Aquatic habitat offset to address cumulative impacts in the context of hydropower development

Special IAIA Symposium on Biodiversity & Ecosystem Services in Impact Assessment
Aquatic Biodiversity and Ecological Flows Session

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IDB's recent experience in hydropower

Pando Monte Lirio Hydropower Project, Panama (Chiriquí Province)	• 2 run of the river facilities in cascade (33 + 50 MW); approved in Dec. 2009 • Key issues: ecological flow for the 26-km dewatered section; cumulative impacts
Chaglla Hydropower Project, Peru (Huanuco Province)	• 406 MW, 4.7 km2 reservoir, 15-km dewatered section; approved in Dec. 2010 • Key issues: endemic "new to science" fish species, ecological flow
Reventazon Hydropower Project, Costa Rica (Limon Province)	• 305 MW, 7 km2 reservoir; approved in October 2012 • Key issues: connectivity ("Jaguar" corridor), downstream impacts, cumulative impacts • First aquatic habitat offset supported by the IDB • Restoring and enhancing corridor connectivity
Amaila Falls Hydropower Project, Guyana	• 165 MW, 23.3 km2 reservoir; under consideration (not yet approved) • Key issues: loss of terrestrial natural habitat, endemic "new to science" fish species, indirect and fragmentation impacts related to access road • Watershed conservation as a measure to protect critical aquatic habitat, offset loss of terrestrial habitat and helps mitigating increased access and unsustainable NR extraction along the road,

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Hydropower & BiodiversityTrends Overview

State-of-the-Art practices

- Biodiversity inclusive EIA at project level
- Downstream flows
- Terrestrial habitat offset

Emerging practices

- Aquatic habitat offset and operationalizing the intact river concept
- Assessing and managing impacts on endemic fish species
- Addressing connectivity issues (terrestrial and aquatic fauna)
- Managing indirect impacts

Exploratory practices

- Managing cumulative impacts at river basin level
- Operationalizing the intact river concept at planning stage
- Regional river basin planning

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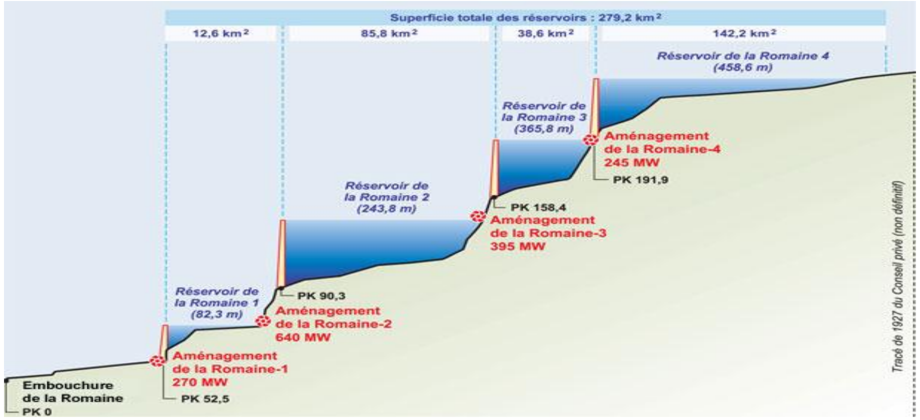
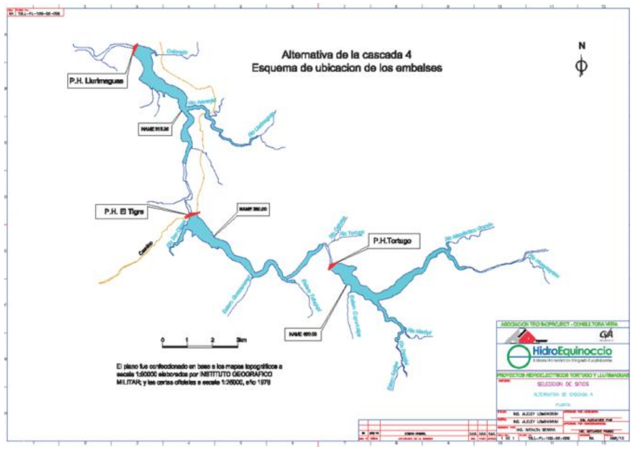
The Cumulative Impacts Conundrum

