

Assessing Impacts of Sustainable Infrastructure in Latin America



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Sustainable?



Un-sustainable?



How to measure sustainability?

Which are the key indicators to measure critical sustainability issues?

How do you evaluate a project's capacity to adjust to a changing context?

What tools do we have available?

How do we make informed policy and investment decisions?

Sustainable Mega-Infrastructure and Impact Assessment

New tools and approaches for the assessment and management of sustainability in infrastructure projects

I) Zofnass Program for sustainable infrastructure at Harvard University

II) Envision: a rating system for sustainable infrastructure

III) Case studies: seven public sector projects in Latin America

IV) Comparative analysis by Envision categories

I. Zofnass Program for sustainable infrastructure at Harvard University

Our mission:

Develop and promote methods, processes, and tools for sustainable infrastructure.

Our goal:

Expand the body of knowledge for sustainable infrastructure, promote best practices and facilitate the adoption of solutions for infrastructure projects and systems.



The Zofnass program is supported by a unique alliance with the Industry. The Sustainable Industry Advisory Board is comprised of senior executives from leading global firms.



Autodesk



THE Louis Berger Group, INC.



GRANITE



CH2MHILL

HNTB



MWH



A photograph of an offshore wind farm with several white wind turbines in a line across a blue sea under a clear sky. A semi-transparent blue rectangle is overlaid on the bottom half of the image.

ENVISION

RATING SYSTEM FOR SUSTAINABLE INFRASTRUCTURE



**Institute for
Sustainable
Infrastructure**



ZOFNASS PROGRAM
FOR SUSTAINABLE INFRASTRUCTURE



Graduate School of Design
Harvard University

The Institute for Sustainable Infrastructure is a not-for-profit education and research organization founded by the American Public Works Association, the American Council of Engineering Companies and the American Society of Civil Engineers.

Envision™ was developed in joint collaboration between the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure.

