation of pump house, pipe network, and ponds was discussed in Section 4.2, as well.)

The environmental impact assessment below is derived from PEA Team field visits, and previous WINNER EMPRs for potable water provision projects. The PEA Scoping Statement (with PEA Team additions/revisions documented below) is used as the framework for the discussion. Scoping Statement concerns, and issues raised in WINNER EMPRs provide the framework for the environmental consequences discussion. Issues deemed significant in the Scoping Statement and by the PEA Team are in bold below.

(1) Potential impacts of the Planning and Site Selection Phase
This phase will have indirect impacts only. No movement of earth or other activities that would have direct environmental effects will take place. Project planning involves meetings and awareness raising among community members, identifying challenges, options, and project requirements, selecting counterparts, and other similar activities that are the foundation of project start-up. Also during this phase, locations of potable water systems to be rehabilitated and constructed will be identified. There is not yet an irreversible or irretrievable commitment of resources and sites that are selected can be changed during this and the following phase, the Design and Feasibility Phase. However, site selection must include environmental concerns in addition to engineering and economic concerns since environmental impacts are easiest and most cost-effective to address at this early stage.

Incorporating an Environmental Due Diligence (EDD) test during this phase will help ensure that potential impacts do not occur in later project phases, when mitigation may be costly or too late.

EDD during the Planning and Site Selection Phase will specifically address potential adverse impacts related to site selection: **important habitat, flora and fauna, sensitive ecosystems, threatened and endangered species and their habitat, cultural and historical assets, and protected areas** (see Table 4.3, Mitigation Plan, below for details of the EDD).

Since at the programmatic level of this PEA, specific intervention sites have yet to be identified, a process that can be used over the LOP of WINNER must be institutionalized. The EDD in Table 4.3 will ensure that environmental concerns are considered in a timely manner and at the same level as other project concerns.

Although not included as a significant issue in the Scoping Statement, **water conservation and drinking water quality** are additional issues for potable water provision projects that should be considered early on in project planning--during the Planning and Site Selection Phase. These are addressed in the Planning and Site Selection Phase of the Mitigation Plan (and later, in the Operation and Maintenance Phase).

(2) Potential impacts of the Design and Feasibility Phase
During this phase, feasibility studies are undertaken by WINNER staff to test economical profitability; these studies include the environmental feasibility of the project. The Terms of Reference (TORs) is developed; designs are requested from qualified firms; proposals are evaluated based on the merits of the proposals; and an award is made. The project is designed in detail during this phase—the extent of repairs and construction, the capacity of the system, including the size of retention ponds, impluvium, and cisterns, and the material and equipment to be used in the construction. Ancillary features will also be identified during this phase—the need for construction staff housing, access roads, storage areas. Most of the potable water construction work is small-scale and will not require extensive ancillary features; however even for small-scale construction, safeguards must be in place to ensure no adverse environmental impacts occur (Table 4.3).

Also during this phase, the extent of the physical interventions is determined, and the need to **acquire land** (relocate homes and other infrastructure, and acquire property, permanently or temporarily) is identified. These concerns could have social, cultural, and livelihood implications, and could determine whether or not the project is accepted by the local communities. These issues must be dealt with prior to construction. At the programmatic level, it is unclear if land acquisition and compensation will be necessary for potable water provision projects. In cases where land acquisition will be necessary, Table 4.3 describes mitigation to be implemented during the Design and Feasibility Phase to ensure land acquisition and just compensation is considered as early as practicable in the design.

The mitigation measures described for the Design and Feasibility Phase will help ensure that no irreversible or irretrievable commitments are made, and that the project is environmentally sound. Other potential impacts—described below—can be mitigated during the follow-on project phases, usually by what are termed ~~"~~best engineering practices"— practices that protect the physical and biological environment and that have become a standard part of construction projects. Regardless of how standard and common they are—best engineering practices, and

other mitigation measures—must be identified and included in engineering contracts; the Mitigation Plan requires this as a Design and Feasibility Phase mitigation measure.

(3) Potential impacts of sourcing construction materials
Much of the material needed for water provision systems--PVC pipe, water tanks, concrete, inlet and outlet structures—are standard construction materials; procuring them will not result in foreseeable environmental impacts. For pump houses, material such as cement and galvanized steel roofing will be needed. Procuring these materials will result in no environmental impacts.

Only small amounts of fill are expected to be needed for potable water provision projects including ancillary features, and enough fill material may be available onsite. However, if fill will be obtained from a quarry, environmental impacts (**flora, fauna, soil erosion, water quality, aesthetics**) could result if not obtained from a permitted, environmentally sound location (see Table 4.3).

(4) Potential impacts of the Construction Phase
Construction of ancillary features (staff housing, latrines, kitchen areas, storage areas, access roads):
Construction could affect **native flora, fauna, result in tree cutting, could affect sensitive ecosystems and cultural/historical resources, and could impact surface, groundwater, require land acquisition, and require the disposal of solid, hazardous, and special wastes**. The PEA Scoping Statement did not consider this issue separately from the overall flood and erosion control project. However, mitigation for typical ancillary features must be integrated into the design, specified in engineering contracts, and requires some measures specific to ancillary features (water and sewage, access roads). Mitigation is required in Table 4.3 and is described in detail in Annex G-Mitigation Plan for Small-Scale construction.

Construction and rehabilitation of potable water systems (cisterns and impluviums, and piped springs with water distribution network):
a) Much of the actual construction involved in potable water provision projects is small-scale: repair of the pumping house/power station (approximately 400 ft^2); laying the pipe network (trenches are dug and pipe is laid and soil is backfilled to cover the pipe); construction of cisterns and retentions ponds (these are about 2500 ft^2, and are lined with concrete). While any construction process can inherently impact **flora, fauna, and sensitive ecosystems**, it is unlikely this will be a major impact. Construction of impluviums and cisterns on hillsides may require special attention due to the potential sensitive nature of the flora and fauna found on hillside habitats. Hillside vegetation and the wildlife it supports may be part of a sensitive/valuable ecosystem. Although the cisterns and impluviums disturb such a small surface area, particular attention should be paid to ensure these structures are not disturbing sensitive ecosystems. With implementation of ~~"b~~est engineering practices," specified in Table 4.3, no adverse effects are expected to occur to sensitive flora, fauna, and ecosystems.

b) Potential impacts to cultural/**historical resources** were found by the PEA Scoping Team not to be significant or relevant. Potable water provision projects will not disturb large areas, but the locations for this work are currently unknown, and therefore, cultural/historical resources could be found while working at the site that were not identified during the Planning and Site Selection

Phase. In this case, contingency plans are needed to ensure there are no adverse effects if these resources are found on-site or are found to be affected by construction activities. See Table 4.3 for mitigation measures.

c) Potential impacts to **threatened and endangered species, and other sensitive species, and their habitat** are expected to be mitigated by measures implemented during the Planning and Site Selection Phase. However, as above, even with mitigation measures, species and habitat may be found once construction begins that were not identified during Planning and Site Selection. In addition, noise from heavy equipment and presence of workers could disrupt TES and sensitive species, even off-site. Table 4.3 contains mitigation measures to minimize risk to these resources if they are found to be affected by construction work.

d) The construction process could result in increased **erosion** and sedimentation, resulting in increased turbidity and decreased **water quality**. This could affect aquatic resources—fish, other aquatic vertebrates and invertebrates, and aquatic vegetation (**native flora and fauna and sensitive ecosystems**); and could also affect wildlife throughout the food chain, including birds and mammals that rely on aquatic resources (**native or terrestrial fauna**). Impluviums and cisterns are a special concern because they are constructed on hillsides, where there is an increased risk of erosion during construction. Once the structures are in place, erosion should be controlled, at a minimum, to the level it was before placement of the structures. Soil erosion control measures typically used during construction where hillside erosion is a threat, are expected to mitigate damage. In addition, erosion control measures should be used on all construction sites where erosion may pose a threat (see Table 4.3).

e) The use of heavy equipment could contaminate **surface and groundwater quality and terrestrial resources** due to the potential for oil and fuel leakages. Table 4.3 describes mitigation.

f) Although the Scoping Statement excluded noise from consideration, **noise** is noted as an issue in WINNER EMPRs where heavy equipment is used. Therefore, the PEA Team retained noise as a potential significant issue for consideration in the PEA. Noise could affect human welfare and wildlife. However, WINNER construction for potable water provision will only take place during daylight and normal work hours, and impacts to the human environment will only last as long as the construction phase, and would not be considered significant. For certain wildlife, noise could disrupt nesting and feeding behavior, and for more sensitive wildlife species, this could have a detrimental effect. The effects of noise on sensitive wildlife is considered and mitigated during the Planning and Site Selection Phase, but a contingency plan may be needed during construction in case sensitive species are found on-site during the Construction Phase (see Table 4.3).

g) During the Construction Phase, there could be a short-term increase in emissions and dust as a result of exhaust from heavy equipment used to dredge and trucks carrying in supplies. Impacts of emissions and dust on **air quality** and the human environment should be short-term and minor, and no additional mitigation is needed.

h) As with any construction project, **public and worker safety** is a concern. Normal precautions should be taken, typical of work at any construction site, to minimize risks to public and workers. These are described in the Mitigation Plan (Table 4.3), and if implemented, are expected to be adequate to eliminate concerns regarding public and worker safety.

i) All WINNER EMPRs included gender as a concern, and therefore, the PEA Team included it for consideration even though it was excluded in the Scoping Statement. For construction activities, a gender ratio of 1:1 will be strived for, but in cases where special expertise or skills are needed, the ratio may vary, favoring one gender over another. As the PEA Team witnessed when visiting construction sites at Kenscoff and Gonaives, WINNER makes every attempt to ensure gender equity. This is included in Table 4.3 to mitigate any concerns regarding gender.

As stated in a WINNER EMPR for a water provision project in Kenscoff: As in many areas in the world, women are primarily responsible for procuring the household water for their families as well as having responsibility for family healthcare (especially relating to children). As such, this program is expected to positively impact the work of women disproportionally as it will provide easier access to potable water which should therefore decrease the time spent in obtaining potable water as well as reducing incidents of health issues relating to lack of access to clean water. Overall, however, the benefits derived from access to potable water are expected to benefit all members of the household regardless of gender.

j) If labor is brought in from outside the general area where potable water systems will be constructed, the project may lose support of the local community. To the greatest extent feasible, local labor shall be used to construct potable water systems. This will also minimize the need for construction staff camps.

(5) Potential impacts of the Decommissioning Phase

(a) If construction camps have been built for staff, decommissioning may involve removal of material—solid waste, buildings, etc. Alternatively, the construction camp and other ancillary features may be turned over to the municipality. Regardless if the camp is small or large, if it included latrines and kitchen areas, if it will be dismantled or turned over, the camp should be left in environmentally sound condition. Excess material that is not properly disposed of could result in environmental impacts: liquid and solid waste could degrade **water quality**, affect aquatic resources (**flora and fauna**), and terrestrial ecosystems. **Water quantity** (hydrology-flood regime) could be affected if trash is left behind to clog waterways and wetlands. Mitigation, requiring the removal of buildings and other ancillary features, or as an alternative, for a sound hand-over plan, is included in the Mitigation Plan (Table 4.3).

(b) Construction equipment that is left on-site after construction is complete could affect the environment. Fuel and oil leaks, rust from equipment, and equipment parts could degrade **water quality**, and affect **flora and fauna**; and could have an impact on hydrology and flood regime (**water quantity**) if equipment clogs waterways. Decommissioning may require the disposal of **solid, hazardous, or special wastes**. There could also be public safety risks if people can enter the site to dismantle abandoned equipment. Mitigation, involving removal of all equipment and supplies, is described in the Mitigation Plan.

(6) Potential impacts of the Operation and Maintenance Phase
(a) Without a practical maintenance plan in place that includes water quality monitoring and testing, potable water projects deteriorate. Impacts are socio-cultural and health-related. If the potable water source is no longer functioning, women and children have to return to the previous methods of obtaining water, which may have involved travelling long distances to the source. If water quality monitoring and testing is no longer being implemented, significant health concerns could result. From the purely human standpoint, the failure of what may be considered a ―development" or ―aid" project could undermine USAID's reputation. A maintenance plan, including training for those responsible for water quality monitoring and testing, should minimize concerns; this requirement is included in Table 4.3.

(b) Other concerns of the Operation and Maintenance Phase involve the accuracy of the predictions made in the Planning and Site Selection and Design and Feasibility Phases. The Mitigation Plan is intended to minimize any potential adverse environmental and social impacts over the LOP. The result should be an ―increase in potable groundwater levels in watersheds"—not at the expense of valuable environmental parameters. Monitoring over the LOP—as required in the Programmatic Environmental Management Plan (Annex E) up to WINNER hand-over in the Decommissioning Phase, will allow for adaptive management. Implementation of the PEMP will allow WINNER to quickly identify when predictions are incorrect and/or if required mitigation is unsuccessful in halting environmental damage. And in a timely manner, alternative mitigation measures can be applied and monitored.

Table 4.3: Mitigation Plan for Cluster 2.3. *Potable Groundwater in Watersheds Increased*

Cluster/ Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
Cluster 2.3 Planning & Site Selection	Identification of project site: WINNER staff in collaboration with communities and local government	At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to livelihood and other issues. Important habitat or ecosystems sensitive to disturbances may be located within project site boundaries or may be affected by the project. Habitat for threatened or endangered species and/or threatened or endangered species may be found within project site boundaries or may	WINNER Biodiversity Specialist shall be involved in planning and site selection. **Environmental Due Diligence shall be conducted at Planning & Site Selection Phase, as follows.** WINNER Biodiversity Specialist shall ensure that the Mitigation Plan for the Construction Phase is adequate so that: (1) any important habitat or ecosystems that are located within project boundaries (project boundaries include all ancillary features) will be protected. (2) any important habitat or ecosystems that may be affected by the project (affected may be temporary/short-term or long-term, direct or indirect, and ―project" includes ancillary features) will be protected. (3) any cultural or historical assets that are within project boundaries or that may be affected by the project will be protected. If WINNER Biodiversity Specialist determines that the Construction Phase Mitigation Plan is not adequate to protect flora, fauna, and sensitive ecosystems), and cultural/historical

Cluster/ Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
		be affected by the project. At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to livelihood and other issues.	resources, an alternative site must be chosen. **Environmental Due Diligence shall also ensure that:** If any threatened, endangered, or other sensitive species, or habitat for threatened, endangered, or other sensitive species is within project boundaries or may be affected by the project, an alternative site shall be chosen. If protected areas are within project boundaries or may be affected by the project, an alternative site shall be chosen. The potable water provision project is in line with the Participatory Watershed Management Plan. A Maintenance Plan for the Operation and Maintenance Phase is developed in consultation with relevant community members and government authorities. All relevant GOH and local legislation is complied with including water quality testing and monitoring and land acquisition and compensation procedures (if necessary) outlined in relevant GOH legislation (also see Design and Feasibility Phase). Any social and environmental concerns that cannot be mitigated by the measures in this Mitigation Plan shall be brought to the attention of WINNER senior management for action. An alternative site shall be chosen or an amended EA must be prepared. **At site selection and planning phase, WINNER shall, in collaboration with Component 3, identify measures and an implementation plan for:** 1. Promoting the introduction of water pricing that represents the market value of water. 2. Promoting water conservation. 3. Developing a water quality monitoring and testing plan (in conformance with DINEPA requirements, Annex H), responsible parties; and training needed to implement it.
Design & Feasibility	Preparation of tender documents: Engineering firm provides specifications for potable water provision.	If tender documents do not include mitigation measures and a budget to implement them, the project could result in a range of adverse environmental impacts (see below).	Mitigation measures described for the Construction and Decommissioning Phases shall be incorporated into tender documents; costs for environmental management shall be included in overall project budget. Tender documents shall include a requirement to discuss initial water quality testing and alternative plans if water quality does not meet GOH requirements (Annex H). In addition to Construction Phase and