Impacts of a single hydropower facility (e.g. run-of-the river) may be localized and manageable

Cumulative impacts, if unaddressed, can jeopardize a whole river ecosystem





- Changes in flow **=** Adverse impacts on water quality and sedimentation processes
- River fragmentation **=** Reduction in natural habitat's ability to maintain viable population of its natives species
- Barrier effect **=** Movement of migratory fish species
- Succession of dewatered stretches between dam and powerhouse **=** River's ecosystem integrity

Assessment methodologies are well established…

- **Identify the Valued Ecosystem Components (VECs)**
- **Consult stakeholders on VECs and agree on key ones**
- **Define the geographical and temporal scale (most likely river basin level)**
- **Build scenarios and assess impacts of each scenario on key VECs (VEC-centered perspective)**
- **Identify impact and risks mitigation strategies following the mitigation hierarchy**

Typical Cumulative Effects Assessment approach

Not specific to hydropower sector

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…with some specific challenges: (1) Attribution

(1) ***Attribution of impacts to a specific project is in effect impossible***

- **General attribution methodology considers:**
  - **Comparison with/without the Project**
  - **Relative contribution of the Project to the resulting cumulative impact**

- **In cascade hydropower:**
  - **With/without a specific project in the cascade generally does not make a lot of difference to the overall cumulative impact**
  - **Cumulative impact >> ∑(project impact): each project can have a small contribution to a resulting significant cumulative impact**

Who owns the resulting cumulative impact?

(Hint: '*It's Nobody!'* bellowed Polyphemus…)

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…with some specific challenges:
(2) Mitigation strategy

(2) ***Can the mitigation strategy for the cumulative impact be defined on the basis of the individual projects mitigation strategies?***

- **NO. Cumulative impact >> ∑(project impact) implies that ∑(project mitigation strategy) is not adequate to mitigate cumulative impact.**

- **Interdependence of effectiveness of mitigation strategies. Considering each project in isolation leads to sub-optimal solutions.**

Example: Migratory fish.

Fish passage systems need to be installed at each of the facilities for the mitigation strategy to be effective.

…with some specific challenges:
(3) Carrying capacity

(3) ***For the CIA to be a useful tool in the decision-making process, there is a need to determine the carrying capacity at the river basin scale***

"Cumulative impacts are those that result from the incremental impact of the project when added to other past, present, and reasonably foreseeable future actions. Effects should be assessed **<u>in terms of the capacity of the water resource, ecosystem, and/or affected communities to accommodate such impacts"</u>**

(IHA Hydropower Sustainability Assessment Protocol)

"The assessment should determine if the project is incrementally responsible for adversely affecting an ecosystem component or specific characteristic **<u>beyond an acceptable predetermined threshold (carrying capacity)</u>** by the relevant government entity, in consultation with other relevant stakeholders." **(IFC Guidance Note 1)**

Should the determination of the carrying capacity be an input OR a result of the Cumulative Effects Assessment? Available methodologies?