ASCE

APWA

ACEC

The ENVISION™ Rating System

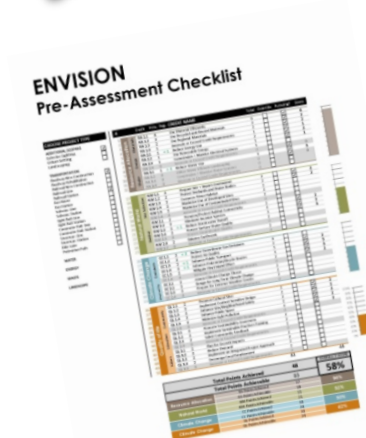
Phase Toolkits



Companion Tools



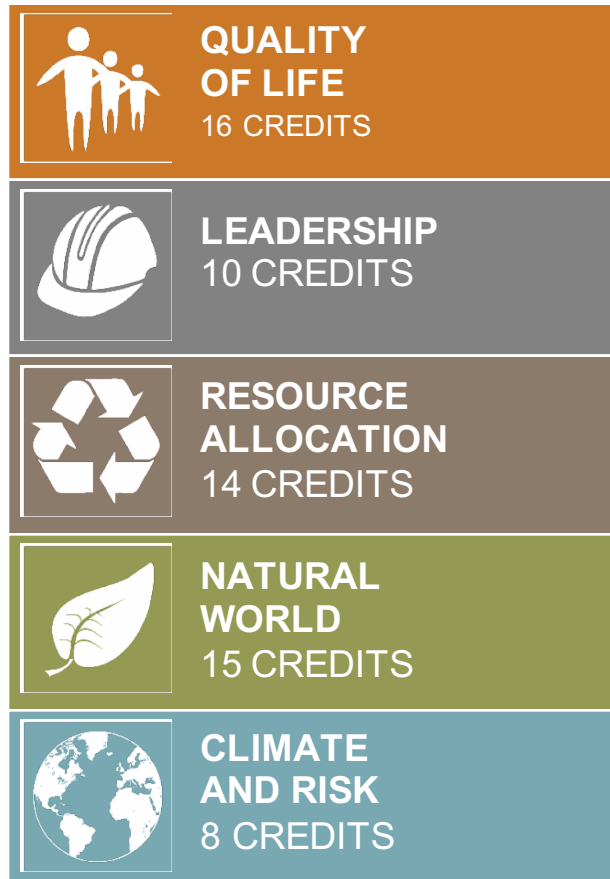
Pre-Assessment Checklist



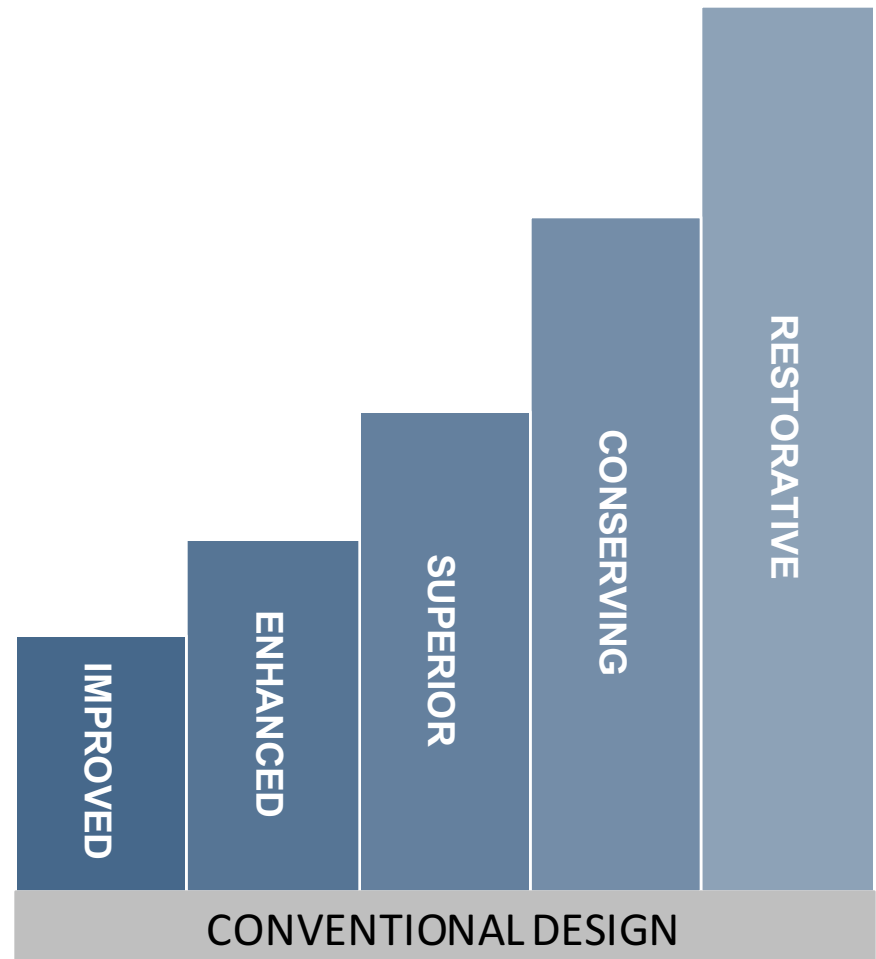
Recognition Assessment



63 CREDITS IN 5 CATEGORIES



5 LEVELS OF ACHIEVEMENT



Envision categories and credits



QUALITY OF LIFE

13 Credits

1 PURPOSE

- QL1.1 Improve Community Quality of Life
- QL1.2 Stimulate Sustainable Growth and Development
- QL1.3 Develop Local Skills and Capabilities

2 WELLBEING

- QL2.1 Enhance Public Health and Safety
- QL2.2 Minimize Noise and Vibration
- QL2.3 Minimize Light Pollution
- QL2.4 Improve Community Mobility and Access
- QL2.5 Encourage Alternative Modes of Transportation
- QL2.6 Improve Accessibility, Safety & Wayfinding

3 COMMUNITY

- QL3.1 Preserve Historic and Cultural Resources
- QL3.2 Preserve Views and Local Character
- QL3.3 Enhance Public Space
- QL0.0 Innovate or Exceed Credit Requirements



LEADERSHIP

10 Credits

1 COLLABORATION

- LD1.1 Provide Effective Leadership & Commitment
- LD1.2 Establish a Sustainability Management System
- LD1.3 Foster Collaboration and Teamwork
- LD1.4 Provide for Stakeholder Involvement

2 MANAGEMENT

- LD2.1 Pursue By-Product Synergy Opportunities
- LD2.2 Improve Infrastructure Integration

3 PLANNING

- LD3.1 Plan Long-Term Maintenance and Monitoring
- LD3.2 Address Conflicting Regulations and Policies
- LD3.3 Extend Useful Life

- LD0.0 Innovate or Exceed Credit Requirements



RESOURCE ALLOCATION

14 Credits

1 MATERIALS

- RA1.1 Reduce Net Embodied Energy
- RA1.2 Support Sustainable Procurement Practices
- RA1.3 Use Recycled Materials
- RA1.4 Use Regional Materials
- RA1.5 Divert Waste from Landfills
- RA1.6 Reduce Excavated Materials Taken Off Site
- RA1.7 Provide for Deconstruction and Recycling

2 ENERGY

- RA2.1 Reduce Energy Consumption
- RA2.2 Use Renewable Energy
- RA2.3 Commission and Monitor Energy Systems

3 WATER

- RA3.1 Protect Fresh Water Availability
- RA3.2 Reduce Potable Water Consumption
- RA3.3 Monitor Water Systems
- RA0.0 Innovate or Exceed Credit Requirements



NATURAL WORLD

15 Credits

1 SITING

- NW1.1 Preserve Prime Habitat
- NW1.2 Preserve Wetlands and Surface Water
- NW1.3 Preserve Prime Farmland
- NW1.4 Avoid Adverse Geology
- NW1.5 Preserve Floodplain Functions
- NW1.6 Avoid Unsuitable Development on Steep Slopes
- NW1.7 Preserve Greenfields

2 LAND+WATER

- NW2.1 Manage Stormwater
- NW2.2 Reduce Pesticides and Fertilizer Impacts
- NW2.3 Prevent Surface and Groundwater Contamination

3 BIODIVERSITY

- NW3.1 Preserve Species Biodiversity
- NW3.2 Control Invasive Species
- NW3.3 Restore Disturbed Soils
- NW3.4 Maintain Wetland and Surface Water Functions
- NW0.0 Innovate or Exceed Credit Requirements



CLIMATE AND RISK

8 Credits

1 EMISSIONS

- CR1.1 Reduce Greenhouse Gas Emissions
- CR1.2 Reduce Air Pollutant Emissions

2 RESILIENCE

- CR2.1 Assess Climate Threat
- CR2.2 Avoid Traps and Vulnerabilities
- CR2.3 Prepare For Long-Term Adaptability
- CR2.4 Prepare for Short-Term Hazards
- CR2.5 Manage Heat Island Effects
- CR0.0 Innovate or Exceed Credit Requirements