Cluster/ Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
		If tender documents do not include mitigation for ancillary features, and a budget to implement them, adverse environmental impacts could result.	Decommissioning Phase mitigation measures, contracts shall include a re-use/recycle and waste segregation plan for the Construction and Decommissioning Phases. Incorporate relevant mitigation measures from Annex G (small-scale construction guidelines); and from Road Rehabilitation Mitigation Plan (Cluster 2.4) into tender documents and engineering contract; and address the following in tender documents/engineering contract: ● Providing existing off-site accommodation for crew. ● Keeping camp size to a minimum. Require that crew preserve as much vegetation as possible, e.g., by creating defined footpaths. ● Providing temporary sanitation on site, e.g., pit latrine (assuming the water table is low enough, with soil and geology of appropriate composition)
	Proposal review	Proposals that fail to incorporate environmental concerns could result in a range of adverse environmental impacts (see below, Construction and Decommissioning Phases).	WINNER Biodiversity Specialist shall be involved in proposal review process to ensure that the proposed potable water provision project is environmentally sound. Based on the requirements above (presented in the tender document), revisions shall be made to the design to ensure adverse environmental impacts do not result. Construction plans must be approved by a certified engineer, and construction works must be performed by a qualified and experienced contractor.
	Negotiations and award of engineering contract	If engineering contract does not include mitigation measures and a budget to implement them, the project could result in a range of adverse environmental impacts (see below).	Mitigation measures described for the Construction and Decommissioning Phases shall be incorporated into contracts; costs for environmental management shall be included as a specific line item in the Bill of Quantities. Revisions to the engineering design to account for potable water quality monitoring shall be incorporated into engineering contract. In addition to Construction Phase and Decommissioning Phase mitigation measures, contracts shall include a re-use/recycle and waste segregation plan for construction phase.
	Feasibility studies	If destruction or degradation of infrastructure and/or privately held or community owned land may result from the project, community and	As part of determining the feasibility of the project, the engineering/design firm shall: Delineate a logical area with a well-defined

Cluster/ Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
		political acceptance may be compromised.	boundary within which the owners of land, buildings or other infrastructure will be compensated. Monitor the implementation of a transparent and fair compensation plan by the Haitian government, as appropriate, for any permanent or temporary loss incurred (e.g. buildings, infrastructure, land, crops, gardens, plantations). Ensure that the plan allows affected people to maintain their current housing condition or better.
Sourcing material	Engineering firm enters into a contract with one or multiple companies to obtain material for potable water project.	Location from which construction company obtains erosion control material, fill material, and other construction material may not be environmentally sound and material may not be sourced sustainably. Obtaining these materials may result in ecological, hydrological, aesthetic, and land use impacts.	WINNER shall ensure that all material to be used in construction is sourced in an environmentally sound and sustainable manner.
			The following mitigation measures shall be incorporated into tender documents and the engineering contract/contract specifications.
Construc-tion	Construct ancillary features such as construction camps, storage areas and equipment maintenance areas.	Although ancillary features for potable water provision projects are likely to be minimal, they could result in environmental impacts similar to other small-scale construction projects (loss or degradation of vegetation, wildlife habitat and species, changes in hydrology, impacts to cultural resources, etc).	Implement relevant mitigation measures from Annex G (small-scale construction guidelines); and from Road Rehabilitation Mitigation Plan (Cluster 2.4) as specified in the engineering contract.
	Repair or construct potable water provision system.	Flora (including trees), fauna, and sensitive ecosystems could be destroyed or degraded.	Identify areas to be cleared and limit vegetation and tree removal to only the vegetation and trees needed to repair or construct water provision system and provide ancillary features. Limit encroachment into riparian areas. Delineate sensitive and/or high quality habitat and keep all foot and motorized traffic and equipment out; where riparian habitat/vegetation is of good quality, limit worker traffic. Do not remove or disturb any mangroves. Save vegetation removed for replacement during de-commissioning phase (as practicable). Any construction or excess material from the construction process (fill, rocks, etc.) shall not be stockpiled temporarily or permanently in wetlands or waterways or in a manner that will damage vegetation or soil.

Cluster/ Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
		Cultural/historical resources could be destroyed or degraded.	Delineate cultural/historical resources to be protected, and keep all foot and motorized traffic and equipment out.
		During construction, TES and other sensitive species and/or habitats and cultural resources could be found within project boundaries or that are being affected by the project.	Educate workers about procedures to be implemented in case protected species or artifacts are found on-site. Engineering contract shall include a stop-work clause that requires project work to stop if these resources are found on site or found to be affected by the project. Work shall resume once collaboration with WINNER senior management and USAID is complete.
		If mitigation measures are not in place to ensure timely and safe removal of waste, land/soil and water quality could be degraded at and downstream of the project site, and hazardous and other waste could contaminate the disposal site.	Dispose of construction waste in a timely manner and at an approved location that uses environmentally sound practices.
		Erosion could result in increased turbidity, decreased water quality, and a degraded aquatic ecosystem. This could have impacts on wildlife and humans that rely on these resources.	Use erosion control measures during construction such as geotextiles, jersey barriers, haybales, siltscreens (or other appropriate and obtainable material). Place erosion control barriers prior to starting construction and do not remove erosion control barriers until construction is complete, and vegetation is re-established. Replace soil and return land to pre-construction condition after laying water pipe network.
		Heavy equipment that is not well-maintained and stored properly could degrade water quality and soils.	Provide a maintenance area that is adequate distance (at least 50 meters) from waterways and any sensitive terrestrial habitat, and require that all equipment maintenance take place there. Keep emergency response equipment on work sites to deal with hazardous or other spills.
		Noise from the use of heavy equipment and other construction equipment could affect breeding and feeding and other wildlife behavior. Noise could affect the human environment.	If during environmental monitoring, noise is found to disrupt breeding, feeding, or other wildlife behavior, limits shall be placed on use of heavy equipment, movement of personnel, or other noise- producing construction phase activities. These limits shall remain in place until determined by the WINNER Biodiversity Specialist that they may be removed. Limit noise from construction activities to daylight hours.
		Public and worker safety could be compromised without adequate mitigation in place.	To ensure the safety of the public: Develop and implement a communication plan for regular public awareness of project activities; and hold meetings to educate and inform residents of the work to be carried out. Restrict access of the public to hazard areas. Reduce vehicle speed in work zone.

Cluster/ Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			See Planning & Site Selection phase and De-commissioning phase for ongoing water quality testing and monitoring; and Design & Feasibility Phase for initial water quality testing. To ensure the safety of employees: Provide adequate training of personnel in safety procedures. Provide appropriate safety equipment (including for noise protection, as needed). Post proper signage. Enforce safety zones and procedures. Implement a work place health and safety plan, which should include employee training.
		Gender concerns and local labor	A gender ratio for project staff of as close to 1:1 shall be strived for. Local sources of labor should be used to the greatest extent possible
Decommi ssioning		If construction camps and other ancillary features are not dismantled or if other provisions are not made for them, they will degrade over time, and potentially impact water quality, degrade soils, and create a public hazard.	Unless other provisions are made, staff construction camps and other ancillary features shall be removed once construction is complete. Removal shall include environmentally sound disposal of solid waste, buildings, etc. A provision shall be included in the engineering contract to allow for WINNER inspection prior to finalizing payment.
		Leaks or spills that are not cleaned up can continue to contaminate the environment.	Any areas where leaks or spills have occurred that were not previously cleaned up during construction phase shall be cleaned prior to completing decommissioning phase.
		If hydrology and grade are not restored, flooding, ponding, and destruction of vegetation and other terrestrial resources could result.	Once construction work is complete, restore hydrology and grade to pre-construction condition (or improved drainage) on work sites and adjacent affected areas.
		If vegetation is not restored, and soil is left bare, erosion and landslides could result.	Re-vegetate areas disturbed with naturally occurring vegetation, if possible with vegetation retained from site; and/or with erosion control vegetation (vetiver, bamboo, elephant grass).
Operation and Mainten-ance		If a practical maintenance plan is not in place and funded, and if those responsible, including the water users associations who will oversee the system, are not trained, it is unlikely the infrastructure will be maintained.	Starting during the Planning & Site Selection Phase, WINNER shall support the development of, training in, and implementation of a maintenance plan. This shall be coordinated with WINNER Component 3, Clusters 3.1 and 3.2. WINNER shall provide training and technical assistance for water association members who will be responsible for water conservation and water quality monitoring and testing; and

Cluster/ Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			with the user association, a water conservation plan and a water quality monitoring protocol shall be developed.

Description of Cluster 2.4: Rebuild and repair critical transportation infrastructure

Training, technical assistance, studies/assessments, and procurement: conduct infrastructure surveys.

Infrastructure and other physical interventions: rehabilitate key farm to market feeder roads and other rural feeder roads that are important for the rural economy.

Only existing roads will be rehabilitated, and construction will usually be within the existing footprint unless for safety reasons or for minor upgrades, the footprint needs to be expanded or the layout slightly realigned. None of these roads will be ―penetration roads"—they will not penetrate into pristine or relatively undisturbed habitat/ecosystems. All roads to be rehabilitated or upgraded will be roads that are currently used mainly as farm to market roads, or that are otherwise well-travelled rural roads and provide access to existing market centers.

Activities involved in rehabilitation and/or upgrade of a road:

1. *Stake, weed, and clear shoulders*: the construction area along the road, and any expansion to the road will be staked, and vegetation will be cleared from the road shoulder so construction can take place. The width of the road will include a shoulder for foot, bicycle, and animal traffic, as practicable.

2. *Excavation/road cuts and fill*: excavate alongside the road and areas of the road to be rehabilitated and place and compact fill.

3. *Rehabilitate drainage structures*, as needed, by excavating, replacing culvert, and backfilling

4. *Place surface material on road*: depending on type of road, this may be dirt or gravel

5. *Plant vegetation* (vetiver grass and trees) along shoulders to reduce erosion and to replace any trees that were cut to rehabilitate the road.

The project phases for road rehabilitation activities are:

1. Planning and Site Selection: preparatory meetings with communities, local government, site visits, reports
2. Design and Feasibility: preparation of tender documents, review of proposals, and signing of engineering contract
3. Sourcing of construction materials
4. Construction: including constructing ancillary features such as access roadways and construction camps

5. Decommissioning of construction works, including site restoration
6. Operation and Maintenance

Environmental Consequences of Cluster 2.4: surveys will have no environmental impacts and no mitigation is needed.

Cluster 2.4 physical interventions involve the upgrade or rehabilitation (without upgrade) of roads. Target roads to rehabilitate or upgrade may be foot trails that would be upgraded to handle vehicle traffic or they may be rural roads which have deteriorated or were damaged in floods or the recent earthquake and where primarily drainage structures and potholes need to be rehabilitated.

(1) Potential impacts of the Planning and Site Selection Phase
This phase will have indirect impacts only. No movement of earth or other activities that would have direct environmental effects will take place. Project planning involves meetings and awareness raising among community members, identifying challenges, options, and project requirements, selecting counterparts, and other similar activities that are the foundation of project start-up. Also during this phase, locations of roads to be rehabilitated and upgraded will be identified.

There is not yet an irreversible or irretrievable commitment of resources, and sites that are selected can be changed during this and the following phase, the Design and Feasibility Phase. However, site selection must include environmental concerns in addition to engineering, economic, and livelihood concerns since environmental impacts are easiest and most cost-effective to address at this early stage.

Incorporating an Environmental Due Diligence (EDD) test during this phase will help to ensure that potential impacts do not occur in later project phases, when mitigation may be costly or too late. EDD during the Planning and Site Selection Phase will specifically address potential adverse impacts related to site selection: **important habitat, flora and fauna, sensitive ecosystems, threatened and endangered species and their habitat, cultural and historical assets, and protected areas** (see Table 4.4, Mitigation Plan, below for details of the EDD).

For road rehabilitation, it is critical, during the Planning and Site Selection Phase, to identify the ~~"i~~mpact area"—not only the road and shoulder, but the entire area that will be affected by the road. For example, if a road will be upgraded that runs adjacent to or provides improved access to a forested area, the forested area is part of the impact area; road rehabilitation will facilitate access to the forest and its resources. Site selection should be based on the potential effects, positive and negative of the entire ~~"i~~mpact area." As described in Table 4.4, the Mitigation Plan, the Biodiversity Specialist shall be involved in site selection and in identifying the impact area for environmental resources.

Since at the programmatic level of this PEA, specific intervention sites have yet to be identified, a process that can be used over the LOP of WINNER must be institutionalized. The EDD in Table 4.4 will ensure that environmental concerns are considered in a timely manner and at the same level as other project concerns.

(2) Potential impacts of the Design and Feasibility Phase
During this phase, feasibility studies are undertaken by WINNER staff to test economical profitability; these studies include the environmental feasibility of the project. The Terms of Reference (TORs) is developed; designs are requested from qualified firms; proposals are evaluated based on the merits of the proposals; and an award is made. The project is designed in detail during this phase—the extent of repairs and upgrade, the type of surface, the width of road and shoulder, the need for drainage structures, and the material and equipment to be used in the construction. Ancillary features will also be identified during this phase—the need for construction staff housing, access roads, storage areas. Even though ancillary features may be considered small-scale construction, safeguards must be in place to ensure no adverse environmental impacts occur (Table 4.4).

Also during this phase, the extent of the physical interventions is determined, and the need to **acquire land** (relocate homes and other infrastructure, and acquire property, permanently or temporarily) is identified. These concerns could have social, cultural, and livelihood implications, and could determine whether or not the project is accepted by the local communities. These issues must be dealt with prior to construction. At the programmatic level, it is unclear if land acquisition and compensation will be necessary for transportation infrastructure projects. In cases where land acquisition will be necessary, Table 4.4 describes mitigation to be implemented during the Design and Feasibility Phase to ensure land acquisition and just compensation is considered as early as practicable in the design.

The mitigation measures described for the Design and Feasibility Phase will help ensure that no irreversible or irretrievable commitments are made, and that the project is environmentally sound. Other potential impacts—described below—can be mitigated during the follow-on project phases, usually by what are termed ―best engineering practices" practices that protect the physical and biological environment and that have become a standard part of construction projects. Regardless of how standard and common they are — best engineering practices, and other mitigation measures—must be identified and included in engineering contracts; the Mitigation Plan requires this as a Design Phase mitigation measure.

(3) Potential impacts of sourcing construction materials
The location where road fill will be obtained and the method for obtaining the fill could have an effect on aesthetics, on **surface water quality and quantity** at the quarry location, and of **flora and fauna** in the vicinity of the quarry, could increase soil erosion, and could also create **safety risks** to workers and the public. These concerns were not included in the Scoping Statement, but were identified by the PEA Team as potentially adverse impacts that require evaluation and mitigation.

At the programmatic level, fill locations are not yet identified; location where materials are sourced will become known once an engineering contract is signed, and the engineering firm then evaluates bids and enters into agreements. Table 4.4 includes mitigation measures to ensure that sourcing of construction material will have no adverse effects.

(4) Potential impacts of the Construction Phase

Construction of ancillary features (staff housing, latrines, kitchen areas, storage areas, access roads):
Construction could affect **native flora, fauna, result in tree cutting, could affect sensitive ecosystems and cultural/historical resources, and could impact surface, groundwater, require land acquisition, and require the disposal of solid, hazardous, and special wastes**. The PEA Scoping Statement did not consider this issue separately from the overall flood and erosion control project. However, mitigation for typical ancillary features must be integrated into the design, specified in engineering contracts, and requires some measures specific to ancillary features (water and sewage, access roads). Mitigation is required in Table 4.4 and is described in detail in Annex G-Mitigation Plan for Small-Scale construction.

Rehabilitation and/or upgrade of transportation infrastructure:

a) Road rehabilitation work will impact **flora and fauna, and may affect sensitive ecosystems**. Mitigation measures, starting at Planning and Site Selection Phase and continuing through the Construction Phase are expected to minimize adverse effects on these resources. However, even though environmental considerations are taken into account when selecting a road to rehabilitate and when designing the repair work, flora, fauna, and sensitive ecosystems could potentially be affected. The measures described for implementation during the Construction Phase will safeguard against adverse impacts (see Table 4.4).

b) Potential impacts to **cultural/historical resources** were found by the PEA Scoping Team not to be significant or relevant. However, the locations for road rehabilitation are currently unknown, and therefore, cultural/historical resources could be found while working at the sites that were not identified during the Planning and Site Selection Phase. In this case, contingency plans are needed to ensure there are no adverse effects if these resources are found on-site or are found to be affected by construction activities. See Table 4.4 for mitigation measures.

c) Potential impacts to **threatened and endangered species, and other sensitive species, and their habitat** are expected to be mitigated by measures implemented during the Planning and Site Selection Phase. However, as above, even with mitigation measures, species and habitat may be found once construction begins that were not identified during Planning and Site Selection. In addition, noise from heavy equipment and presence of workers could disrupt TES and sensitive species. Table 4.4 contains mitigation measures to minimize risk to these resources if they are found at the site once construction begins.

d) When road rehabilitation crosses or is adjacent to a waterway or wetland or when roads are rehabilitated on steep slopes, the construction process could result in increased **erosion** and sedimentation, resulting in increased turbidity and decreased **water quality**. This could affect aquatic resources—fish, other aquatic vertebrates and invertebrates, and aquatic vegetation (**native flora and fauna and sensitive ecosystems**); and could also affect wildlife throughout the food chain, including birds and mammals that rely on aquatic resources (**native or terrestrial fauna**). For road rehabilitation, water crossings (including wetland

crossings) are a special concern because of the potential for adverse impacts to occur during construction (erosion, sedimentation, and the potential to have far-reaching effects on downstream aquatic ecosystems). Erosion control measures will be used to minimize concerns. In addition to erosion control measures, to further protect aquatic resources, water crossings may need to be constructed during the dry season.