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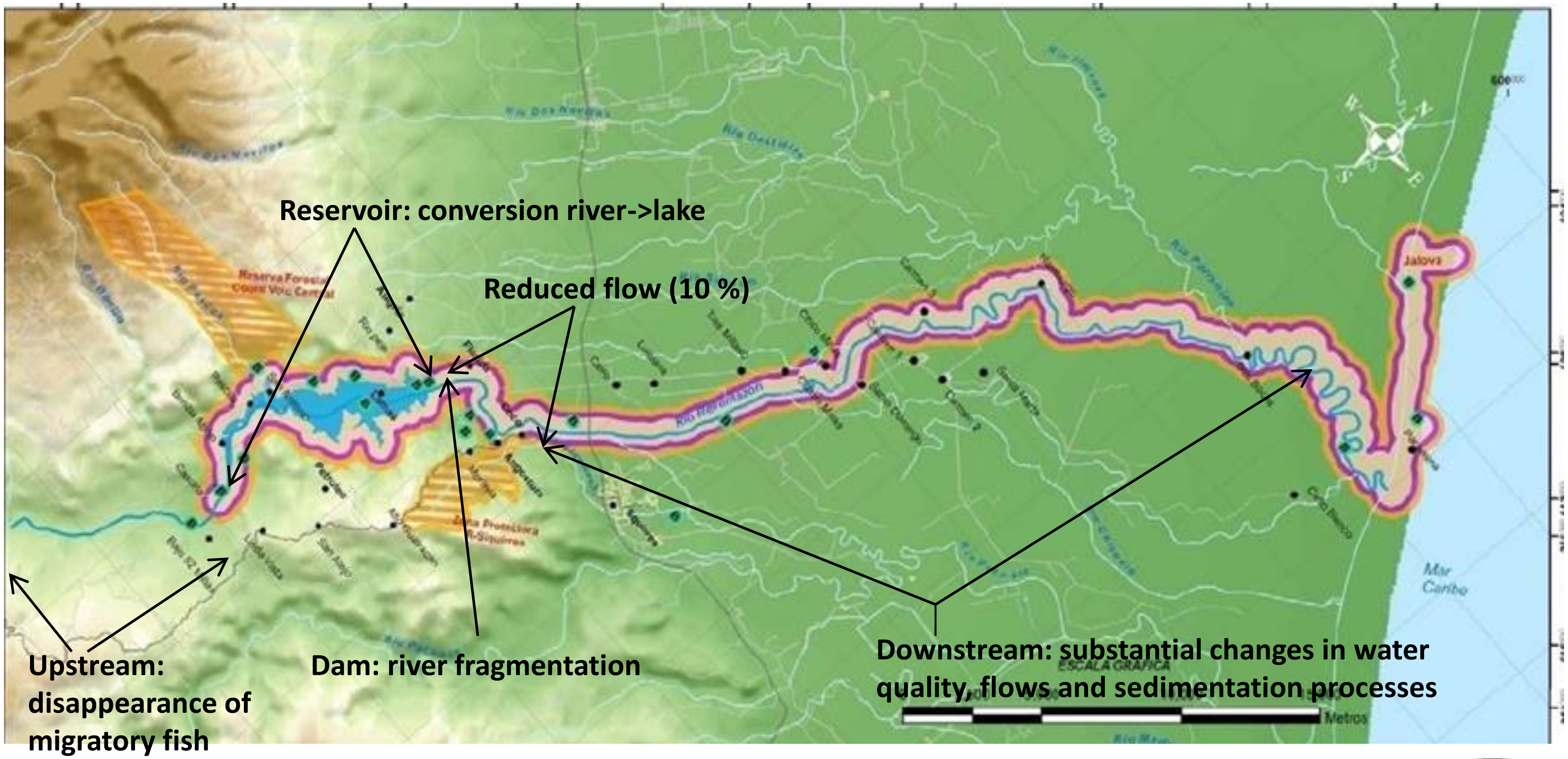
Options to address cumulative impact at river basin scale

- ***Appropriate regulatory and institutional framework in place:***
  - **Planning tools at the river basin scale, e.g. watershed management plan**
  - **Stakeholders representation, e.g. river basin committees**
  - **Authority which "owns" the cumulative impacts at river basin scale**

- ***If residual cumulative impacts on aquatic habitat and biodiversity are significant AND offsetable:***
  - **Development and implementation of an aquatic habitat offset**
  - **E.g. commitment to leave a free flowing and healthy river system untouched recognizing that cumulative impact on the developed river system can't be further mitigated.**

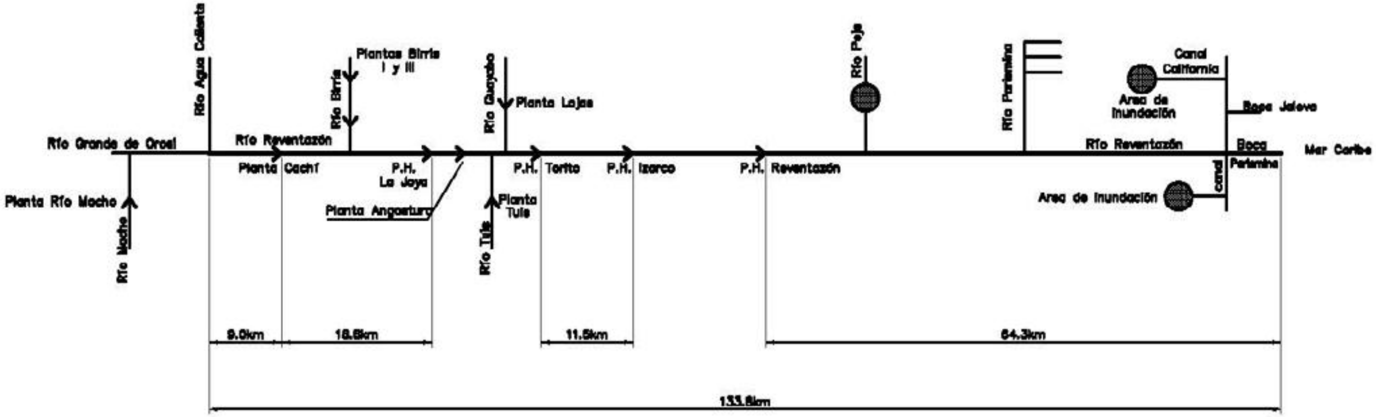
Case Study: the Reventazon Hydropower Project in Costa Rica