TABLE OF POINT VALUES

TABLE OF POINT VALUES			Improved	Enhanced	Superior	Conserving	Restorative	
1	QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
2			QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
3			QL1.3 Develop local skills and capabilities	1	2	5	12	15
4		COMMUNITY	QL2.1 Enhance public health and safety	2			16	
5			QL2.2 Minimize noise and vibration	1			8	11
6			QL2.3 Minimize light pollution	1	2	4	8	11
7			QL2.4 Improve community mobility and access	1	4	7	14	
8			QL2.5 Encourage alternative modes of transportation	1	3	6	12	13
9			QL2.6 Improve site accessibility, safety and wayfinding		3	6	12	15
10		WELLBEING	QL3.1 Preserve historic and cultural resources	1		7	13	16
11			QL3.2 Preserve views and local character	1	3	6	11	14
12			QL3.3 Enhance public space	1	3	6	11	13
			13	27	62	150	151	
13	LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
14			LD1.2 Establish a sustainability management system	1	4	7	14	
15			LD1.3 Foster collaboration and teamwork	1	4	8	15	
16			LD1.4 Provide for stakeholder involvement	1	5	9	14	
17		MNGMT.	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
18			LD2.2 Improve infrastructure integration	1	3	7	13	16
19		PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3		10	
20			LD3.2 Address conflicting regulations and policies	1	2	4	8	
21			LD3.3 Extend useful life	1	3	6	12	
			10	31	56	115	31	
22	RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
23			RA1.2 Support sustainable procurement practices	2	3	6	9	
24			RA1.3 Use recycled materials	2	5	11	14	
25			RA1.4 Use regional materials	3	6	9	10	
26			RA1.5 Divert waste from landfills	3	6	8	11	
27			RA1.6 Reduce excavated materials taken off site	2	4	5	6	
28			RA1.7 Provide for deconstruction and recycling	1	4	8	12	
29		ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
30			RA2.2 Use renewable energy	4	6	13	16	20
31			RA2.3 Commission and monitor energy systems		3		11	
32		WATER	RA3.1 Protect fresh water availability	2	4	9	17	21
33			RA3.2 Reduce potable water consumption	4	9	13	17	21
34			RA3.3 Monitor water systems	1	3	6	11	
			29	66	112	170	62	
35	NATURAL WORLD	SITING	NW1.1 Preserve prime habitat			9	14	18
36			NW1.2 Protect wetlands and surface water	1	4	9	14	18
37			NW1.3 Preserve prime farmland			6	12	15
38			NW1.4 Avoid adverse geology	1	2	3	5	
39			NW1.5 Preserve floodplain functions	2	5	8	14	
40			NW1.6 Avoid unsuitable development on steep slopes	1		4	6	
41			NW1.7 Preserve greenfields	3	6	10	15	23
42		L&W	NW2.1 Manage stormwater		4	9	17	21
43			NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
44			NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
45		BIODIVERSITY	NW3.1 Preserve species biodiversity	2			13	16
46			NW3.2 Control invasive species			5	9	11
47			NW3.3 Restore disturbed soils				8	10
48			NW3.4 Maintain wetland and surface water functions	3	6	9	15	19
			15	33	86	165	169	
49	CLIMATE	Emission	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
50			CR1.2 Reduce air pollutant emissions	2	6		12	15
51			CR2.1 Assess climate threat				15	
52		Resilience	CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
53			CR2.3 Prepare for long-term adaptability				16	20
54			CR2.4 Prepare for short-term hazards	3		10	17	21
55			CR2.5 Manage heat islands effects	1	2	4	6	
			12	21	39	100	101	
			79	178	355	700	514	

ENVISION USAGE

UNITED STATES

INTERNATIONAL

Types of projects using Envision

- Airports
- Seaports
- Roads
- Power plants
- Wind
- Pipelines
- Water and Sanitation
- Rail
- Stormwater LID
- Hydro
- Transmission

US agencies using Envision:

- Port of Long Beach
- NYC Dept. of Environmental Protection
- CA Dept. of Water Resources
- Los Angeles County DPW
- MassDOT, DelDOT, KCMO, Edina (MN)

Projects applying Envision exist in:

US, Canada, Mexico, Brazil, Chile, Colombia,
UK, Italy, Greece, Saudi Arabia, Pakistan, China

III. Case studies:

Seven public sector projects in Latin America

Common characteristics:

- Multiple stakeholders involved
- Need of partnerships between multiple institutions
- Long-term period of implementation (multiple phases / years)
- Aligned with national strategies for economic development and poverty mitigation
- Large monetary investments (co financed by IDB loans)
- Located in developing countries
- Environmental and social impacts

Differences:

- Multiple scales and levels of complexity: projects and programs
- Sectors and typologies
- Different phases of development
- Countries with different standards, institutions, and capacities
- Different models of management and autonomy of execution agencies
- Different strategies for impact mitigation

Public Sector Projects assessments

- | | | |
|-----|--|--|
| ● 1 | Energy | Norte Grande Electricity Transmission Program |
| ● 2 | Energy | Punta del Tigre B Combined Cycle Power Generation |
| ● 3 | Transport | New Providence Transportation Program |
| ● 4 | Transport | Mario Covas Rodoanel Northern Section |
| ● 5 | Water & Sanitation | Metropolitan Quito Water & Sanitation Program |
| ● 6 | Economic Infrastructure | Caracol Industrial Park |
| ● 7 | Environment and Natural Disasters | Serra do Mar and Atlantic Forest Mosaics System Socio-Environmental Recovery |



Norte Grande Electricity Transmission Program

Country: Argentina

Location: 6 provinces / north region

Sector: Energy

Type: Energy Transmission

Total Cost: US\$ 725 millions

Dates: from 2006 to 2016

Status: implementation

Owner: Government of Argentina

Execution Agency: Federal Administrative Committee of Electric Transport Trust Fund

Operation: Private concessionaire

Main component:

1. Extra high Transmission line (1220 km)

Other components:

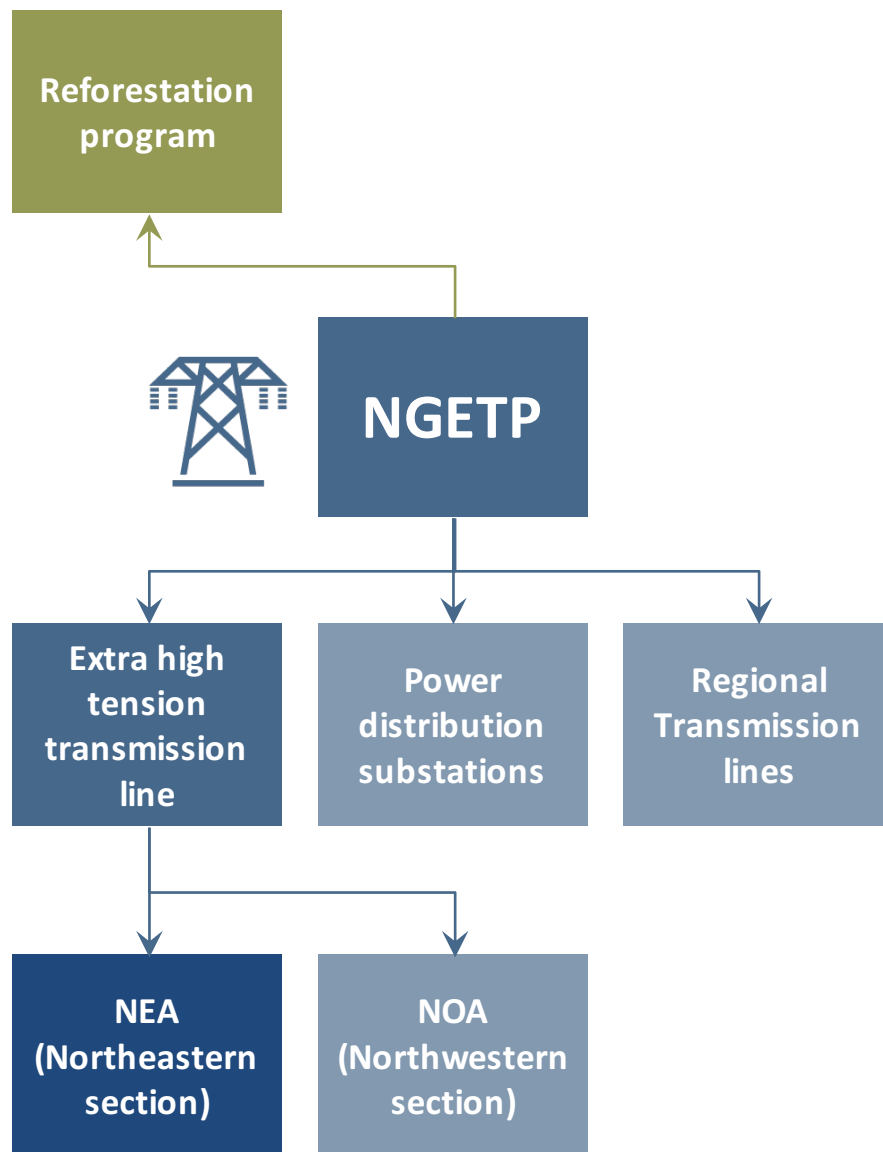
1. Transformation Stations
2. High and medium tension lines
3. Institutional capacity development

Mitigation Program:

- Reforestation Program

The width of the easement strip of the transmission line is on average 44 meters by 1260 km length, equivalent to 5500 ha. From this total, 90% was private property and most of the land was used for agricultural purposes.





Opportunities:

- Improve the quality, reliability, and accessibility of the electrical distribution system
- Stimulate economic growth and social equity in the northern region of Argentina

Obstacles:

- Complexities in the implementation of the transmission line
- Land conflict between the expansion of agriculture use (property owners / farmers) and the reforestation program (government)

Punta del Tigre Combined Cycle Power Generation Project (PTB) Country: Uruguay

Location: 40 km northwest of Montevideo
Sector: Energy
Type: Energy Generation

Total Cost: US\$ 440 million

Dates: from 2011 to 2017
Status: implementation

Owner: Government of Uruguay

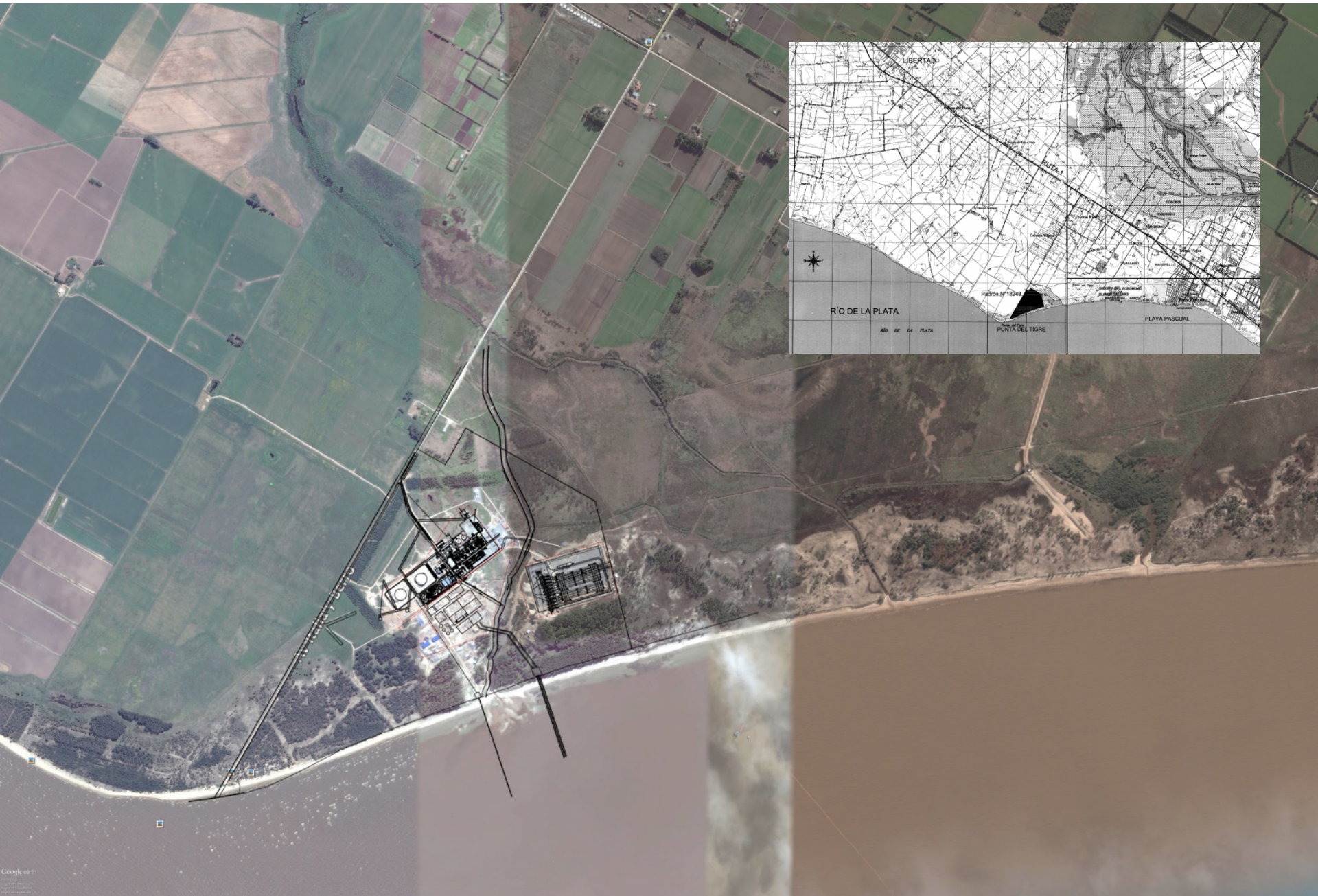
Execution & Operation: Administracion
Nacional de Usinas y Transmisiones
Electricas (UTE)