Erosion control measures should be kept in place until after construction of the crossing is complete and vegetation has been established to remove the threat or erosion. In addition, erosion control measures should be used on all construction sites where erosion may pose a threat (see Table 4.4).

Environmental monitoring of the waterway/wetland crossing process will help ensure that water and wetland crossings are done with appropriate safeguards in place, and will ensure timely implementation of additional safeguards, if needed.

e) The use of heavy equipment could contaminate **surface and groundwater quality and terrestrial resources** due to the potential for oil and fuel leakages; Table 4.4 describes mitigation.

f) Although the Scoping Statement excluded noise from consideration, noise is noted as an issue in WINNER EMPRs where heavy equipment is used. Therefore, the PEA Team retained noise as a potential significant issue for consideration in the PEA. Noise could affect human welfare and wildlife. However, WINNER road rehabilitation will only take place during daylight and normal work hours, and impacts to the human environment will only last as long as the construction phase, and would not be considered significant. For certain wildlife, noise could disrupt nesting and feeding behavior, and for more sensitive wildlife species, this could have a detrimental effect. The effects of noise on sensitive wildlife is considered and mitigated during the Planning and Site Selection Phase, but a contingency plan may be needed during construction in case sensitive species are found on-site during the Construction Phase (see Table 4.4).

g) During the Construction Phase, there could be a short-term increase in emissions and dust as a result of exhaust from heavy equipment used to dredge and trucks carrying in supplies. Impacts of emissions and dust on **air quality** and the human environment should be short-term and minor, and no additional mitigation is needed.

h) As with any construction project, **public and worker safety** is a concern. Normal precautions should be taken, typical of work at any construction site, to minimize risks to public and workers. These are described in the Mitigation Plan (Table 4.4), and if implemented, are expected to be adequate to eliminate concerns regarding public and worker safety.

i) All WINNER EMPRs included **gender** as a concern, and therefore, the PEA Team included gender as an issue for consideration even though it was excluded in the Scoping Statement. For construction activities, a gender ratio of 1:1 will be strived for, but in cases where special expertise or skills are needed, the ratio may vary, favoring one gender over

another. As the PEA Team witnessed when visiting construction sites at Kenscoff and Gonaives, WINNER makes every attempt to ensure gender equity. This is included in Table 4.4 to mitigate any concerns regarding gender.

Road rehabilitation is expected to benefit women and men equally. Rehabilitated roads will facilitate access to markets, to health care, and to schools—these are in the interest of men and women and of people of all ages.

j) If labor is brought in from outside the general area where roads will be rehabilitated, the project may lose support of the local community. To the greatest extent feasible, **local labor** shall be used to repair roads. This will also minimize the need for construction staff camps.

(5) Potential impacts of the Decommissioning Phase

(a) If construction camps have been built for staff, decommissioning may involve removal of material — solid waste, buildings, etc. Alternatively, the construction camp and other ancillary features may be turned over to the municipality. Regardless if the camp is small or large, if it included latrines and kitchen areas, if it will be dismantled or turned over, the camp should be left in environmentally sound condition. Excess material that is not properly disposed of could result in environmental impacts: liquid and solid waste could degrade **water quality**, affect aquatic resources (**flora and fauna**), and **terrestrial ecosystems**. **Water quantity** (hydrology-flood regime) could be affected if trash is left behind to clog waterways and wetlands. Mitigation, requiring the removal of buildings and other ancillary features, or as an alternative, for a sound hand-over plan, is included in the Mitigation Plan (Table 4.4).

(b) Construction equipment that is left on-site after construction is complete could affect the environment. Fuel and oil leaks, rust from equipment, and equipment parts could degrade **water quality**, and affect **flora and fauna**; and could have an impact on hydrology and flood regime (**water quantity**) if equipment clogs waterways. Decommissioning may require the disposal of **solid, hazardous, or special wastes**. There could also be **public safety** risks if people can enter the site to dismantle abandoned equipment. Mitigation, involving removal of all equipment and supplies, is described in the Mitigation Plan.

(6) Potential impacts of the Operation and Maintenance Phase

(a) Without a practical maintenance plan in place the road will likely degrade and the benefits of road rehabilitation will be short-term. Other WINNER activities that rely on improved transportation infrastructure, such as the promotion of market agriculture and support for small and medium-sized enterprises, may fail without the improved access to markets. This could have far-ranging socio-economic effects. A maintenance plan, including training for those responsible for monitoring and cleaning culverts and bridges, will minimize concerns, and is included in Table 4.4.

(b) Other concerns of the Operation and Maintenance Phase involve the accuracy of the predictions made in the Planning and Site Selection and Design and Feasibility Phases. The Mitigation Plan is intended to minimize any potential adverse environmental and social impacts over the LOP. The result should be ~~"r~~epaired critical transportation infrastructure"—

not at the expense of valuable environmental resources. Monitoring over the LOP—as required in the Programmatic Environmental Management Plan (Annex E), up to WINNER hand-over in the Decommissioning Phase, will allow for adaptive management. Implementation of the PEMP will allow WINNER to quickly identify when predictions are incorrect and/or if required mitigation is unsuccessful in halting environmental damage. And in a timely manner, alternative mitigation measures can be applied and monitored.

Table 4.4: Mitigation Plan for Cluster 2.4. *Critical Transportation Infrastructure Rebuilt and Repaired*

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
Cluster 2.4 Phase 1: Planning & Site Selection	Identification of project site: WINNER staff in collaboration with communities and local government	At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to livelihood and other issues. Important habitat or ecosystems sensitive to disturbances may be located within project site boundaries or may be affected by the project. Habitat for threatened or endangered species and/or threatened or endangered species may be found within project site boundaries or may be affected by the project. At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to livelihood and other issues.	WINNER Biodiversity Specialist shall be involved in planning and site selection phase. **Environmental Due Diligence shall be conducted at planning & site selection phase, as follows.** WINNER Biodiversity Specialist shall ensure that the Mitigation Plan for the Construction Phase is adequate so that: (1) any important habitat or ecosystems that are located within project boundaries (project boundaries include all ancillary features) will be protected. (2) any important habitat or ecosystems that may be affected by the project (affected may be temporary/short-term or long-term, direct or indirect, and —project" includes ancillary features) will be protected. For road rehabilitation, —area affected by the project" is usually defined by a certain # of meters alongside the road, where access to natural resources and development will be facilitated by road rehabilitation. The affected area is site-specific. (3) any cultural or historical assets that are within project boundaries or that may be affected by the project will be protected. If WINNER Biodiversity Specialist determines that the Construction Phase Mitigation Plan is not adequate to protect flora, fauna, and sensitive ecosystems), and cultural/historical resources, an alternative site must be chosen. **Environmental Due Diligence**

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			shall also ensure that: If any threatened, endangered, or other sensitive species, or habitat for threatened, endangered, or other sensitive species is within project boundaries or may be affected by the project, an alternative site shall be chosen. If protected areas are within project boundaries or may be affected by the project, an alternative site shall be chosen. The road rehabilitation project is in line with the Participatory Watershed Management Plan. A Maintenance Plan for the Operation and Maintenance Phase is developed in consultation with relevant community members and government authorities. All relevant GOH and local legislation is complied with including, as necessary, land acquisition and compensation procedures and zoning outlined in relevant GOH legislation (also see Design and Feasibility Phase). This Mitigation Plan covers road rehabilitation only; for road construction, a site-specific EA is required. Any social and environmental concerns that cannot be mitigated by the measures in this Mitigation Plan shall be brought to the attention of WINNER senior management for action. An alternative site shall be chosen or an amended EA must be prepared.
Design & Feasibility	Preparation of tender documents: Engineering firm provides specifications for road repair work.	If tender documents do not include mitigation measures and a budget to implement them, the project could result in a range of adverse environmental impacts (see below).	Mitigation measures described for the Construction Phase and Decommissioning Phase shall be incorporated into tender documents; costs for environmental management shall be included in overall project budget. In addition to mitigation

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
		If tender documents do not include mitigation for ancillary features, and a budget to implement them, adverse environmental impacts could result.	measures required in the Mitigation Plan, tender documents should include a requirement for a re-use/recycle and waste segregation plan to be implemented during construction phase. Incorporate relevant mitigation measures from Annex G (small-scale construction guidelines); for access roads, incorporate measures from Construction Phase Mitigation Plan below into tender document and engineering contract; and address the following in tender documents/engineering contract: • Providing existing off-site accommodation for crew. • Keeping camp size to a minimum. Require that crew preserve as much vegetation as possible, e.g., by creating defined footpaths. • Providing temporary sanitation on site, e.g., pit latrine (assuming the water table is low enough, with soil and geology of appropriate composition)
	Proposal review	Proposals that fail to incorporate environmental concerns could result in a range of adverse environmental impacts (see below, Construction and Decommissioning Phases).	WINNER Biodiversity Specialist shall be involved in proposal review process to ensure that the proposed road rehabilitation project is environmentally sound. Based on the requirements above (for tender documents), revisions shall be made to the design to ensure adverse environmental impacts do not result. Construction plans must be approved by a certified engineer, and construction works must be performed by a qualified and experienced contractor.
	Negotiations and award of engineering contract	If engineering contract does not include mitigation	Mitigation measures described for the Construction and

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
		measures and a budget to implement them, the project could result in a range of adverse environmental impacts (see below).	Decommissioning Phases shall be incorporated into contracts; costs for environmental management shall be included as a specific line item in the Bill of Quantities. Revisions to the engineering design to account for mitigation identified during proposal review shall be incorporated into engineering contract. In addition to Construction Phase and Decommissioning Phase mitigation measures, contracts shall include a re-use/recycle and waste segregation plan for the Construction and Decommissioning Phases.
	Feasibility study	If destruction or degradation of infrastructure and/or privately held or community owned land may result from the project, community and political acceptance may be compromised.	As part of determining the feasibility of the project, the engineering/design firm shall: Delineate a logical area with a well-defined boundary within which the owners of land, buildings or other infrastructure will be compensated. Monitor and implement a transparent and fair compensation plan by the Haitian government, as appropriate, for any permanent or temporary loss incurred (e.g. buildings, infrastructure, land, crops, gardens, plantations). Ensure that the plan allows affected people to maintain their current housing condition or better.
Sourcing material	Engineering firm enters into a contract with company(ies) to obtain material for transportation infrastructure repair.	Location from which construction company obtains erosion control material—rocks for riprap, fill material, and other construction material may not be environmentally sound and material may not be sourced sustainably. Obtaining these materials may result in ecological, hydrological, aesthetic, and land use impacts.	WINNER shall ensure that all material to be used in construction is sourced in an environmentally sound and sustainable manner.

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			The following mitigation measures shall be incorporated into tender documents and the engineering contract/contract specifications.
Construction	Construct ancillary features such as construction camps, storage areas and equipment maintenance areas.	Ancillary features could result in environmental impacts similar to other small-scale construction projects (loss or degradation of vegetation, wildlife habitat and species, changes in hydrology, impacts to cultural resources, etc).	Implement relevant mitigation measures from Annex G, (small-scale construction guidelines).
	Repair transportation infrastructure.	Flora (including trees), fauna, and sensitive ecosystems could be destroyed or degraded.	Identify areas to be cleared and limit vegetation and tree removal to only the vegetation and trees needed to repair roadway and provide ancillary features. Delineate sensitive and/or high quality habitat and keep all foot and motorized traffic and equipment out. Keep road repair work in riparian areas, wetlands, and waterways to a minimum and use safeguards as follows: 1) As practicable, retain original road footprint through these sensitive areas. 2) Schedule construction at a time of year to minimize damage to these ecosystems. 3) Use erosion control barriers when working in and adjacent to these sensitive areas, and keep them in place until vegetation has re-established. 4) Place culverts to retain hydrology of wetlands and waterways. 5) Conserve and return soils after construction in wetlands and riparian areas is complete. 6) Return area to pre-construction contours. 7) Re-vegetate slopes and stream/river banks. Do not remove or disturb mangroves. Save vegetation removed for replacement during Decommissioning Phase (as practicable).

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			Any construction or excess material from the construction process (fill, rocks, etc.) shall not be stockpiled temporarily or permanently in wetlands or waterways or in a manner that will damage vegetation or soil.
		Cultural/historical resources could be destroyed or degraded.	Delineate cultural/historical resources to be protected, and keep all foot and motorized traffic and equipment out.
		During construction, TES and other sensitive species and/or habitats and cultural resources could be found within project boundaries or that are being affected by the project.	Educate workers about procedures to be implemented in case protected species or artifacts are found on-site. Engineering contract shall include a stop-work clause that requires project work to stop if these resources are found on site or found to be affected by the project. Work shall resume once collaboration with WINNER senior management and USAID is complete.
		If mitigation measures are not in place to ensure timely and safe removal of waste, land/soil and water quality could be degraded at and downstream of the project site, and hazardous and other waste could contaminate the disposal site.	Dispose of construction waste in a timely manner and dispose of it at an approved location that uses environmentally sound practices.
		Erosion could result in increased turbidity, decreased water quality, and a degraded aquatic ecosystem. This could have impacts on wildlife and humans that rely on these resources.	Use erosion control measures during construction such as geotextiles, jersey barriers, haybales, siltscreens (or other appropriate and obtainable material). Place erosion control barriers prior to starting construction and do not remove erosion control barriers until construction is complete, and vegetation is re-established.
		Heavy equipment that is not well-maintained and stored properly could degrade water quality and soils.	Provide a maintenance area that is adequate distance (at least 50 meters) from waterways and any sensitive terrestrial habitat, and require that all equipment maintenance take place there. Keep emergency response equipment on work sites to

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			deal with hazardous or other spills.
		Noise from the use of heavy equipment and other construction equipment could affect breeding and feeding and other wildlife behavior. Noise could affect the human environment.	If during environmental monitoring, noise is found to disrupt breeding, feeding, or other wildlife behavior, limits shall be placed on use of heavy equipment, movement of personnel, or other noise-producing construction phase activities. These limits shall remain in place until determined by the WINNER Biodiversity Specialist that they may be removed. Limit noise from construction activities to daylight hours.
		Public and worker safety could be compromised without adequate mitigation in place.	To ensure safety of the public: Develop and implement a communication plan for regular public awareness of project activities; and hold meetings to educate and inform residents of the work to be carried out. Restrict access of the public to hazard areas. Reduce vehicle speed in work zone. To ensure safety of employees: Provide adequate training of personnel in safety procedures. Provide appropriate safety equipment (including for noise protection, as needed). Post proper signage. Enforce safety zones and procedures. Implement a work place health and safety plan, which should include employee training.
		Gender concerns and local labor	A gender ratio for project staff of as close to 1:1 shall be strived for. Local sources of labor should be used to the greatest extent possible
Decommission-ing		If construction camps and other ancillary features are not dismantled or if other provisions are not made for them, they will degrade over time, and could impact water quality, degrade soils, and create a public hazard.	Unless other provisions are made, staff construction camps and other ancillary features shall be removed once construction is complete. Removal shall include environmentally sound disposal of solid waste,

Cluster/Project Phase	Activity	Potential Adverse Impacts	Mitigation Measures
			buildings, etc. A provision shall be included in the engineering contract to allow for WINNER inspection prior to finalizing payment.
		Leaks or spills that are not cleaned up can continue to contaminate the environment.	Any areas where leaks or spills have occurred that were not previously cleaned up during construction phase shall be cleaned prior to completing decommissioning phase.
		If hydrology and grade are not restored, flooding, ponding, and destruction of vegetation and other terrestrial resources could result.	Once construction work is complete, restore hydrology and grade that has not previously been restored--to pre-construction condition (or improved drainage) on work sites and adjacent affected areas.
		If vegetation is not restored, and soil is left bare, erosion and landslides could result.	Re-vegetate areas disturbed with naturally occurring vegetation, if possible with vegetation retained from site; and/or with erosion control vegetation (vetiver, bamboo, elephant grass).
Operation and Maintenance		If a practical maintenance plan is not in place and funded, and if those responsible, including the water users associations who will oversee the system, are not trained, it is unlikely the infrastructure will be maintained.	Starting during the Planning & Site Selection Phase, WINNER shall support the development of, training in, and implementation of a maintenance plan. This shall be coordinated with WINNER Component 3, Clusters 3.1 and 3.2.