- 305.5 MW installed capacity, 130-m high dam, 6.9 km2 (690 ha) 8-km long reservoir: when built the largest hydropower facility in Central America



Significant Residual Cumulative Impacts

ESQUEMA DE PLANTAS Y PROYECTOS HIDROELECTRICOS EN EL RIO REVENTAZON

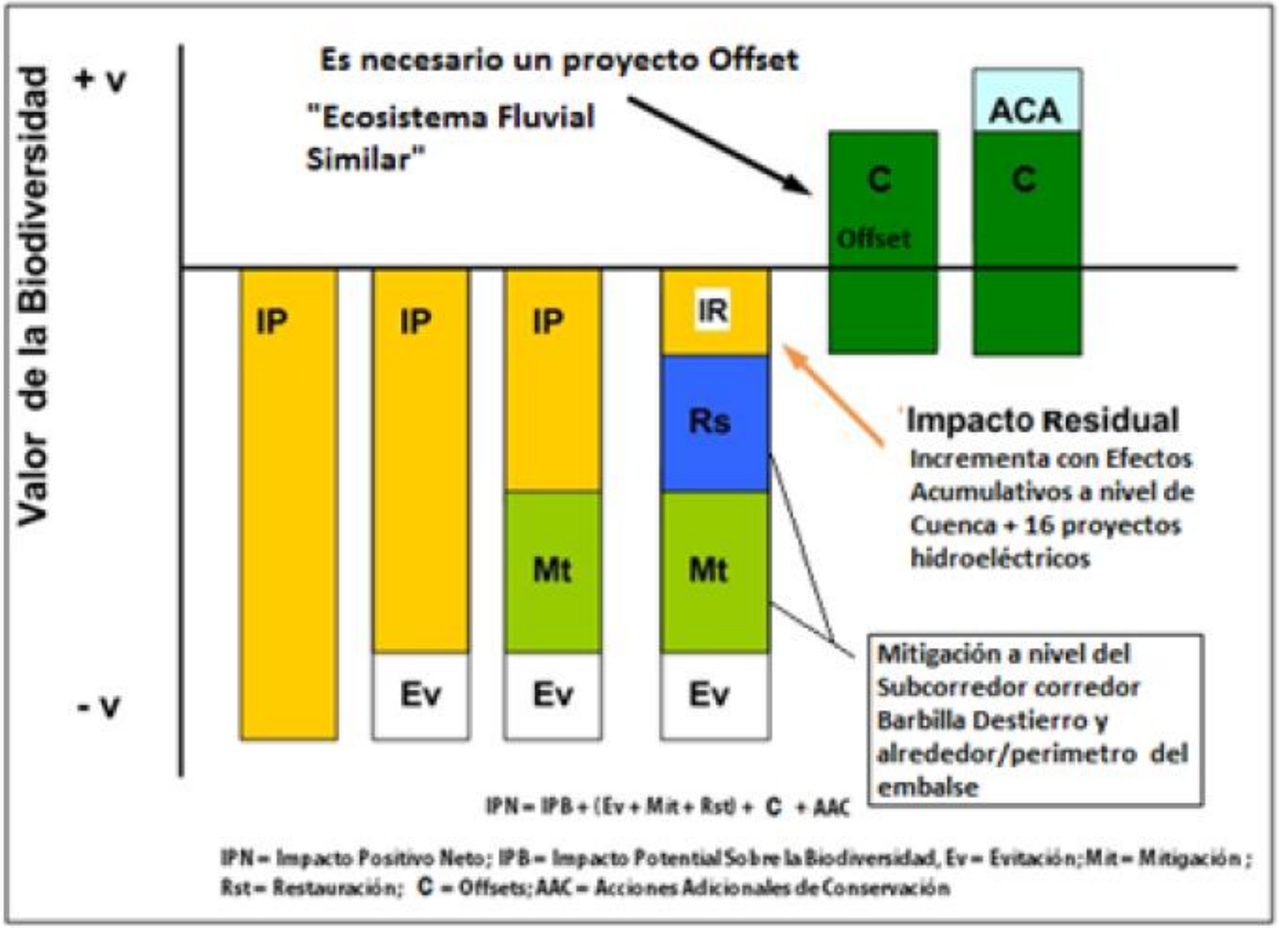


Tramo crítico	Distancia (km)
Presa Cachi - C.M. Cachi	11.0
Toma La Joya - C.M. La Joya	7.8
Presa Angostura - C.M. Angostura	9.5
Toma P.H. Torito - C.M. P.H. Torito	3.3
Toma P.H. Izarco - C.M. P.H. Izarco	8.1
Presa P.H. Recentazón - C.M.P.H. Reventazón	4.0
Total	**43.8**

Proyectos	Entrada	Capacidad (MW)
Torito	2013	50
Reventazón	2015	305