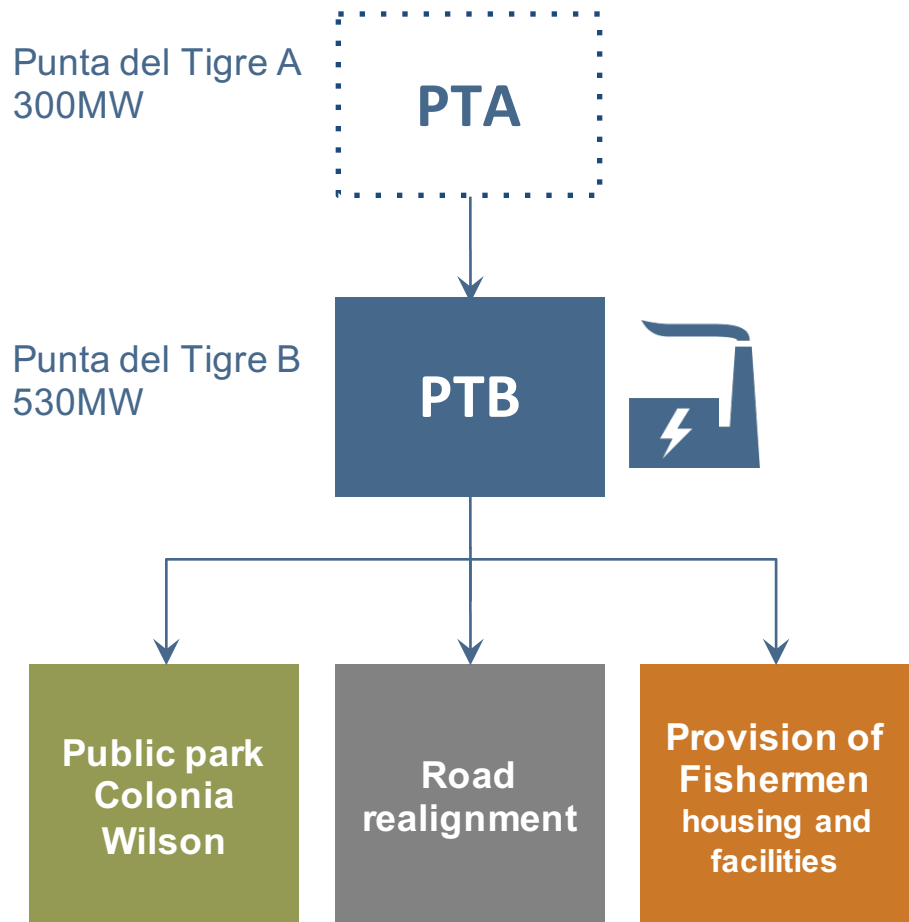
Main component:
Combined cycle power generation plant /
Capacity 530 MW

Mitigation Programs:

1. Public park Colonia Wilson
2. Road realignment
3. Fishermen relocation (housing and fishing facilities)







Opportunities:

- Satisfy the growing demand of electric energy
- Diversify the country's energy matrix
- Reduce dependency on hydropower
Projected water shortages

Obstacles:

- Located in an environmentally sensitive area (water / dunes)
- Balance development with environmental degradation

New Providence Transport Program (NPTP)

Country: Bahamas

Location: New Providence Island, Bahamas
Sector: Transport
Type: Transportation System

Total Cost: US\$ 195 million

Dates: from 2001 to 2014

Status: Completed

Owner: Government of Bahamas

Execution Agency: Ministry of Public Works (MOW)

Main component:

1. 19 corridors
 - 23km road improvement
 - 15 km new roads

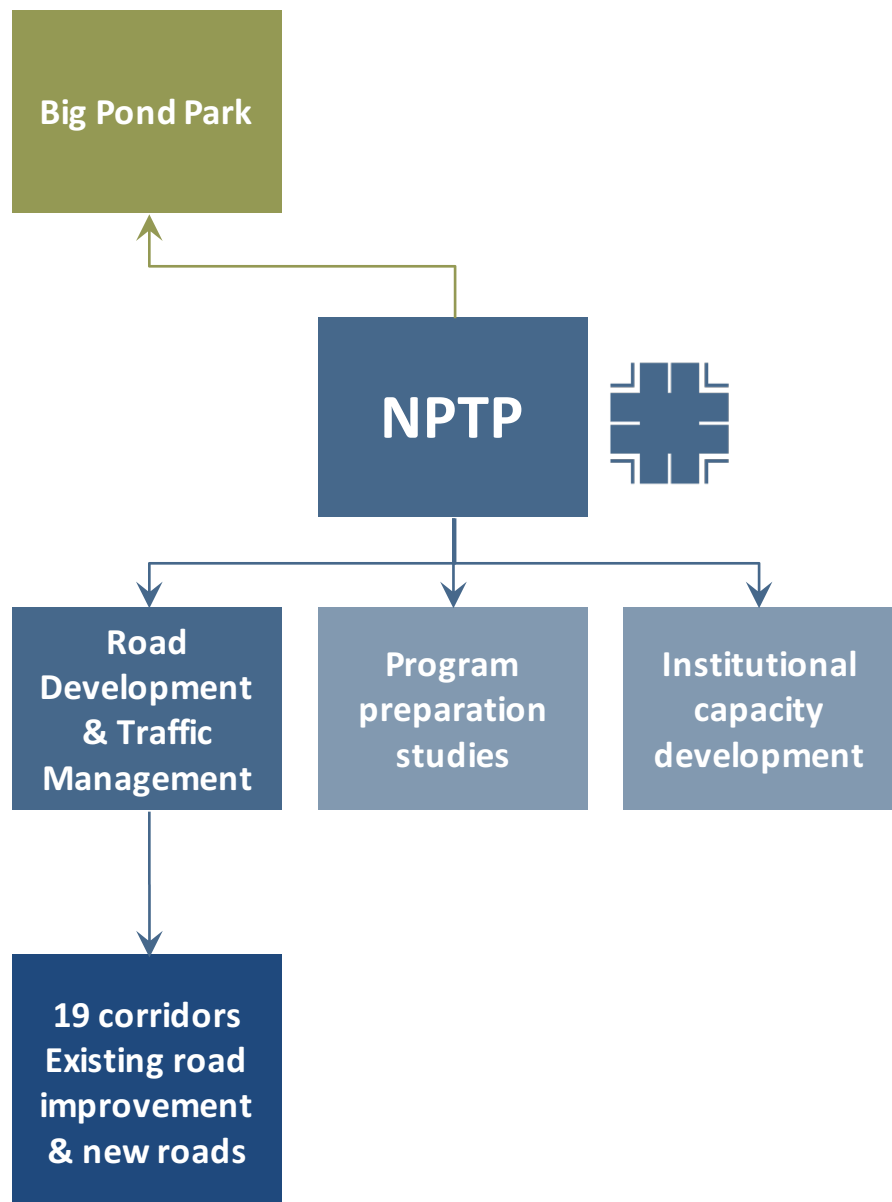
Other components:

2. Program Preparation Studies
3. Institutional capacity development

Mitigation Program:
Big Pond Park

COMPLETION OF NEW PROVIDENCE ROAD IMPROVEMENT PROJECT International Airport Package + Additional Corridors





Opportunities:

- Reduce transport costs and time by improving the existing road work
- Modernize the transportation services system
- Reduce environmental impacts associated with congestion levels
- Improve stormwater management

Obstacles:

- Extended period of implementation with no political continuity
- No autonomy of execution agency
- Many changes in the program resulted in implementation delays

Mario Covas Rodoanel

Project - Northern Section

Country: Brazil

Location: North of Sao Paulo
Sector: Transport
Type: Highway

Total Cost: US\$ 3 billion

Dates: from 2011 to 2017
Status: Implementation

Owner: Government of Sao Paulo (GESP)

Execution Agency: State Secretary of
Logistics and Transports through
Desenvolvimento Rodoviario (DERSA)

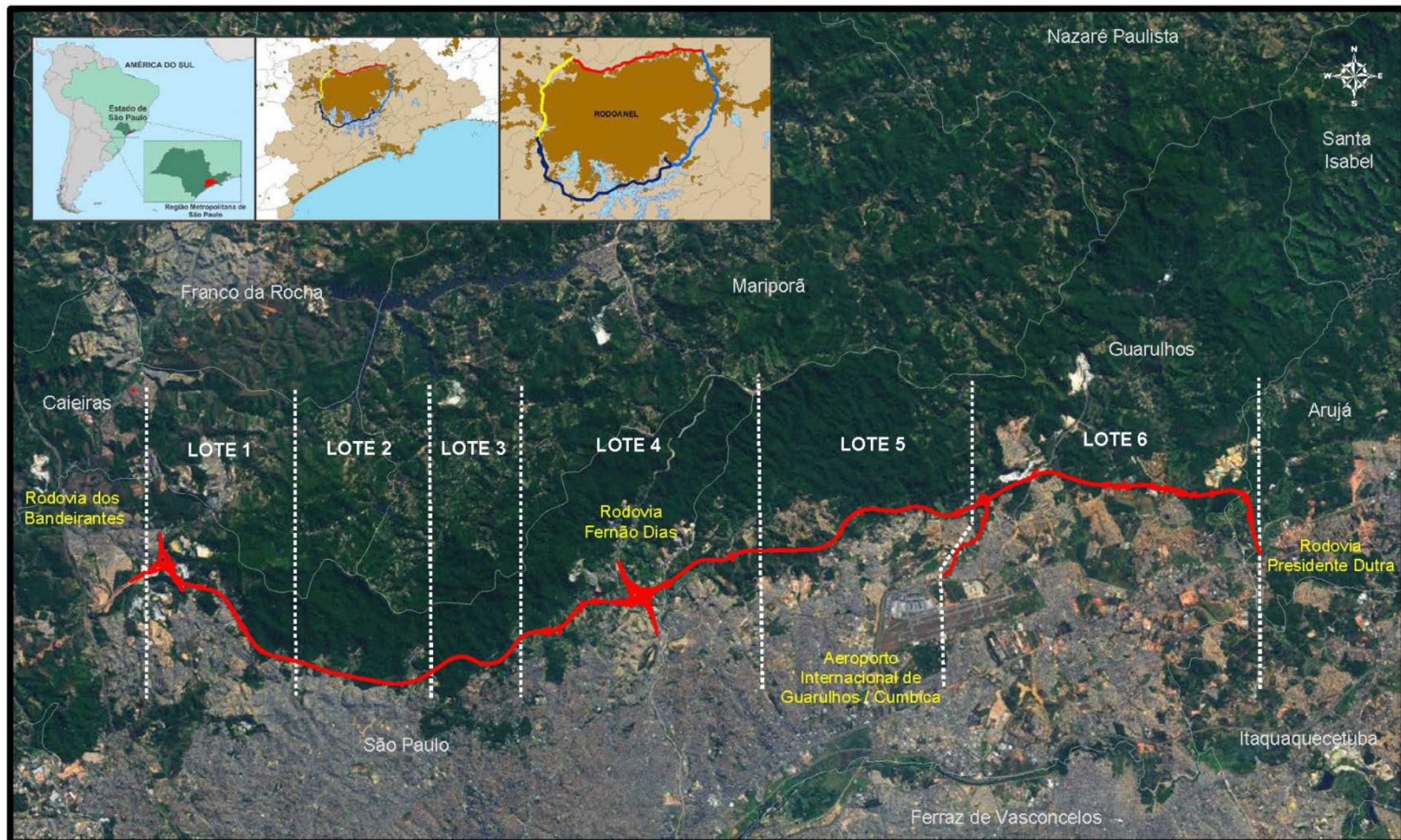
Main component:

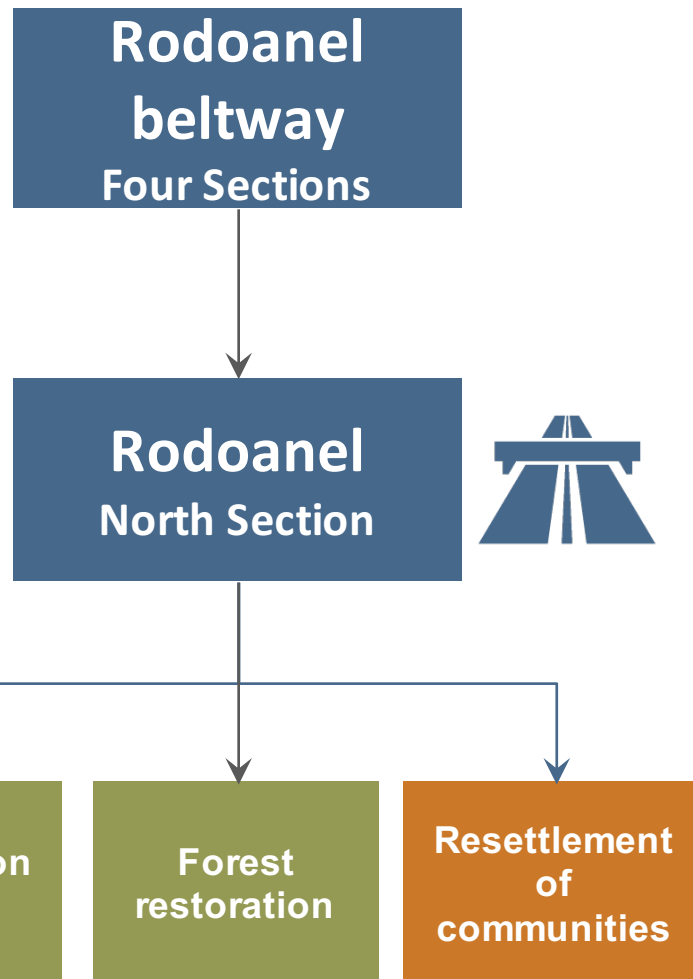
1. Highway with 7 underground tunnels

Mitigation Programs:

1. Creation and management of conservation corridors
2. Forest restoration
3. Resettlement of communities

Northern section of Rodoanel betway





Opportunities:

- Redistribute freight and passenger traffic
- Improve access to major international connection points
- Decentralize logistics activity in the Sao Paulo Metro region
- Improve traffic conditions by shortening travel times, reducing costs and accidents
- Improve air quality and living conditions for overall Sao Paulo

Obstacles:

- Crosses urban fabric with informal housing / need of resettlement
- Comprises the sensitive 'Mata Atlantica' rainforest / environmental degradation

Metropolitan Quito Environmental Sanitation Program - Phase II

Country: Ecuador

**Location: Quito Metropolitan District
Sector: Water & Sanitation
Type: Holistic water management**

Total Cost: US\$ 113 millions

**Dates: Phase I from 2003 to 2006
Phase II 2006 to 2015**

Status: Completed

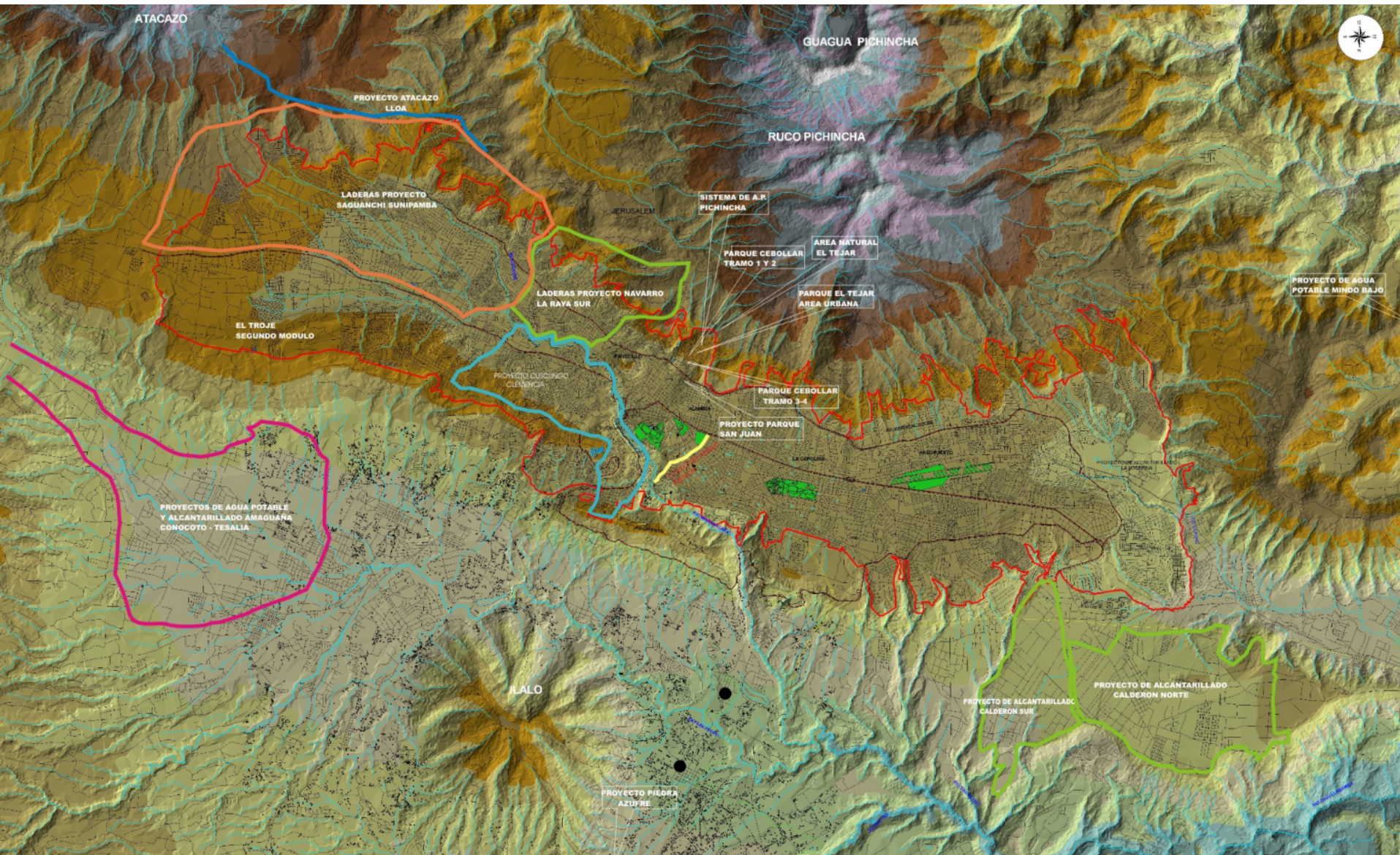
**Owner: Municipality of Metropolitan District
of Quito**