Description of Cluster 2.5: Flood warning systems installed and maintained

Training, technical assistance, studies/assessments, and procurement: assess critical flood risks; develop a flood risk management strategy; develop flood potential maps; develop a training program for disaster preparedness teams; procure rainfall and river flow meters, and train local field partners to operate, read, and maintain.

Infrastructure and other physical interventions: Install rain gauges and flow meters.

Environmental Consequences of Cluster 2.5: Assessments and development of maps, training programs, and strategies, and procurement of equipment will have no direct effects on the environment. No mitigation is needed.

Placement of rain gauges, river flow meters, and other disaster preparedness instruments will have negligible environmental impact. Installation involves no changes to the land surface or to aquatic or terrestrial ecosystems.

4.2.3 Component 3: Watershed governance strengthened.

Description of Cluster 3.1: Establish watershed governance structures.

Training, technical assistance, studies/assessments, and procurement: work with watershed management groups to build, train, and guide sub-watershed governance structures; use junior professionals in these efforts.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 3.1: This activity cluster addresses government challenges at local levels, and involves only training and technical assistance which will have no direct or indirect environmental impacts. Training may involve a range of topics, including: financial management, implementation of a tax system, activity development and planning, proposal writing, budgeting, and operations of local government organizations. None of these will have indirect or direct environmental impacts, and therefore, no mitigation is needed.

Description of Cluster 3.2: Watershed population increasingly covering costs of public works

Training, technical assistance, studies/assessments, and procurement: support irrigation canal management committees as a permanent structure to manage rehabilitated irrigation canals, including establishing payment systems; and set up road user associations and water user associations to manage and maintain rehabilitated infrastructure, including establishing payment systems.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 3.2: Technical assistance and training to build skills of committee members to transparently collect and track user fees will have no direct environmental effects. Indirectly, this training and TA is expected to benefit the environment by increasing the budget for maintenance, and by encouraging conservation through the fee for services system. No mitigation is needed.

Description of Cluster 3.3: Strengthen representative governing bodies

Training, technical assistance, studies/assessments, and procurement: conduct training needs assessments; train local authorities in natural resources management, land use planning, zoning, appropriate use, and enforcement strategies; and provide equipment and materials for internet access, map drawing, and rainfall measurement.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 3.3: Training needs assessments, and provision of equipment and materials for internet access, map drawing, and rainfall measurement will have no direct or indirect environmental impacts; no mitigation is needed.

Training local authorities in natural resources management, etc. will have no direct effects, but would be expected to have indirect positive environmental effects. This activity is considered a mitigation measure (incorporated into the design) for the other components: the livelihood component, infrastructure component, PPPP component, and earthquake recovery activity clusters, in that improved land use planning, zoning, appropriate use, and enforcement of these directives will help ensure that agricultural production, infrastructure, and processing activities are undertaken in appropriate areas and in a way that will not result in adverse environmental and health effects.

Description of Cluster 3.4: Identify, assess, and make recommendations on policy constraints in a participatory manner.

Training, technical assistance, studies/assessments, and procurement: support the development of appropriate zoning and construction standards/building codes; support implementation of building codes; assess and support mitigation of policy constraints to improved agricultural productivity; identify priorities for policy development, reform, and enforcement; develop the regulations for the 2006 Decree on the Environment in collaboration with the Ministry of the Environment and other stakeholders. This decree provides the framework to help stop and reverse environmental degradation; support CIAT to develop a methodology for watershed management planning and monitoring; and provide other support (mainly workshops, technical assistance, and training; physical interventions are described in other components) on a demand-driven basis to the GOH in watershed management.

Infrastructure and other physical interventions: install seismic monitoring systems (see photo below).

Environmental Consequences of Cluster 3.4: Provision of technical assistance and training to develop and implement appropriate zoning and building codes will have indirect positive environmental effects—as with Cluster 3.3, this would be expected to mitigate activities under the other cluster by ensuring that they take place in appropriate locations and in accordance with acceptable standards.

Other support to strengthen or develop policies and planning methodologies, and technical assistance in support of the GOH for watershed management that does not involve physical interventions will have indirect positive effects on the environment and is the foundation for WINNER physical interventions in target watersheds; essentially this basket of activities—support for improved watershed management planning, is considered mitigation, and is already incorporated into the design of WINNER.

Installation of seismic monitoring systems (photo below) requires very minimal land disturbance and movement of soil, and will not result in physical disturbance of the environment. No mitigation is necessary.

A typical seismic monitoring station

Description of Cluster 3.5: Create participatory watershed management plans

Training, technical assistance, studies/assessments, and procurement: organize and work with key stakeholders to develop the watershed management plans; map immediate land use; planning and visioning exercises; support the production of watershed management plans at the communal level; and develop and distribute posters and other communication materials on watershed management.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 3.5: This activity cluster involves technical assistance, workshops and meetings, and document and information transfers. It will result in no direct environmental impacts, and indirect environmental effects are expected to be positive—if the plans are implemented, watersheds will be managed in a more sustainable manner, with conservation of soil, water, and other natural resources in the forefront; the production of watershed management plans will bring a more rational process to decision making and to land use and zoning. As above, this activity cluster can be considered mitigation for livelihood, physical infrastructure, PPPP, and earthquake recovery components.

Description of Cluster 3.6: Implement sustainably financed, community-based NRM of biologically significant sites

Training, technical assistance, studies/assessments, and procurement: identify alternative income opportunities for producers near biologically significant sites such as mangroves.

Infrastructure and other physical interventions: None

Other: work with international conservation donors to contribute to PPPPs that include payment for ecosystem services; provide a grant to support the protection and conservation of Parc de la

Visite, which will include support for and training of guards to prevent wood cutting for charcoal within protected area boundaries and an environmental education campaign for communities surrounding Parc de la Visite. The grant for will support the Ministry of Environment to recruit, train, and manage a corps of park rangers.

Within the boundaries of Parc de la Visite there are 469 families (about eight people/family) on 2,000 hectares. With park inhabitants, government authorities, and the surrounding communities, WINNER may assist in developing a strategy to relocate a significant number of these families. The strategy will be based on socio-economic studies in the buffer zone to help identify places where these families could be relocated.

Environmental Consequences of Cluster 3.6: The purpose in identifying alternative income opportunities is to alleviate pressure on the biologically significant sites. This activity is expected to have positive environmental effects. However, while alleviating pressure on certain resources, alternative income opportunities could place pressure on other resources and could have unintended consequences. This activity cluster involves studies/assessments of alternative opportunities with no direct impacts; enterprises/partnerships will be funded under Component 4 and potential impacts of this support are described there. PPPPs for ecological services, such as potable water provision, water for irrigation, and flood control measures are discussed under Component 4.

Support for recruiting, training, and managing park guards will have positive environmental effects. As mentioned above, the GOH has not provided budgetary support for the country‘s national guards, and this has been a major constraint to conservation. The grant will address this constraint. A trained cadre of park guards will be expected to minimize incursions into the park to collect fuelwood and wood for charcoal making, to control poaching and other illegal collection of natural resources. The environmental education campaign will reinforce the work of the park guards.

Production of socioeconomic studies and a strategy to relocate families currently living in Parc de la Visite would not have direct environmental impacts. However, if the relocation strategy is implemented, positive and negative environmental effects would be expected. The inhabitants of the park are currently using park resources (wood, water, plants, etc.), and indirectly, they are impacting wildlife by their daily activities. Positive environmental effects on park resources would be expected. The families, however, could be adversely affected; and the communities to where they are relocated could also be adversely affected. In addition, if infrastructure is built for the families, adverse environmental impacts could result. As compared with relocating families and structures away from flood-prone and other areas with high disaster risk, relocating families out of protected areas has often been a highly controversial activity. Given the potential controversial nature of this activity, mitigation is required (including, possibly, a site-specific EA due to the potential controversy—see Table 5).

Description of Cluster 3.7: Develop participatory disaster management plan for the watershed

Training, technical assistance, studies/assessments, and procurement: assess disaster risks; strengthen local disaster preparedness teams; identify emergency shelters and assess their

suitability; update flood maps so they are available for disaster planning; and conduct training on disaster preparedness drills.

Infrastructure and other physical interventions: reinforce emergency shelters that do not meet building code requirements.

Environmental Consequences of Cluster 3.7: Training, technical assistance, identification and assessment of shelters, updating of flood maps will have no direct or indirect environmental effects, and no mitigation is necessary.

Reinforcing emergency shelters will not involve increasing the footprint of the existing structure nor will it involve upgrading water, power, or other services. This activity will primarily involve strengthening the existing structure to a higher standard than emergency shelters in Haiti are usually constructed so that it is more likely to withstand floods, hurricane, and earthquakes. Reinforcing the structure may involve dismantling and disposing of material, and if disposed of in an environmentally unsound manner, environmental impacts could result. Mitigation is described below (Table 5).

Description of Cluster 3.8: Strengthen donor coordination in watersheds

Training, technical assistance, studies/assessments, and procurement: reinforce coordination of activities through development of a GIS-based map of all interventions in watersheds.

Infrastructure and other physical interventions: None

Environmental Consequences of Cluster 3.8: Strengthening donor coordination and production of GIS maps will have no direct or indirect environmental impacts. No mitigation is needed.

Table 5: Component 3 Mitigation Plan

Cluster	Activity	Potential Adverse Impacts	Mitigation Measures
3.6 Implement sustainably financed, community-based NRM of biologically significant sites	Relocate families from Parc de la Visite	While park resources are expected to benefit, socio-economic impacts could result from relocation: families being relocated, as well as communities that receive the families could be adversely affected.	Socioeconomic studies will be undertaken to ensure all social, cultural, and economic aspects are considered as part of developing a compensation plan, and prior to any relocation. At a minimum, the standard mitigation measures for relocation shall be implemented: • Monitor the implementation of a transparent and fair compensation plan by the Haitian government, as appropriate, to provide compensation for any permanent or temporary loss incurred. • Ensure that the plan allows affected people to maintain their current

Cluster	Activity	Potential Adverse Impacts	Mitigation Measures
		If structures will be built for the relocated families, environmental impacts could result. Relocation from protected areas to local communities could be highly controversial from a socio-economic, cultural, and/or environmental standpoint, and thorough due diligence is needed, and possibly, an activity-specific EA.	housing condition or better. Depending on the extent of structures needed to relocate families, mitigation measures for small-scale construction (buildings, water, and sanitation) and Cluster 2.4 for road rehabilitation shall be incorporated. In coordination with USAID COTR, and based on socio-economic studies and a review of the extent of the relocation, USAID and WINNER shall determine the need for additional socio-economic and/or environmental review, including a site-specific EA.
3.7 Develop participatory disaster management plan for the watershed	Reinforce emergency shelters	Environmentally unsound disposal of construction material could pollute waters or land.	Material shall be disposed of at an approved and environmentally sound disposal site.

4.2.4 Component 4: Public-Private-Producer Partnerships established.

Description of Cluster 4.1: Leverage public-private partnerships for the majority of watershed interventions.

Training, technical assistance, studies/assessments, and procurement: identify PPPP opportunities; identify processing/value-added opportunities; and provide technical support for possible PPPPs.

Infrastructure and other physical interventions: provide direct financial support to implement PPPPs; provide financing to bakeries and dry cleaners to convert from wood and charcoal to LPG; launch a program to promote LPG consumption especially among street vendors by providing training and financial assistance to small enterprises to help manufacture gas stoves to reduce charcoal and wood consumption and to create non-farm sources of income; stock Savanne Jong lake and provide TA to fishermen for more efficient use and marketing of fisheries resources; organize wholesale centers for farmer association production in market nodes, including a study to identify possible sites, negotiate to obtain rights to land, and develop plans; rehabilitate and re-organize markets; and offer solar panels to farmer associations.

Possible PPPPs will involve: small agricultural products processing units; animal production improvement; sugarcane, cereals, tubers, vegetables, fruits, oilseeds, herbs, biofuel seeds, furniture value chains; link local fishermen with distributors of fish and seafood in major Haitian markets; organize laying hens units to support the market for local eggs by providing feed and technical assistance to farmers, and by organizing the egg producers and helping to market eggs.

Environmental Consequences of Cluster 4.1: Identification of potential PPPP opportunities has no direct or indirect environmental impacts. However, technical support could involve a variety

of technical assistance and training, including in pesticide and fertilizer use, measures to improve processing capacity and quality of product, business/financial planning, etc. Some aspects of technical support could result in environmental impacts; if pesticides and fertilizers are recommended, as above, human health, livelihood, and environmental impacts could result. Other technical support could have indirect environmental impacts, and should only be provided within the context of environmentally sound design and management.

Other interventions (below, under the general heading of providing financial support to implement PPPPs) in support of PPPPs could have a range of environmental impacts depending on the type of PPPP and the type of support WINNER provides. Positive environmental effects are also expected of WINNER support for PPPPs, especially for PPPPs in buffer zones to areas of significant biodiversity and for ecosystem services.

Table 6: Component 4 Mitigation Plan

Cluster	Activity	Potential Adverse Impacts	Mitigation Measures
4.1 Leverage public-private partnerships for the majority of watershed interventions	Technical support: pesticides Technical support: fertilizer	Potential health, environmental, and livelihood impacts from support for the use/procurement of pesticides; and from recommendations and procurement of fertilizer	Support the procurement or use of pesticides shall comply with the USAID/Haiti approved PERSUAP. Support for fertilizer use shall only be provided with the incorporation of measures from the Fertilizer Factsheet (Annex G).
	Other technical support	Variety of potential impacts—all indirect--depending on the type of support	Coordinate with WINNER Biodiversity Specialist prior to providing support to ensure it is environmentally sound.
	Financial support of PPPPs	Range of impacts depending on the type of PPPP and the type of support provided by WINNER.	To ensure financial support of PPPPs has no adverse environmental impacts, environmental due diligence (EDD) is required prior to providing funds, as follows: (a) For all PPPPs ensure that the value chain, from producer to processor to market is environmentally sound: Biodiversity Specialist shall review value chain study prior to funding to identify concerns. (b) For processing facilities, require incorporation of cleaner production including recycling/re-use and waste disposal in a manner that will not contaminate the environment (waste is considered liquid and solid waste, including biological wastes, air pollutants, hazardous and toxic waste, and any material that would attract animals—pigs, dogs, etc.). (c) For market renovation and other small-scale construction: construction shall follow guidance and incorporate mitigation measures in Annex G. (d) For natural resource-based PPPPs, prior to signing an agreement, ensure there is a plan for sustainable use. . Whenever animal or vegetal species are to be reared or grown in the open near or within a wetland, the environmental impacts must be included in the list of criteria considered for the selection of the specie and variety and due consideration must be given to the use of native species. This shall be cleared and monitored by the WINNER Biodiversity Specialist (e) For products involving harvest of wood (i.e., furniture, crafts), an amended IEE shall be prepared prior to providing

Cluster	Activity	Potential Adverse Impacts	Mitigation Measures
			support. No funds shall be disbursed until the IEE is approved by the BEO. (f) For PPPPs involving wild-caught fish and seafood (not aquaculture/constructed fish ponds), an amended IEE shall be prepared prior to providing support. No funds shall be disbursed until the IEE is approved by the BEO. (g) For animal/livestock-based PPPPs, ensure there is a waste disposal plan in place that is environmentally sound. This shall be cleared and monitored by the WINNER Biodiversity Specialist. (h) For aquaculture/constructed fish ponds, ensure drainage from the pond/facility will not pollute surrounding land or water; ensure that the system is closed, and cultured fish cannot escape to wild populations; ensure filtering is adequate so as not to pollute pond water with feed and waste. (i) For agriculture-based PPPPs, ensure producers are not converting natural ecosystems to crop production; and ensure that procurement or use of pesticides shall comply with the approved PERSUAP. (j) For alternative livelihoods and ecosystem services, monitor to ensure benefits to areas of significant biodiversity are actually accruing.
	Generator or other fuel dependent motor installed in processing facility.	Leaks and regular oil change maintenance could contaminate land or water.	Ensure a maintenance plan is in place to safeguard against leaks and to ensure that when oil will be changed, it will be disposed of safely, and in a manner not to contaminate land or water.