Izarco	Sin datos	140

Plantas en operación	Entrada	Capacidad (MW)	Caudal (m^3/s)	Embalse (km^2)
Cachí	1978	108	54	3.24
Angostura	2000	177	160	2.56
La Joya	2005	50	54	Sin datos

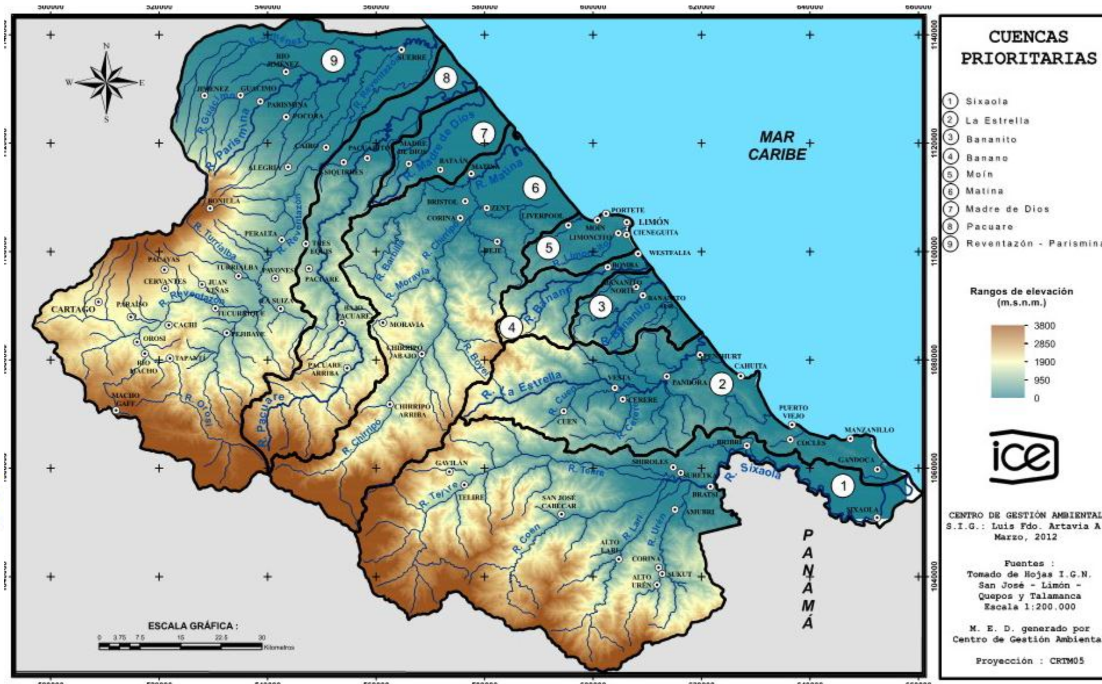
Application of Mitigation Hierarchy



Selection of Offset River Basin

Criterios de Selección de Sitios de Compensación

- Presencia de áreas protegidas
- Conectividad al mar
  - Caribe
- Topografía
  - Pendiente
- Condiciones ecológicas
  - Hábitats
  - Biodiversidad acuática
    - Macroinvertebrados acuáticos
    - Peces migratorios
  - Zonas de vida
- Condiciones climáticas
- Servicios Ambientales
  - Turismo



1. Río Sixaola
2. Río La Estrella
3. Río Bananito
4. Río Banano
5. Río Moin
6. Río Matina
7. Río Madre de Dios
8. Río Pacuare
9. Río Parismina

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Basic Design of the Aquatic Habitat Offset

- ICE’s commitment to contribute to the long term protection of the Parismina River as an healthy and free flowing river system, including through: rapid ecological assessment, establishment of legal basis for long term protection and development and implementation of an Offset Management Plan.
  - Este presupuesto no incluye los costos de actividades de mitigación futuras.

ACTIVIDAD	Estimación de costos en dólares US - año 1	Costos recurrentes - año 2	Costos recurrentes - año 3
OBJETIVO 1 Proporcionar condiciones de hábitat adecuadas para las diferentes comunidades acuáticas de peces y macroinvertebrados y de los ecosistemas terrestres asociados			
Asistencia técnica Fase III - Contratar consultores externos internacionales para facilitar/iniciar la implementacion del proyecto Offset	$ 100,000		
Implementar una Evaluación Ecológica y Social Rápida del Sitio Offset	$ 150,000		
Iniciar investigación de uso de hábitats/reproducción de especies migratorias	$ 80,000	$ 80,000	$ 80,000
Implementar programa de regulación/control uso de pesticidas en plantaciones agroindustriales de banana y otros productos	$ 50,000	$ 50,000	$ 50,000
Trabajar/contratar expertos externos (mínimo tres) en supervisión y capacitación en EER, monitoreo, restauración/gestión fluvial	$ 100,000	$ 100,000	$ 100,000
Elaborar e implementar un Plan de Gestión del Offset a nivel de rio/cuenca	$ 50,000	$ 50,000	$ 50,000
Implementar dos talleres de capacitación en metodologías relevantes	$ 40,000		
Subtotal	$ 570,000	$ 280,000	$ 280,000
OBJETIVO 2 Evitar modificaciones artificiales al patrón natural de los caudales, para garantizar la estructura y composición del ecosistema fluvial y hábitat asociados, y mantener la integridad biológica del ecosistema.			
Crear una figura legal adecuada para el proyecto Offset	$ 30,000		
Iniciar un programa de protección de bosques con COVIRENAS	$ 50,000	$ 50,000	$ 50,000
Implementar un programa de educación ambiental en el Sitio Offset	$ 50,000	$ 50,000	$ 50,000
Fomentar el uso de mejores prácticas agrícolas en áreas prioritarias del Offset	$ 100,000	$ 100,000	$ 100,000
Subtotal	$ 230,000	$ 200,000	$ 200,000
OBJETIVO 3 Identificar y mantener la viabilidad de corredores acuáticos de dispersión presentes en los tributarios que forman la red hídrica del Río principal			
Implementar actividades de restauracion fluvial donde sea necesario	$ 150,000	$ 150,000	$ 150,000
Iniciar un programa de monitoreo multinivel (paisaje, especies)	$ 150,000	$ 150,000	$ 150,000
Subtotal	$ 300,000	$ 300,000	$ 300,000
	año 1	año 2	año 3
Totales	$ 1,100,000	$ 780,000	$ 780,000
Total a 3 años			$ 2,660,000

Some challenges related to development of Aquatic Habitat Offset

- Limited experience and guidance available in LAC and even worldwide
  - BBOP, biodiversity accounting, etc… focusing mostly on terrestrial habitat
- How to assess equivalence and no net loss?
  - Ha may not be the most relevant measure unit for aquatic habitat
- How to determine level of protection to be achieved?
  - Intact river?
  - Free flowing river?
  - River vs. Watershed Protection?
  - Habitat restoration?
- Last resort in the mitigation hierarchy - may not be the most cost-effective tool for aquatic habitat conservation
  - Intact river as an offset may not be as effective as intact river as a result of upfront regional planning, considering trade-offs between power generation, habitat protection and water use.

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