4.2.5 Component 5: Earthquake recovery enhanced

Description of Cluster 5.3: Implement work for recovery.

Training, technical assistance, studies/assessments, and procurement: procure uniforms for workers and equipment to clean canals.

Infrastructure and other physical interventions: clean irrigation and drainage canals that will benefit the rural economy and that will improve the availability of irrigation water.

Other: provide grants for small businesses affected by the earthquake-this will include a program of small grants to small, formal businesses to expand economic opportunities and job creation-these will be supplemented by loans from partner financial institutions.

Environmental Consequences of Cluster 5.3: Procuring uniforms and equipment will have no direct or indirect environmental impacts. Cleaning irrigation canals will improve the environment by improving water flow and by removing debris, some of it dangerous for people and wildlife (i.e., plastics). However, the material removed from the canal, if not disposed of in an environmentally sound manner and at an approved disposal site could have negative environmental impacts—the material would be removed from one site only to pollute another. Mitigation is needed and is described in Table .

Providing grants to small businesses could have environmental impacts. Grants that would support the procurement or use of pesticides or fertilizers could have health, livelihood, and environmental impacts. Grants could support businesses that potentially harm the environment, even inadvertently; WINNER must be vigilant and ensure grants are awarded to businesses that will not directly or indirectly result in environmental harm.

Description of Cluster 5.4: Agricultural Production Campaign: support the agricultural production campaign by working with the Ministry of Agriculture on soil preparation and by paying for tractor hire, i.e., rent tractors and pay for fuel; and transfer process to farmers associations for the management.

Environmental Consequences of Cluster 5.4: Soil preparation for the agricultural campaign will have no environmental impacts (fertilizer/pesticides are not included in this cluster, it is focused on tractor hire only). Transferring the tractor hire process to farmer associations will have no environmental impacts. As the EMPRs for this activity note, tractors that are rented by WINNER must be in good condition and oil and other fluids should not be disposed of so that they contaminate water or land, and a process should be incorporated into the rental to ensure the tractors are well-maintained and there are no leaks. Mitigation measures from previously approved EMPRs will be incorporated into this activity in the future (see Table 7).

Table 7: Component 5 Mitigation Plan

Cluster	Sub-activity	Description of Impact	Mitigation Measures
5.3 Implement work for recovery.	Cleaning irrigation and other drainage canals	Improper disposal of material removed from canals	Ensure material is disposed of at an (a) approved and (b) environmentally sound disposal site.
	Grants to small businesses and assistance to procure loans	Grants/Loans may be provided to businesses that directly or inadvertently harm the environment.	Conditions are the same as above, Component 4, for –financial support of PPPPs."
5.4 Agricultural Production Campaign	Tractor rental	Oil and fuel could contaminate land or water.	Ensure a maintenance plan is in place to safeguard against leaks and to ensure that if oil will be changed, it will be disposed of safely, and in a manner not to contaminate land or water.

SECTION FIVE: ENVIRONMENTAL MITIGATION AND MONITORING PLAN

The Components 1, 3, 4, and 5 Mitigation Plans and the Clusters 2.1, 2.2, 2.3, and 2.4 Mitigation Plans (above, Section Four) provide guidance for WINNER component managers on implementation of mitigation measures over the life of each activity. The Programmatic Environmental Management Plan (PEMP) includes the mitigation measures from each of the Mitigation Plans, along with monitoring and reporting requirements. The PEMP is a tool for the use of the WINNER Biodiversity Specialist and component managers are responsible for implementing and reporting on, and in some cases overseeing the implementation of mitigation and monitoring. Annex E contains the PEMP.

WINNER Quarterly Reports shall report on implementation of mitigation measures
-ongoing monitoring and findings
-successes, failures, and actions to address failed mitigation measures
-any other issues identified or concerns to be brought to the attention of USAID COTR

REFERENCES

In addition to the documents referenced below, the PEA Team reviewed and used information from all approved and draft WINNER Environmental Mitigation Reports and Environmental Mitigation Plan and Reports; CHF EMPRs for debris removal, economic institutional development, and agricultural production; the WINNER Performance Monitoring Plan; the PEA Scoping Statement; and the IEE for WINNER and DEED.

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ANNEX A: DEED AND WINNER IEE

Attached Separately

ANNEX B: EXCERPT FROM SCOPING STATEMENT

HAITI WINNER

WATERSHED INITIATIVE FOR NATIONAL NATURAL ENVIRONMENTAL RESOURCES

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT SCOPING STATEMENT

Contract No. EPP-I-04-04-000200-00

EXECUTIVE SUMMARY

Chemonics International, the implementing partner for the Haiti Watershed Initiative for National Natural Environmental Resources (WINNER) project, has prepared this Scoping Statement as part of the Programmatic Environmental Assessment (PEA) process. Preparation and approval of the Scoping Statement provides the relevant specifications, and frames the environmental issues that the PEA team will explore in detail.

The WINNER project is implementing activities to foster the sustainable management of critical watersheds in Haiti. At this stage, WINNER project activities focus on the Cul de Sac (Riviere Grise and Riviere Blanche), Cabaret/Arcahaie (Matheux, Courjolle, Torcelle and Bretelle rivers), Gonaives (La Quinte river), and Mirebalais/Saut d'Eau (La Tombe, Gascogne, Janleba, Fer-à-cheval rivers of the Artibonite river system) watersheds. Project activities span all the geographic components of these watersheds (e.g. upper, middle and lower reaches) and include interventions with a direct and indirect impact of the management and long term health of the watersheds and associated ecosystems (e.g. farming practices, water management, and soil conservation).

Decades of over-exploitation and mismanagement have severely diminished the effective ecological functions and associated economic productivity of Haiti's watersheds. Near total deforestation, growing population pressure, insufficient soil conservation, inappropriate agricultural practices, over-intensive agricultural use, lack or poor off-farm employment opportunities have combined to dramatically decrease the resiliency of Haiti's watersheds. They have led to significant increase in land marginalization and degradation, gully formation, river siltation and sedimentation as well as vulnerability to flooding, droughts and other natural and human-induced events.

The scoping process included identifying stakeholders, conducting structured meetings with those stakeholders to solicit their opinions about environmental issues related to the planned project activities, and determining which issues raised by stakeholders will be evaluated in detail during the PEA process. The WINNER team used a questionnaire proceeded by a brief description of the WINNER project to obtain input from stakeholders on biological, physical, chemical, social and cultural issues. The team conducted scoping meetings in eight communities representative of those in which WINNER watershed management activities are planned. These reports are included in Annex A.

From these meetings, and based on its own knowledge of watershed management and Haitian environmental issues, the WINNER team developed a set of issues recommended for detailed evaluation in the PEA. These issues include:

- Loss of local or natural flora – tree cutting
- Soil erosion
- Water quality
- Water quantity
- Land acquisition and just compensation
- Socio-cultural issues
- Community access to river water and other river resources
- Worker and public safety
- Governance

Once the Scoping Statement is approved by USAID, the WINNER team will begin the PEA process, with completion submission to USAID estimated for August2010.

PROPOSED INFRASTRUCTURE ACTIVITIES

Haiti WINNER infrastructure activities are focused on improving watershed management, repairing damage from poor management, neglect and natural disasters, reducing risks and damage during and after flood events as well as their frequency and magnitude, and enhancing the livelihood security of residents in the geographic areas in which the project works. Table 1.1 summarizes the types of infrastructure the WINNER project plans to address.

Table 1.1 Planned Haiti WINNER Infrastructure Activities

Infrastructure Category	Activity and Sub-Activities	General Location and/or Land Type
Irrigation and Drainage system Improvement/Rehabilitation	• New system construction, • Canal Cleaning and widening, • Sediment and other debris removal and disposal	Lower sections of Cul-de-Sac and Gonaives watersheds, Cabaret and Arcahaie plains, and Mirebalais/Saut d'Eau low lands
	• Intake Construction and Rehabilitation ○ Head water works ○ Diversion dams	Water intakes in lower sections of Cul-de-Sac and Gonaives watersheds, Cabaret and Arcahaie plains, and Mirebalais/Saut d'Eau
	• Pumping Station Construction and Rehabilitation • Diesel Genset Installation	Lower sections of Cul-de-Sac and Gonaives watersheds
	Catchment Reservoirs Construction	Steep catchments in the upper sections of the Cul-de-Sac, Gonaives, Cabaret/Arcahaie, and Mirebalais/Saut d'Eau
Flood Control and Erosion Control	• Riverbed Sediment Removal • River Bank Stabilization ○ Slope improvement ○ Gabion ○ Vegetation	Mid to lower rivers sections in Cul de-Sac , Gonaives, Cabaret and Arcahaie areas
	• Ravine Treatment ○ Gabion ○ Check dams ○ Other gully plugs ○	Upper to mid-sections of the Cul-de Sac, Gonaives, Cabaret/Arcahaie, and Mirebalais/Saut d'Eau watersheds
	• Retention Pond Construction ○ Earthen dikes and dams ○ Outlets	Upper to mid-sections of the Cul-de Sac, Gonaives, Cabaret/Arcahaie, and Mirebalais/Saut d'Eau
Potable Water System Improvement	• Water source / spring capping • Elevated Cistern Construction ○ Tower ○ Tank ○ Slab foundation • Buried Pipe Installation • Diesel Genset Installation • Slab foundation • Reservoir Construction • Pumping Station Construction and Rehabilitation • Water Treatment Facilities	Mid to lower-sections of the Cul-de Sac, Gonaives, Cabaret/Arcahaie, and Mirebalais/Saut d'Eau watersheds
Feeder Road Rehabilitation	• Rural Road Reconstruction ○ Gravel resurfacing ○ Drainage system development ○ Culvert Repair ○ Bridge Repair	Upper and mid sections of both the Cul-de-Sac and Gonaives watersheds

SECTION 2
Scoping Activities

The PEA scoping activities took place between December 2009 and May 2010. The process was interrupted for two (2) months by the January the earthquake. The Scoping meetings and consultations were held in Port-au-Prince, and in the project work areas within the Cul-de-Sac/Kenscoff, Gonaives, Mirebalais/Saut d'Eau and Cabaret/Arcahaie watersheds.

Scoping meeting process

WINNER Senior Management Team work directly with national government representatives at the Ministry of Environment (Project partner/Responsible Government Authority for Environmental Protection), Ministry of Agriculture and Rural Development (Project partner/Responsible Government Authority for the agriculture sector and rural development), CIAT (Comite Interministeriel d'Amenagement du Territoire) Project Partner/ Responsible Government Authority for Watershed Management. WINNER Regional and sub-regional Directors and their teams work directly with the respective local authorities, civic leaders, and government, private sector, NGO and CBO representatives in their respective areas of intervention, namely in Croix des Bouquets, Ganthier, Thomazeau, Duvier and Kenscoff (Cul de Sac), Bassin Mangnan (Gonaives), Mirebalais (Mirebalais/Saut d'Eau) and Cabaret (Cabaret/Arcahaie).

The scoping meetings and consultations took place both at the national level and in the localities in which WINNER activities are planned. The PEA team and members of the WINNER project staff made a brief presentation to each stakeholder group, describing the project objectives and relevant activities. Some meetings were with individual officials, others were with larger groups. The WINNER team was careful in all of its meetings to explain the scope of the PEA, specifically the focus of the exercise on environmental issues. Following the short presentation, the team engaged each group in informal discussion, using a standardized questionnaire to structure the discussion, answering questions, and noting issues raised and ideas proposed related to project activities. The questionnaire is included in Annex A. A list of stakeholders with whom the team met is included in Annex B. Issues raised by the stakeholders which fall outside the scope of the PEA process were recorded separately for follow-up as deemed appropriate.

SECTION 3
Significant Issues to Be Addressed in the Programmatic Environmental Assessment

The PEA team used a simple two-phase methodology to determine the environmental issues that the team will address during the PEA. This methodology started with evaluation of the issues raised by stakeholders (Phase 1). Those issues judged to be relevant to planned WINNER infrastructure activities were evaluated to determine their potential adverse impacts in the context of the WINNER project. Those issues judged to have the potential to result in adverse environmental impacts were deemed ~~–s~~ignificant issues (Phase 2). The results of each phase of the process are summarized in Tables 2.1 and 2.2 respectively.

Issues Identified By Stakeholders

Table 2.1 summarizes the issues raised by representatives of stakeholder groups during scoping meetings.

Table 2.1: Summary of Issues Raised by Stakeholders

Areas	Summary of Issues	Relevance to WINNER Activities
Coastal Zone Management	• Lack of management structure and system • River sedimentation • Lack of resources • Flash flood	Direct project activities aiming at addressing these issues
Protected Area Management	• Lack of management structure and system • Lack of resources	Direct project activities aiming at addressing these issues
Conversion of Agricultural Land to Other Uses	• Lack of zoning – conversion to housing	Governance project activities
Forest or Tree cover	• Deforestation • Tree cutting for energy use • Tree cutting for construction • Conversion to human housing or dwelling • Decrease of fruit trees values or loss of fruit markets • Conversion to pastures or agriculture	Direct project activities aiming at addressing these issues
Surface water	• Poor management of wastes • Poor management of agricultural chemicals • Animal husbandry • Soil erosion • Poor hygiene	Direct project activities aiming at addressing these issues
Soil erosion	• Deforestation • Inappropriate agricultural practices • Human population pressure • Colonization of marginal lands • Slash and burn practices	Direct project activities aiming at addressing these issues
Air quality	• Tire burning • Solid waste burning • Dead animals in public areas • Open sewage or open drainage systems used as refuse • Illegal discharge	No direct WINNER Project activities
Gully creation	• Agriculture on steep slopes • Poor agricultural practices • Poor road drainage • Mining for construction	Direct project activities aiming at addressing these issues

Areas	Summary of Issues	Relevance to WINNER Activities
Flood	• Riverbed accretion • Riverbanks damage or destruction • Excessive runoff • Deposit of solid waste in riverbed • Mining in river courses	Direct project activities aiming at addressing these issues

Table 2.2: Screening of Stakeholder Issues

Areas	Issues	Potential Adverse Impacts	Activities See Table 1.1 for sub-components	Significance (Y/N)
Biological	Native or local flora	Destruction of vegetation on and around the site of construction activities and/or during operation of completed facilities.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control and Erosion Control • Potable Water System Improvement • Feeder Road Rehabilitation	Y
	Native or local terrestrial fauna	Disruption or destruction of wildlife habitat on and around the site of construction activities and/or during operation of completed facilities.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control and Erosion Control • Potable Water System Improvement • Feeder Road Rehabilitation	Y
	Sensitive Terrestrial or Marine Ecosystems	Construction within sensitive ecosystems (e.g. biologically diverse, containing endangered flora and/or fauna, location of pristine water sources) can cause serious damage to their delicate balance and proper function.	• Flood Control and Erosion Control • Feeder Road Rehabilitation	Y
Physical and Chemical	Air Quality	Impacts to local air quality during construction can be anticipated due to fugitive dust generation in and around the construction sites. Construction activities will also result in the generation of diesel exhaust from heavy equipment and generators.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control • Feeder Road Rehabilitation	Y
	Soil Erosion	Construction activities can result in increased turbidity of runoff water due to soil erosion. Construction activities and operation of some facilities in river basins can result in soil erosion and sedimentation at the mouth of rivers that obstructs water flow.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control • Potable Water System Improvement	Y

		Sourcing of construction materials from steep slopes (e.g. stones, gravel) can cause soil erosion.	• Feeder Road Rehabilitation	
	Surface Water Contamination	Construction activities can result in contamination of runoff due to leaking fuel or lubricants from construction equipment.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control and Erosion Control • Feeder Road Rehabilitation	Y
	Surface Water Withdrawal or Disruption	Construction of the facilities will result in an increase in hardscape with a resulting incremental increase in surface water runoff. Construction of facilities can change surface water flow patterns in and around building sites. Construction and operation of facilities, particularly infrastructure that uses surface water resources (e.g. irrigation systems, industrial plants, potable water systems) can significantly reduce the quantity of surface water in a watershed or other system.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control and Erosion Control • Potable Water System Improvement • Feeder Road Rehabilitation	Y
	Groundwater Withdrawal or Disruption	Construction activities can result in contamination of runoff due to leaking fuel or lubricants from construction equipment. Construction of facilities will result in an increase in hardscape with a resulting incremental decrease in groundwater percolation. Construction of new wells and rehabilitation of existing wells place additional demand on groundwater resources.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control and Erosion Control • Potable Water System Improvement • Feeder Road Rehabilitation	N
	Groundwater Contamination	Construction of some facilities such as sanitary latrines, use of construction equipment and solid waste disposal centers can cause the release of chemical and biological contaminants into the soil and ultimately into the groundwater.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control and Erosion Control • Potable Water System Improvement • Feeder Road Rehabilitation	Y

Areas	Issues	Potential Adverse Impacts	Activities See Table 1.1 for sub-components	Significance (Y/N)
	Noise	Construction activities will result in noise impacts resulting from the use of heavy equipment and machinery.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control • Feeder Road Rehabilitation	N
	Visual Quality and Viewscape	Construction activities may result in a short-term impact to the visual. In particular, buildings in progress are generally stark in appearance. Additionally, construction material and wastes may result in a cluttered site.	• Irrigation and Drainage system Improvement/Rehabilitation • Potable Water System Improvement • Feeder Road Rehabilitation	N
Social and Cultural	Local Labor	Development of facilities should result in a number of construction jobs and permanent positions during facility operation. It is important that this employment is handled to maximize local employment.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control and Erosion Control • Potable Water System Improvement • Feeder Road Rehabilitation	Y
	Public Safety and Worker Safety	Construction activities create health and safety hazards for both workers and residents living in and around the construction zone. Operation of constructed facilities can create health and safety hazards for workers, and for residents living in the vicinity of the facilities.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control and Erosion Control • Potable Water System Improvement • Feeder Road Rehabilitation	Y
	Disruption of Community Livelihoods	Some construction work and facilities development can inadvertently disrupt access by local residents to traditional or otherwise livelihood related activities (e.g. reaching rivers or other bodies of water).	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control • Feeder Road Rehabilitation	N
	Traffic and Transportation	Construction activities will result in additional truck traffic and potential traffic congestion on local streets. The truck traffic will also result in potential threats to pedestrian safety, particularly in urban and peri-urban areas.	• Irrigation and Drainage system Improvement/Rehabilitation • Flood Control • Feeder Road Rehabilitation	N
	Cultural Resources	Buried cultural or archaeological resources may be uncovered during construction activities. Similarly, cultural or archeological resources adjacent to construction sites	• Irrigation and Drainage system Improvement/Rehabilitation	N

		may be impacted during construction or operation of completed facilities.	• Flood Control • Potable Water System Improvement	

Areas	Issues	Potential Adverse Impacts	Activities See Table 1.1 for sub-components	Significance (Y/N)
Material Pilfering		Construction materials and equipment, and parts of completed facilities may be pilfered by residents of surrounding communities, particularly in densely populated and high poverty areas.	N/A	N/A
	Land Appropriation	Construction materials and equipment, and parts of completed facilities may be pilfered by residents of surrounding communities, particularly in densely populated and high poverty areas.	N/A	N/A
	Solid, Hazardous, and Special Wastes	Construction activities, including demolition and excavation, will result in solid wastes which will require disposal	• Irrigation and Drainage system • Improvement/Rehabilitation • Flood Control and Erosion Control	Y
		Operation of facilities constructed generally results in generation of solid waste.	• Potable Water System Improvement • Feeder Road Rehabilitation	
		Construction activities may result in the generation of hazardous wastes, including oils and lubricants. Accidental release of these wastes may result in impacts.		

Issued to be address in the PEA

Based on analysis of the issued raised during the scoping process, the following issues are deemed significant and will be covered by the PEA:

- Loss of local flora – tree cutting
- Loss of local fauna
- Sensitive terrestrial or marine ecosystems
- Air quality
- Soil erosion
- Water quality
- Water quantity
- Local labor
- Land acquisition and just compensation
- Community access to river water and other river resources
- Worker and public safety
- Solid, hazardous and special wastes

Issues Eliminated from Further Consideration

The following issued have been eliminated from further consideration because they are either (a) not significant, (b) not relevant to the proposed project interventions or (c) both.

- Groundwater withdrawal or disruption
- Disruption of community Livelihoods
- Noise
- Visual Quality and viewscape
- Disruption of community livelihoods
- Traffic and transportation
- Cultural resources

SECTION 4
Schedule for Preparing the Environmental Analysis

The PEA team intends to have an approved PEA by October 15, 2010[12]. The proposed schedule includes the following milestones:

Scoping Statement	
Draft Scoping Statement prepared	December 1, 2009 – June11, 2010
Draft Scoping Statement submitted to USAID	June 14, 2010
Draft Scoping Statement revised	July 31, 2010
Final Scoping Statement approved	Aug 5, 2010
PEA	
Preliminary data collection and analysis	December 1, 2009-July 31, 2010
Draft watershed management plan prepared	July 31, 2010
Draft PEA prepared	August 2010
Draft PEA submitted to USAID	August 31, 2010
Draft PEA revised	September 15-30, 2010
Revised PEA submitted to USAID	September 30, 2010
Final PEA approved by USAID	October 15, 2010

[12] It is important to note that the PEA preparation schedule has been adversely impacted by the January 12, 2010 earthquake in Haiti.

SECTION 5
Proposed Approach to Address Significant Issues

Methodology

The PEA will be prepared according to the requirements of USAID 's environmental procedures. Following approval of the PEA Scoping Statement, the PEA team will collect baseline environmental information relevant to the environmental issues deemed significant in the Scoping Statement. These key issues are summarized in Section 4. They will be used to develop alternative actions to the proposed actions/activities listed in table 1.1. The PEA team will evaluate the potential adverse environmental impacts of the proposed actions and alternatives in regard to the key associated issues raised. Direct, indirect, connected, and cumulative actions will be included in the PEA's environmental impact analysis section. The team will work with the WINNER team to identify and analyze specific project activities aiming at addressing the key issues.

The team will evaluate the potential adverse environmental impacts associated with these issues, and identify mitigation and monitoring measures to eliminate these impacts, reduce them to acceptable levels, or propose/recommend alternative actions or activities with less an impact. The PEA team will draw heavily on the sets of mitigation and monitoring measures developed for USAID/Haiti for the following activity areas:

- Debris Removal, Storage, Disposal and Recycling
- Flood Control and Drainage
- Infrastructure Construction and Rehabilitation
- Irrigation and Soil Conservation

The PEA report will include a process for environmental review, management and monitoring on each WINNER activity, using the USAID/Haiti Environmental Management Plan and Report (EMPR) methodology.

PEA Team

The original PEA team was led by Chris Perine, an EIA specialist with more than 15 years experience preparing environmental compliance documentation for USAID-funded activities, including IEEs, EAs and PEAs. The services of a short-term Technical Assistance will be acquired to continue the process and develop the PEA. Technical inputs were received and will continue to be received from various members of the WINNER project team and USAID representatives, including:

<u>WINNER Project</u>
Michelet Fontaine, Project Director
Jean-Robert Estime, Chief of Party
Mario Kerby, Deputy Chief of Party
WIF Director (former Kathy Wachala, and current Jennifer Brinkeroff)
Pierre Marcellus, Infrastructure Senior Advisor

Jean Parnell Dimanche, Center Director (Cul-de-Sac/Plaine) Jean Raoul Dominique, Center Director
Wilner Dessources, Center Director Gonaives
Obenson Louis, Disaster Management Specialist
Frito Dolisca, Natural Resources Management Specialist

USAID/Haiti
HAITI WINNER COTR (Chris Abrams, former and current James Woolley) Joe Torre, Regional Environmental Advisor, Caribbean

List of Stakeholders Interviewed during the Scoping Process

This annex includes a list of stakeholders with whom the WINNER PEA team consulted during the scoping process.

1. Ministry of Environment
   Lionel Parisien, Engineer
   Adjunct Director General
   Tel: +509.3555.2552 and 2245.7572
   Parisien lionel@yahoo.com

2. Ministry of Agriculture
   Pierre Karly Jean Jeune, Engineer
   Hydro-Agriculture and Basin Management
   Tel: +509.3732.0088 and 3446.7111
   kjjeune@yahoo.com

3. Ministry of Agriculture
   Jean Pierre-Louis Oge
   Agro-Forestry and Forestry
   +509.3458.2845
   pierreoge@yahoo.ca

ANNEX C: BIO OF PEA TEAM MEMBERS

Mr. Yves-André Wainright currently works as a freelance consultant in environmental management, and is active in promoting coordination among Haitian environmental organizations with an interest in protected areas. He has extensive experience with capacity building with local government, civil society, and producer groups. He has worked at the highest levels of government, serving twice as the Minister of the Environment. In that position, Mr. Wainright led the development and adoption of landmark environmental legislation and policy in Haiti. Mr. Wainright also worked for the Ministry of Agriculture, in the early nineties, serving as the regional director in the North-West Department.

Mr. Wainright received his BS in Agronomy from the State University in 1981. He has continued his education, receiving training on carbon-credit market with the Emissions Marketing Association and on environmental law with the United Nations Institute for Training and Research (UNITAR).

A decree adopted by the State in October 2005, under his leadership, established, at least, three innovations in the participation of local governments in the management of watersheds. First, the Central Government must provide assistance to local governments for designing, in a participatory way, a framework strategy that will empower the local governments in planning and managing the natural resources for each watershed or sub-watershed. Each such SDAGE (Schéma Directeur d'Aménagement et de Gestion de l'Environnement) is independent and has legal value once adopted by the concerned assemblies of sections communal. Second, that decree created a national autonomous agency for the protected areas while stipulating that this institution must involve local governments in strategic decisions regarding the management of the national protected areas linked to their jurisdiction. That decree also made mandatory the conduct of environmental impact assessments for activities that would impact the natural ecosystems and the livelihoods of the population with a phase of public debate on the issues identified before the writing of the final version of the document. Mr. Wainright has continued to work for positive policy change since leaving public service, drafting policy on land use and environmental policy.

Ms. Karen Menczer currently works as a freelance consultant in environmental impact assessment and biodiversity conservation. From 1991-1997, she worked for USAID/LAC Bureau/Environment Office, as a Natural Resources Specialist and as the assistant Bureau Environmental Advisor. There, she reviewed documents for compliance with Reg. 216 and helped USAID/LAC missions prepare environmental documentation. From 1997-1999, she worked in the USAID/Uganda mission as a Natural Resources Advisor and Mission Environmental Advisor, where she was COTR of biodiversity programs and monitored the mission‘s environmental compliance. With the exception of 2006-2008, since 2000, she has been an independent consultant, working from her home in Uganda, Jamaica, Botswana, and Ghana. From 2006-2008 she worked directly for The Cadmus Group, mainly on USAID/Africa Bureau‘s Environmental Capacity Building project, and also during this period, spent seven months in Namibia as deputy team leader for an MCC Strategic Environmental Assessment.

ANNEX D. LIST OF CONTACTS

Name	Affiliation	Contact information
Jean-Robert Estime	Haiti WINNER COP	jestime@winner.ht
Mario Kerby	Haiti WINNER Deputy COP	mkerby@winner.ht
Pierre Marcellus	Haiti WINNER Director, Infrastructure	pmarcellus@winner.ht
Maurice Wiener	Haiti WINNER Public-Private-Producer Partnerships	mwiener@winner.ht
Pierre Marius St. Pierre	Vice Mayor (meeting on Riviere Grise flood-erosion control work)	Mariusstp2005@yahoo.fr
Sanon Frietz	GDG Beton Construction	Sanon_88@hotmail.com
Philippe Lerouge	HL Construction	
Nesley Bissainthe	GDG Beton Construction Logistics Manager	Bissainthe2003@yahoo.com
Augustin Wisler	Haiti WINNER Engineer	waugustin@winner.ht
Daphne Boulin	Haiti WINNER GIS team	dboulin@winner.ht
Antoinette Sanon Estor	Agronomist, Wynne Farm	
John Atis	CRDD Director, Kenscoff	jatis@winner.ht
M. Pierre Louis	Haiti WINNER Potable water engineer	mpierrelouis@winner.ht
Carine Bourjolly	Haiti WINNER Watershed Investment Fund	Cbourjolly@itradehaiti.com
Jennifer Brinkerhoff	Haiti WINNER WIF Director	Jbrinkerhoff@winner.ht
Roosevelt Decimus	Haiti WINNER Livelihoods	rdecimus@winner.ht
Obenson Louis	Haiti WINNER Disaster Management	olouis@winner.ht
Garry Filippi	Haiti WINNER Engineer, Transportation	
Jean-Philippe IRA	Haiti WINNER, Natural Ressources Management Officer	jira@winner.ht
Lesly Dumont	DINEPA	Lesly.dumont@dinepa.gov.ht
Ducarmel FRANCOIS	SOTECH, Engineer (Works on La Quinte River)	
Ing. JEUDY	LGL, Engineeer (Supervision of works on La Quinte River)	

ANNEX E: PROGRAMMATIC ENVIRONMENTAL MANAGEMENT PLAN

The following Programmatic Environmental Management Plan (PEMP) provides details of mitigation and monitoring (indicators, responsible parties for mitigation implementation/oversight, and frequency of monitoring). For information on cluster-specific activities and anticipated impacts, see the relevant section of the PEA; the Component/Cluster Mitigation Plans should be used in conjunction with the PEMP.

Implementation of mitigation measures shall be reported on to USAID in WINNER Quarterly Reports.

An over-arching WINNER impact is that training activities at CRDDs have the potential to produce significant amounts of waste material; the mitigation measure is:

The TORs for the training/logistics contractor for training at CRDDs shall require that washable, reusable dishes be used to serve meals; non-reusable plates, bowls, and silverware shall be highly discouraged. **Logisticians at each CRDD are responsible for implementing, monitoring, and reporting on this mitigation measure.**

Responsible Party for overseeing implementation of the PEMP: Biodiversity Specialist

Programmatic Environmental Management Plan

Cluster#	Description of the Mitigation Measure	Person Responsible	Methods of Supervision			Estimated Cost	Results			Recommended Adjustments
			Indicators	Methods	Frequen-cy		Dates of Super-vision	Problems Found	Efficacy of Mitigation	
COMPONENT 1: LIVELIHOODS OF PEOPLE LIVING IN THE WATERSHED IMPROVED THROUGH INCREASED AGRICULTURAL PRODUCTIVITY AND ALTERNATE INCOME GENERATION										
1.1 1.4 1.5	TA/training of master farmers and extension agents shall incorporate conservation information, such as retaining natural vegetation, especially tree cover, planting trees, including for agro-forestry, and other conservation farming measures.	Component 1 Manager	Training material incorporates conservation information. TA includes conservation information	Review training material Briefing/de-briefing with technical experts	As training material is developed. As necessary, during meetings with technical experts	0 0				
1.1 1.4 1.51.6	TA/training shall not include recommendations for the use or procurement of pesticides until a Supplemental IEE (SIEE)/ PERSUAP is approved by USAID/Haiti and the BEO; all such TA/training must comply with the PERSUAP.	Component 1 Manager	Until there is an approved PERSUAP: Training material does not contain recommendations for specific pesticides or on pesticide use. TA does not include recommendations for specific pesticide or	Review training material Briefing/de-briefing with technical experts	As training material is developed. As necessary, during meetings with technical experts	0 0				

			on pesticide use. Once there is an approved PERSUAP: TA and training only includes recommenda tions and information on approved pesticides.							
1.1 1,4 1.5 1.6	TA/training shall incorporate information from the Fertilizer Factsheet	Component 1 Manager	Training material includes information from the factsheet. TA includes information from the factsheet.	Review training material Briefing/de-briefing with technical experts	As training material is developed. As necessary, during meetings with technical experts	0 0				
1.1 1.5 1.7	For construction/re habilitation of CRDDs and rural markets, see Annex G for mitigation measures	Component 1 Manager	TORs & engineering contract includes mitigation measures Construction activities incorporates mitigation measures	Standard clause is incorporated into TORs & contracts Spot checks during construc-tion rehabilitation	one-time at development of TORs and contract As necessary during construction work, but at least one time for each activity	0 (mitigation measures are BEPs and are expected to be included in engineering design.)				
1.1 1.5	Ensure that agricultural packages incorporate safeguards to ensure appropriate land use and agronomy	Component 1 Manager	Agricultural packages include information from Cluster 1.1 and 1.3 studies.	Review information provided in ~~-p~~ackages.”	When developed	0				

	practices (as identified in Cluster1 1.1 and 1.3 studies) are integrated into agricultural packages.									
1.2 1.5	No grants (including to agri-supply stores) shall be awarded for procurement of pesticides, including treated seed, until an SIEE/PERSUAP has been approved by the USAID BEO. All such procurement must comply with the PERSUAP.	Component 1 Manager	Until there is an approved PERSUAP: Grants do not include funding or other support for procurement or use of pesticides. Once there is an approved PERSUAP: Grants only include funding for procurement or use of pesticides approved in the PERSUAP.	Review grant application and award (and PERSUAP when approved and available).	As necessary	0				
1.2 1.5	Grants (including to agri-supply stores) shall include a condition to provide fertilizer best practices to clients, as described in the Fertilizer Fact Sheet	Component 1 Manager	Include standard clauses from factsheet.	Develop clauses	One-time at incorporation of clause	0				
1.3 1.8	Tree seedlings shall be	Component 1 Manager	Seedlings procured are	Field visits	Spot checks, as needed	0				

	appropriate for the zone (incorporating findings of WINNER assessments and studies). At WINNER-supported nurseries, no pesticides shall be procured, used, or recommended, including training in the use of pesticides until an SIEE and PERSUAP is approved by the BEO. All use and procurement of pesticides must comply with the PERSUAP. At WINNER-supported nurseries, use of fertilizers shall comply with the Fertilizer Factsheet. Nurseries should provide a wide variety of cultivars.		in line with WINNER studies. Until there is an approved PERSUAP: No pesticides being used at nurseries. When there is an approved PERSUAP: All pesticide use is in compliance with the PERSUAP. Fertilizer use is in line with best practices/ factsheet. # of cultivars offered							
1.4	TA/training for processors shall incorporate cleaner	Component 1 Manager	Training material incorporates cleaner production	Review training material Briefing/de-briefing with	As training material is developed. As	0				

	production (reuse/recycling, waste minimization, environmentally sound disposal).		information. TA includes information on cleaner production.	technical experts	necessary, during meetings with technical experts	0				
1.6	For water users (irrigation) associations, include training in: maintenance of the system water conservation For potable water management committees train members in: water quality monitoring and testing requirements water conservation and implementation of water conservation measures For road rehabilitation committees, train members in: maintenance, including clearing culverts to ensure water flows are maintained	Component 1 Manager	Required points are included in training material	Review training material at development, spot checks at trainings	At development of material Ad-hoc during trainings	0				
1.8	Monitor to	Biodiversity	Production	Review/	As needed	0				

	ensure that production systems that WINNER is promoting are actually reducing impacts on biologically significant sites.	Specialist	systems are have positive effects on biologically significant sites.	monitor systems/impacts						
COMPONENT 2: CRITICAL INFRASTRUCTURE REBUILT AND IMPROVED AND THREAT OF FLOODING REDUCED										
2.1 2.2 2.3 2.4	WINNER Biodiversity Specialist shall be involved in **planning and site selection**. Environmental Due Diligence shall be conducted at Planning &Site Selection Phase (See individual cluster Mitigation Plans)	Biodiversity Specialist	Involved at onset and throughout P & SS phase Environmental DD conducted for each Cluster 2 infrastructure activity	See EDD in Cluster Mitigation Plans	As necessary when project planning begins	0				
2.1 2.2 2.3 2.4	Mitigation measures described for the Construction Phase and Decommissioning Phase shall be incorporated into **tender documents**; Cluster-specific mitigation measures shall be included in tender documents ; tender	Cluster 2 managers	Mitigation measures and requirement to budget for them are included in tender documents	Review tender documents	When documents are prepared	0 (including as part of sub-contracts)				

	documents should include a requirement for a re-use/recycle and waste segregation plan ; and costs for environmental management shall be included in overall project budget.									
2.1 2.2 2.3 2.4	WINNER Biodiversity Specialist shall be involved in **proposal review process** to ensure environmental soundness and that mitigation measures required by tender documents are incorporated.	Biodiversity Specialist	Biodiversity Specialist is involved in proposal review. Proposals include appropriate environment al soundness measures.	Review proposals	When submitted	0				
2.1 2.2 2.3 2.4	Construction plans must be approved by a certified engineer, and construction works must be performed by a qualified and experienced contractor.	Cluster 2 managers	Construction plans are approved by a certified engineer Construction is performed by a qualified and experienced contractor	Check construction plans Check qualifications of contractor	When submitted to WINNER Prior to award	0				
2.1 2.2 2.3 2.4	Mitigation measures (standard and cluster-specific) shall	Cluster 2 managers with support from Biodiversity Specialist	Mitigation measures are incorporated	Review contracts	When contracts are prepared	0				

	be incorporated into **contracts**; costs for environmental management shall be included as a specific line item in the Bill of Quantities.									
2.1 2.2 2.3 2.4	Along with economic, social, engineering, and cost issues typically included in **feasibility studies**, environmental concerns (see individual Cluster Mitigation Plans) shall be included in feasibility studies.	Cluster 2 managers with support from Biodiversity Specialist	Environmental concerns are included in feasibility studies	Review TORs for feasibility studies Review feasibility studies	Prior to issuing sub-contract for study When study is submitted to WINNER	0				
2.1 2.2 2.3 2.4	As part of determining the feasibility of the project, identify the need for land acquisition and compensation.	Cluster 2 managers	The need for land acquisition and compensation is included in feasibility studies	Incorporate study into TORs for feasibility studies	Prior to issuing sub-contract for studies	0				
2.1 2.2 2.3 2.4	Ensure that all material is sourced in an environmentally sound and sustainable manner.	Cluster 2 managers	Engineering contracts identify a sustainable, environmentally sound source	Review sub-contract to identify source.	Prior to approving contract	0				
2.1	Cluster 3 manager shall work with Bureau for	Biodiversity Specialist	Biodiversity Specialist provides input to	TA by Biodiversity Specialist	As needed/ requested	0				

	Mines and Energy to develop a strategic plan for construction rocks and sand established for each of the watershed where the WINNER project works.		strengthen legislation							
2.1 2.2 2.3 2.4	For ancillary features, implement relevant mitigation measures from Annex G (small-scale construction guidelines); and from Road Rehabilitation Mitigation Plan (Cluster 2.4) as specified in the engineering contract.	Cluster 2 managers and engineering contractor	Mitigation measures in place to minimize impacts from ancillary feature construction	Field visits	Ad-hoc visits during constructio n, but at least one time	Dep. On extent of ancillary construction & mitigation required				
2.1 2.2 2.3 2.4	Implement Construction Phase mitigation measures (see Cluster Mitigation Plans)	Cluster 2 managers and engineering contractor	Mitigation measures are in place to minimize impacts from project construction	Field visits (include Biodiversity Specialist for sensitive construction)	Ad-hoc visits during constructio n, at least monthly, but for sensitive ecosystem s more often	Depends on extent of mitigation require				
2.1 2.2 2.3 2.4	Implement Decommissioni ng Phase mitigation measures	Cluster 2 managers and engineering contractor	Mitigation measures are in place to minimize impacts from decommissio ning	Field visits	At least once during decommis sioning phase	Depends on extent				
2.1 2.2 2.3	Starting during the planning phase,	Cluster 2 managers	Operation and Maintenance	Review plans for O & M process	Continuou s	Depends on O & M needs				

2.4	WINNER shall support the development of, training in, and implementation of a maintenance plan. This shall be coordinated with WINNER Component 3, Clusters 3.1 and 3.2.		Plan is being developed O & M training is occurring O & M Plan is ready for implementation	Implement/fund O & M training Assessment of capacity	At end of construction- before hand-over					
COMPONENT 3: WATERSHED GOVERNANCE STRENGTHENED										
3.6	Socioeconomic studies will be undertaken to ensure all social, cultural, and economic aspects are considered as part of developing a compensation plan, and prior to any relocation. At a minimum, the standard mitigation measures for relocation shall be implemented: Monitor and implement a transparent and fair compensation plan by the Haitian government, as appropriate,	Component 3 Manager & WINNER Biodiversity Specialist	Socio-economic studies are undertaken Compensation Plan is developed Mitigation	Study Plan Field visits	Prior to relocation Prior to relocation Prior to relocation Prior to relocation Various	Depends on relocation and compensation requirements				

	for any permanent or temporary loss incurred. Ensure that the plan allows affected people to maintain their current housing condition or better. Depending on the extent of structures needed to relocate families, mitigation measures for small-scale construction (buildings, water, and sanitation) and Cluster 2.4 for road rehabilitation shall be incorporated. In coordination with USAID COTR, and based on socio-economic studies and a review of the extent of the relocation, USAID and WINNER shall determine		measures are implemented. Additional environmental review is implemented, as needed.	Meetings between WINNER and USAID COTR	times during construction As needed, depending on socio-economic studies and relocation requirement					

	the need for additional socio-economic and/or environmental review, including a site-specific EA.									
3.7	Material shall be disposed of at an approved and environmentally sound disposal site.	Component 3 Manager	Approved/licensed and environmentally sound disposal location is identified. Material is disposed there.	Review plans for disposal Site visit	Prior to approving sub-contract During disposal operations					
COMPONENT 4: PUBLIC-PRIVATE-PRODUCER PARTNERSHIPS ESTABLISHED										
4.1	Support shall not be provided for the procurement or use of pesticides without an SIEE and PERSUAP approved by the BEO; all support must comply with the PERSUAP.	Component 4 Manager	Until there is an approved PERSUAP: No support is provided for the use of procurement of pesticides. Once there is an approved PERSUAP: Support is provided only for use/procurement of approved pesticides.	Review partnership agreements	As developed	0				
4.1	Support for fertilizer use shall only be provided with the	Component 4 Manager	Support to partnerships for fertilizer use includes information from	Review partnership agreements	As developed	0				

	incorporation of measures from the Fertilizer Factsheet		the factsheet.							
4.1	Coordinate with WINNER Biodiversity Specialist prior to providing support to ensure it is environment ally sound.	Componen t 4 Manager	Cluster 4 Manager and Biodiversity Specialist regularly coordinate on partnership agreements.	Coordination meetings	As needed	0				
4.1	Financial support of PPPPs incorporates mitigation measures: a) For all PPPPs ensure that the value chain, from producer to processor to market is environment ally sound: Biodiversity Specialist shall review **value chain study** prior to funding to identify concerns. (b) For processing facilities, require incorporation of cleaner production including recycling/re-	Componen t 4 Manager and Biodiversit y Specialist	Appropriate mitigation measures are incorporated into partnership agreements, and are implemented.	Review agreements Site visits	Prior to signing agreement s Ad-hoc over WINNER involvemen t in agreement					

	use and waste disposal in a manner that will not contaminate the environment (waste is considered liquid and solid waste, air pollutants, hazardous and toxic waste causing multiplication of rats or other unhealthy dog and pig roaming practices). (c) For market renovation and other small-scale construction: construction shall follow guidance and incorporate mitigation measures in Annex G. (d) For natural resource-based PPPPs, prior to signing an agreement, ensure there is a plan for sustainable use. This shall be cleared and									

	monitored by the WINNER Biodiversity Specialist. (e) For products involving harvest of wood (i.e., furniture, crafts), an amended IEE shall be prepared prior to providing support. No funds shall be disbursed until the IEE is approved by the BEO. (f) For PPPPs involving wild-caught fish and seafood (not aquaculture/constructed fish ponds), an amended IEE shall be prepared prior to providing support. No funds shall be disbursed until the IEE is approved by the BEO. (g) For animal/livestock-based PPPPs of more than 3 heads/farmer, ensure there is a									

	waste disposal plan in place that is environment ally sound. This shall be cleared and monitored by the WINNER Biodiversity Specialist. (h) For aquaculture/c onstructed fish ponds, ensure drainage from the pond/facility will not pollute surrounding land or water; ensure that the system is closed, and cultured fish cannot escape to wild populations; ensure filtering is adequate so as not to pollute pond water with feed and waste. (i) For agriculture-based PPPPs, ensure producers are not converting natural									

	ecosystems to crop production; and ensure no procurement or use of pesticides without an approved SIEE and PERSUAP; the PPPP shall comply with the PERSUAP. (j) For alternative livelihoods and ecosystem services, monitor to ensure benefits to areas of significant biodiversity are actually accruing.									
4.1	When a generator or any other fuel dependent motor is to be installed for a processing facility, ensure a maintenance plan is in place to safeguard against leaks and to ensure that when oil will	Component 4 Manager	Maintenance plan is in place that provides information on safe motor oil disposal	Review maintenance plans	As developed	0				

	be changed, it will be disposed of safely, and in a manner not to contaminate land or water.									
COMPONENT 5: EARTHQUAKE RECOVERY ENHANCED										
5.3	Ensure material is disposed of at an (a) approved and (b) environmentally sound disposal site.	Component 5 Manager	Approved/licensed and environmentally sound site identified Site is being used for disposal	Review engineering contract for disposal site location Site visits	Prior to signing contract During disposal	0				
	Conditions are the same as above, Component 4, for ~~fi~~nancial support of PPPPs."	Component 5 Manager and Biodiversity Specialist	Appropriate mitigation measures are incorporated into grant agreements, and are implemented.	Review agreements Site visits	Prior to signing agreements Ad-hoc over WINNER involvement in grant	Depends on type of grants and extent of mitigation require				
5.4	Ensure a maintenance plan is in place to safeguard against leaks and to ensure that if oil will be changed, it will be disposed of safely, and in a manner not to contaminate land or water.	Component 5 Manager	Maintenance plan is in place that provides information on safe motor oil disposal	Review maintenance plans	As developed	0				

ANNEX F: FERTILIZER FACT SHEET

Attached Separately

ANNEX G: ENVIRONMENTAL MITIGATION FOR SMALL-SCALE CONSTRUCTION

This annex covers mitigation measures for construction/rehabilitation of CRDDs and construction camps, and water and sanitation systems as part of CRDDs or as part of ancillary features for larger projects (flood/erosion control, irrigation and potable water provision, and road rehabilitation).

Table G-1: Mitigation Plan for Construction or Renovation of CRDDs, Construction Camps, and other Small-Scale Facilities/Buildings

Phase	Activity	Potential Adverse Impacts	Mitigation measures
Planning & Site Selection	Identification of project site: WINNER staff in collaboration with producer organizations, communities and other stakeholders	At this early stage in project planning, environmental issues may not be considered or may not be given equal weight to other issues. Important habitat or ecosystems sensitive to disturbances may be located within project site boundaries or may be affected by the project. Habitat for threatened or endangered species and/or threatened or endangered species may be found within project site boundaries or may be affected by the project.	WINNER Biodiversity Specialist shall be involved in planning and site selection. **Environmental Due Diligence shall be conducted at Planning &Site Selection Phase, as follows.** WINNER Biodiversity Specialist shall ensure that the Mitigation Plan for the Construction Phase is adequate so that: (1) any important habitat or ecosystems that are located within project boundaries (project boundaries include all ancillary features) will be protected. (2) any important habitat or ecosystems that may be affected by the project (affected may be temporary/short-term or long-term, direct or indirect, and —project" includes ancillary features) will be protected. (3) any cultural or historical assets that are within project boundaries or that may be affected by the project will be protected. If WINNER Biodiversity Specialist determines that the Construction Phase Mitigation Plan is not adequate to protect flora, fauna, and sensitive ecosystems), and cultural/historical resources, an alternative site must be chosen. **Environmental Due Diligence shall also ensure that:** If any threatened, endangered, or other sensitive species, or habitat for threatened, endangered, or other sensitive species is within project boundaries or may be affected by the project, an alternative site shall be chosen. If protected areas are within project boundaries or may be affected by the project, an alternative site shall be chosen. Construction/rehabilitation shall be in line with the Participatory Watershed Management Plan. A —land-over plan" is developed in consultation with relevant community members and government authorities. All relevant GOH and local legislation is complied with including, as necessary, land acquisition and compensation procedures, and water and sanitation system permits, as outlined in relevant GOH legislation (also see Design and Feasibility Phase. Any social and environmental concerns that cannot be mitigated by the measures in this Mitigation Plan shall be brought to the attention of WINNER senior management for action, and an alternative site shall be chosen.

Phase	Activity	Potential Adverse Impacts	Mitigation measures
Design & Feasibility	Preparation of tender documents: Engineering firm provides specifications.	If tender documents do not include mitigation measures and a budget to implement them, the project could result in adverse environmental impacts (see below for Construction Phase).	Mitigation measures described for the Construction Phase and Decommissioning Phase shall be incorporated into tender and engineering documents; costs for environmental management shall be included in overall project budget. Tender documents shall include information on water and sanitation systems to be provided (see Table 2 below). Tender documents shall include information about access roadways to be included in the project (see Cluster 2.4 Mitigation Plan). In addition to mitigation measures required for the Construction Phase and the Decommissioning Phase, tender documents should include a requirement for a re-use/recycle and waste segregation plan.
	Proposal review	Proposals that fail to incorporate environmental concerns could result in adverse environmental impacts (see below, Construction and Decommissioning Phases).	WINNER Biodiversity Specialist shall be involved in proposal review process to ensure that the proposed construction/rehabilitation is environmentally sound. Construction plans must be approved by a certified engineer, and construction works must be performed by a qualified and experienced contractor.
	Negotiations and award of engineering contract	If engineering contract does not include mitigation measures and a budget to implement them, the project could result in adverse environmental impacts (see below).	Mitigation measures described for the Construction and Decommissioning Phases shall be incorporated into contracts; costs for environmental management shall be included as a specific line item in the Bill of Quantities. Revisions to the engineering design to take into account mitigation measures identified during proposal review shall be incorporated into engineering contract. Contracts shall include a re-use/recycle and waste segregation plan for the Construction and Decommissioning Phases.
	Feasibility studies	If destruction or degradation of infrastructure and/or privately held or community owned land may result from the project, community and political acceptance may be compromised.	As part of determining the feasibility of the project, the engineering/design firm shall: Delineate a logical area with a well-defined boundary within which the owners of land, buildings or other infrastructure will be compensated. Monitor and implement a transparent and fair compensation plan by the Haitian government, as appropriate, for any permanent or temporary loss incurred (e.g. buildings, infrastructure, land, crops, gardens, plantations). Ensure that the plan allows affected people to maintain their current housing condition or better.
Sourcing of construction materials	Engineering firm enters into a contract with company(ies) to obtain material.	Location where fill material is obtained may not be environmentally sound, and mining of fill may result in ecological, hydrological, aesthetic, and land use impacts. Other construction material may not be sourced sustainably, resulting in adverse environmental impacts.	WINNER shall ensure that all material is sourced in an environmentally sound and sustainable manner.
Phase	Activity	Potential Adverse Impacts	Mitigation measures

			The following mitigation measures shall be incorporated into tender documents and the engineering contract/contract specifications.
Construction	Construct ancillary features: staff camps, access roads, storage areas, and equipment maintenance areas.	Construction of ancillary features could result in environmental impacts similar to other small-scale construction projects (loss or degradation of vegetation, wildlife habitat and species, changes in hydrology, impacts to cultural resources, etc).	Incorporate relevant mitigation measures from Road Rehabilitation Mitigation Plan (Cluster 2.4) into engineering contract. Incorporate the below Construction Phase mitigation measures into ancillary feature construction and decommissioning activities. If ancillary features will include water or sanitation systems, see Table G-2.
	Construct /renovate CRDD or other small-scale structure	Flora (including trees), fauna, and sensitive ecosystems could be destroyed or degraded.	Identify areas to be cleared and limit vegetation and tree removal to only the vegetation and trees needed to construct/rehabilitate building and to provide ancillary features. Limit encroachment into riparian areas. Delineate sensitive and/or high quality habitat and keep all foot and motorized traffic and equipment out; where riparian habitat/vegetation is of good quality, limit worker traffic. Do not remove or disturb any mangroves. Save vegetation removed for replacement during Decommissioning Phase (as practicable). Any construction or other excess material from the construction process (fill, rocks, etc.) shall not be stockpiled temporarily or permanently in wetlands or waterways or in a manner that will damage vegetation or soil.
		Cultural/historical resources could be destroyed or degraded.	Delineate cultural/historical resources to be protected, and keep all foot and motorized traffic and equipment out.
		During construction, TES and other sensitive species and/or habitats and cultural resources could be found within project boundaries or that are being affected by the project.	Educate workers about procedures to be implemented in case protected species or artifacts are found on-site. Engineering contract shall include a stop-work clause that requires project work to stop if these resources are found on site or found to be affected by the project. Work shall resume once collaboration with WINNER senior management and USAID is complete.
		Erosion could result in increased turbidity, decreased water quality, and a degraded aquatic ecosystem. This could have impacts on wildlife and humans that rely on these resources.	Use erosion control measures during construction such as geotextiles, jersey barriers, haybales, siltscreens (or other appropriate and obtainable material). Place erosion control barriers prior to starting construction and do not remove until construction is complete and vegetation is re-established.
		Heavy equipment that is not well-maintained and stored properly could degrade water quality.	Provide a maintenance area that is adequate distance (at least 50 meters) from waterways and any sensitive terrestrial habitat, and require that all equipment maintenance take place there. Keep emergency response equipment on work sites to deal with hazardous or other spills.
		Noise from the use of heavy equipment and other construction equipment could affect breeding and feeding and other wildlife behavior. Noise could affect the human environment.	If during environmental monitoring, noise is found to disrupt breeding, feeding, or other wildlife behavior, limits shall be placed on use of heavy equipment, movement of personnel, or other noise-producing construction phase activities. These limits shall remain in place until determined by the WINNER Biodiversity Specialist that they may be removed. Limit noise from construction activities to daylight hours.
		Public and worker safety could be compromised without adequate	To ensure the safety of the public: Restrict access of the public to hazard areas.

		mitigation in place.	Hold meetings to educate and inform residents of the work to be carried out. Reduce vehicle speed in work zone. Implement a communication plan for regular public awareness of project activities. To ensure the safety of employees: Provide adequate training of personnel in safety procedures. Provide appropriate safety equipment (including for noise protection, as needed). Post proper signage. Enforce safety zones and procedures Implement a work place health and safety plan, which should include employee training.
		Gender concerns and local labor	A gender ratio for project staff of as close to 1:1 shall be strived for. Local sources of labor should be used to the greatest extent possible.
Decommissioning		If construction camps and other ancillary features are not dismantled or if other provisions are not made for them, they will degrade over time, and could impact water quality, degrade soils, and create a public hazard.	Unless other provisions are made, staff construction camps shall be removed once construction is complete. Removal shall include disposal of solid waste, buildings, etc. A provision shall be included in the engineering contract to allow for WINNER inspection prior to finalizing payment.
		Leaks or spills that are not cleaned up can continue to contaminate the environment.	Any areas where leaks or spills have occurred that were not previously cleaned up, shall be cleaned prior to completing Decommissioning Phase.
		If hydrology and grade are not restored, flooding, ponding, and destruction of vegetation and other aquatic and terrestrial resources could result.	Once construction work is complete, restore hydrology and grade to pre-construction condition (or improved drainage) on work sites and adjacent affected areas.
		If vegetation is not restored, and soil is left bare, erosion and landslides could result.	Re-vegetate areas disturbed with naturally occurring vegetation, if possible with vegetation retained from on-site; and/or with erosion control vegetation (vetiver, bamboo, elephant grass).
Operation and Maintenance		If a hand-over plan is not in place, it is unlikely the infrastructure will be maintained and that the CRDD will be sustainable.	Starting during the planning phase, WINNER shall prepare a hand-over plan, and shall provide training necessary to ensure sustainable operation of the CRDD.

TABLE G-2: MITIGATION PLAN FOR CRDDS AND CONSTRUCTION CAMPS WHERE WATER AND SANITATION SYSTEMS WILL BE PROVIDED

Table G-2 is adapted from USAID's Environmental Guidelines for Small-Scale Activities (water and sanitation projects)

Issue or aspect of activity	Impact *The activity may. . .*	Mitigation
Water Supply Systems		
If CRDD or construction camp includes a water supply system…	Deplete ground and/or surface water resources and damage local ecosystems or downstream/down communities. Pose risks to human health if contaminants are present in the water. Cause groundwater contamination	• Determine safe and sustainable yield. Establish system for regulating use. • Test seasonal water quality and examine historical water quality and quantity data before building facility. • Incorporate sitting, design, and operation and maintenance practices that minimize environmental impacts.
Wells	Provide water contaminated with nutrients and bacteria from animal waste Create pools of stagnant water Change groundwater flow Create saltwater intrusion Deplete aquifer (groundwater) (O&M) Cause land subsidence (impact from many wells) (O&M)	Don't allow animals to graze or be watered up-gradient from wellhead Monitor and repair leaks from cracked containment structures, broken pipes, faulty valves and similar structures Keep withdrawals within safe yield limits to avoid overdrawing, possible salt water intrusion and contamination of the well Put in place a system for regulating use, such as a local warden or appropriate pricing Include a focus on proper use and maintenance of the improvement as part of the behavior change and education program Monitor water levels
Standpipes	Create pools of stagnant water (This problem can be more severe when water table is high, clay soils are present, or population/tap density is high, such as at construction staff camps)	Ensure that spilled water and rainwater drain to a soakway or equivalent structure and do not accumulate and create stagnant standing water Monitor and repair leaks from cracked containment structures, broken pipes, faulty valves and similar structures
Sanitation Systems		
If CRDD or construction camp includes a sanitation system….	Discharge untreated or insufficiently treated sewage that: • Contaminates drinking water (ground and surface) • Spreads diseases • Degrades aquatic ecosystems	• Do not site in wetland or next to stream, river, lake or well • Do not site up-gradient from potable water sources such as wells, if possible • Do not site where water table is high or underlying geology makes contamination of groundwater likely. Alternately, choose dry sanitation options or closed disposal systems, instead of wet ones such as septic tanks or detention ponds.

Issue or aspect of activity	Impact *The activity may. . .*	Mitigation
		• Incorporate education/social marketing programs; e.g. community participation, sanitation promotion focusing on women and children, use of appropriate natural treatment systems, etc.
Pit latrine	Increase transmission of vector-borne diseases Contaminate groundwater supply with pathogens Contaminate water supplies, damage water quality and/or transmit disease at other locations if waste is not properly handled and treated during or after servicing Cause injury to people or animals	Devote adequate attention to identifying and addressing social barriers to using latrine Use the ventilated improved pit latrine design that traps insect vectors Evaluate depth to water table, including seasonal fluctuations and groundwater hydrology. The size and composition of the unsaturated zone determine the residence time of effluent from the latrine, which is the key factor in removal and elimination of pathogens. Pit latrines should not be installed where the water table is shallow or where the composition of the overlying deposits make groundwater or an aquifer vulnerable to contamination. Ensure that a reliable system for safely emptying latrines and transporting the collected material off-site for treatment is used. This should include use of a small pit-emptying machine such as the vacutug that relies on an engine-driven vacuum pump. Ensure that collected material is adequately treated and not directly applied to fields or otherwise disposed of improperly. Properly decommission pit latrines. Do not leave pits open. Fill in unused capacity with rocks or soil.
Composting toilets	Increase transmission of vector-borne diseases Contaminate groundwater supply with pathogens (O) Cause disease transmission to field workers and consumers of agricultural products.	Maintain humidity of composting material above 60% and supplement excreta with generous quantities of carboniferous material (dry leaves, straw, etc.). The pile should then remain aerobic, odor-free and insect-free. Construct sealed vaults to hold composting material if using fixed-batch systems. If using movable-batch systems check removable containers for leaks before installing. Test samples from active chamber and mature chamber after fallow period for *Ascaris* eggs and fecal coliforms. Allow sufficient residence time in mature chamber (approximately 6 months). Ensure that the systems will be properly operated and maintained so that the soil amendment taken out after the treatment period is truly sanitized.

Issue or aspect of activity	Impact *The activity may. . .*	Mitigation
Dry toilets	Increase transmission of vector-borne diseases Cause disease transmission to field workers and consumers of agricultural products	Maintain humidity of composting material below 20% and supplement excreta with alkaline material (ashes or lime). Generous applications of ashes will help ensure that pathogens are destroyed. pH is the most important factor for sterilization. Construct sealed vaults to hold dehydrating and curing material. Ensure that the systems will be properly operated and maintained so that the soil amendment taken out after the treatment period is truly sanitized. Test samples from active chamber and mature chamber after fallow period for *Ascaris* eggs and fecal coliforms to assess level of sterilization. Allow sufficient residence time in mature chamber (approximately 6 months).
Septic tanks	Contaminate groundwater supply with pathogens Contaminate surface water supplies with nutrients, biological oxygen demand (BOD), suspended solids (SS) and pathogens. (Septic tank effluent generally contains relatively high concentrations of pathogens, BOD, and SS). Contaminate water supplies, damage water quality and/or transmit disease at other locations if waste is not properly handled and treated during or after servicing.	Evaluate depth to the water table, including seasonal fluctuations and groundwater hydrology. If water table is too high, line the tank with clay, plastic sheeting or some other impermeable material to prevent leakage. Avoid direct discharge of effluent to waterways if possible. Direct discharge to waterways with sufficient volume and flow to assimilate the waste may be acceptable. It is better to add a secondary treatment, such as passing effluent through an anaerobic filter, followed by discharge to an absorption field, or better yet, a constructed wetland. Ensure that a reliable system for safely removing sludge and transporting the collected material off-site for treatment is available. This should include use of a mechanized (probably vacuum-based) removal system. Ensure that collected sludge is adequately treated and not directly applied to fields or otherwise improperly disposed of.
Settled and simplified sewers	Damage ecosystems and degrade surface water quality Transmit diseases to field workers and consumers of agricultural products	Ensure that collected sewage will be treated, e.g., in a wastewater stabilization pond, and not simply discharged to a river or stream or used directly in agriculture or aquaculture. This is especially important for simplified sewerage, since there is no interceptor tank.
Biogas reactors	Damage ecosystems and degrade surface water quality Transmit diseases to field workers and consumers of agricultural products	Do not allow disposal of digested slurry in or near water bodies. Follow WHO or other national or international guidelines for use of sludge in wastewater in agriculture and aquaculture.

ANNEX H: DINEPA WATER QUALITY TESTING REQUIREMENTS

The following are the requirements of DINEPA (GOH) for water quality testing. They are required at least twice, once after a dry season and the other during the rainy season and every time a change is made upstream in the capping and the distribution pipes. That also satisfy USAID water quality testing concerns:

NAME OF THE RESOURCE :

NATURE OF THE RESOURCE: SPRING ☐ WELL ☐ RIVER ☐ FORAGE ☐

LOCALISATION OF THE RESOURCE

Geographic position: .....

Department : .....Municipality :.....

Section communale;
.....Borrough .....

DATE of analysis / / 201 TIME

NAME OF
TECHNICIAN.....

Physical Parameters

Temperature: ^{o}C	Conductivity (µS/cm):	pH:
Turbidity (NTU)	Salinity (mg/)L:	

Organoleptic Parameters

Appearance:	Odor:

Chemical Parameters

Parameters	**WHO Guidelines**	**Parameters**	**WHO Guidelines**
Aluminium (mg/L)	0,2	Fluorures (mg/L)	1,5
Total Hardness (mg/L CaCO3)	200	Arsenic (mg/L)	0,01
Alcalinity (mg/L Caco3)	No ref determined	Copper(mg/L) Cu^{2+}	2
Nitrates (mg/L)	50	Lead (mg/L)	0,01
Nitrites (mg/L)	3	Pesticide (presence or lack)	<100 µg/L
Chlorures(mg/L)	250		
Parameters	**WHO Guidelines**	**Parameters**	**WHO Guidelines**
Sulfates(mg/L)	500		
Iron (mg/L)	0,3		