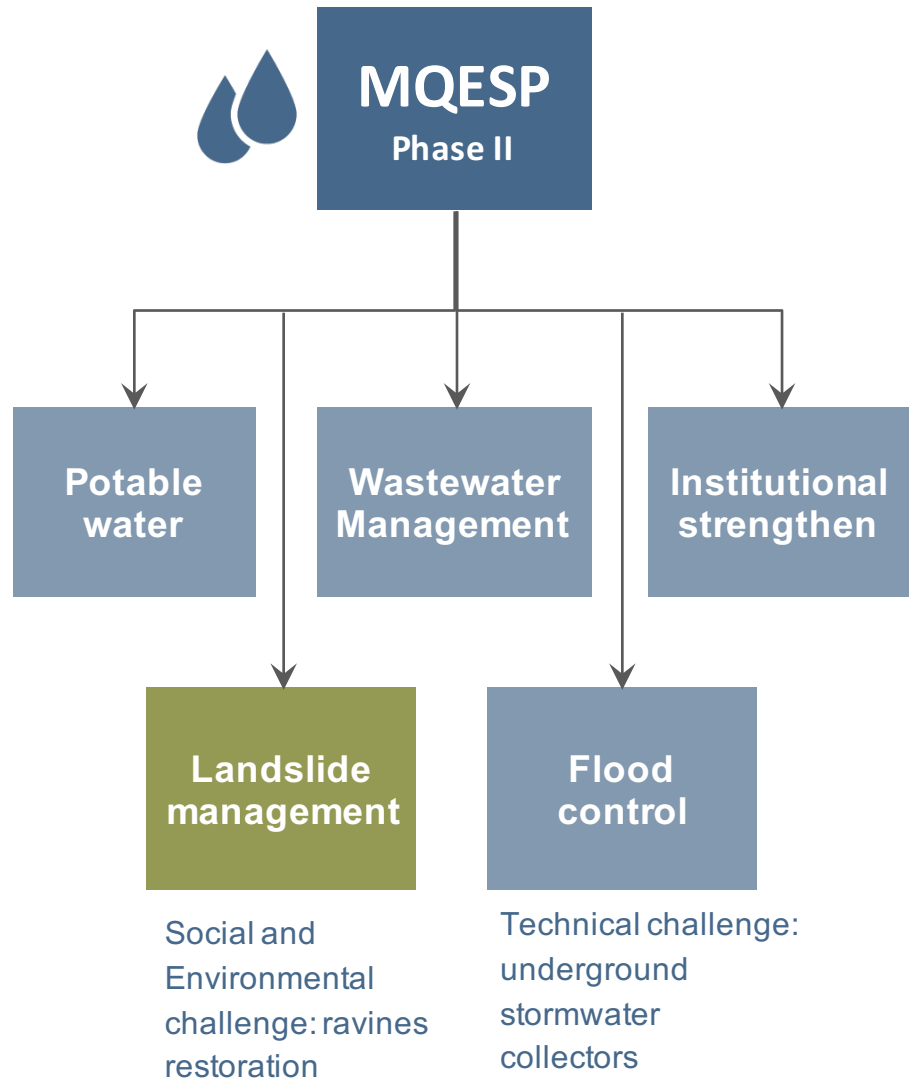
**Execution Agency: Metropolitan Quito
Water & Sewerage Company (EPMAP) /
Execution Unit for the Environmental
Sanitation program (PSA)**

Five components:

- 1. Potable water**
- 2. Sewerage**
- 3. Flood control**
- 4. Landslide management**
- 5. Institutional strengthening**

Master plan of environmental sanitation interventions in Quito





Opportunities:

- Provide residents of Quito with efficient and sustainable water, sewer, and flood control services
- Improve territorial planning for urban expansion
- Recover environmentally degraded areas
- Reduce damages by landslide risk management

Obstacles:

- Integration of interventions with existing urban systems
- Alignment of improvements with residential expansion of Quito
- Limited studies of the impacts of the project in natural water sources

Caracol Industrial Park

Country: Haiti



Location: North of Haiti
Sector: Urban development and housing
Type: Industrial Park

Total Cost: US\$ 257 million (only IDB loans)

Dates: 2011 to 2019 (IDB operations)

Status: Implementation

Partnership: Government of Haiti (GOH), US Government, IDB

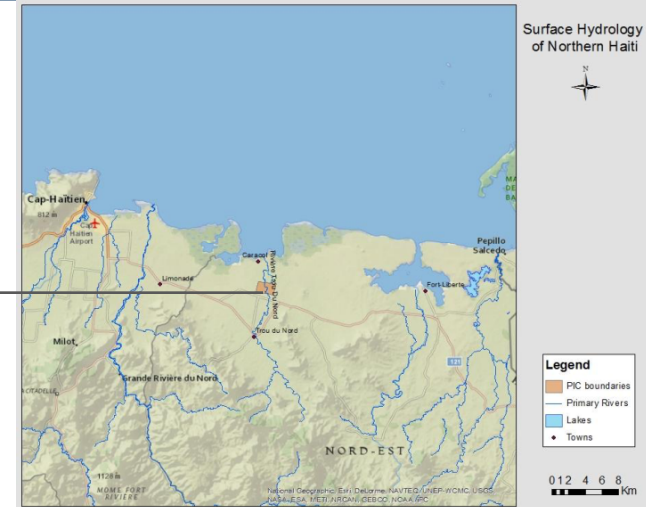
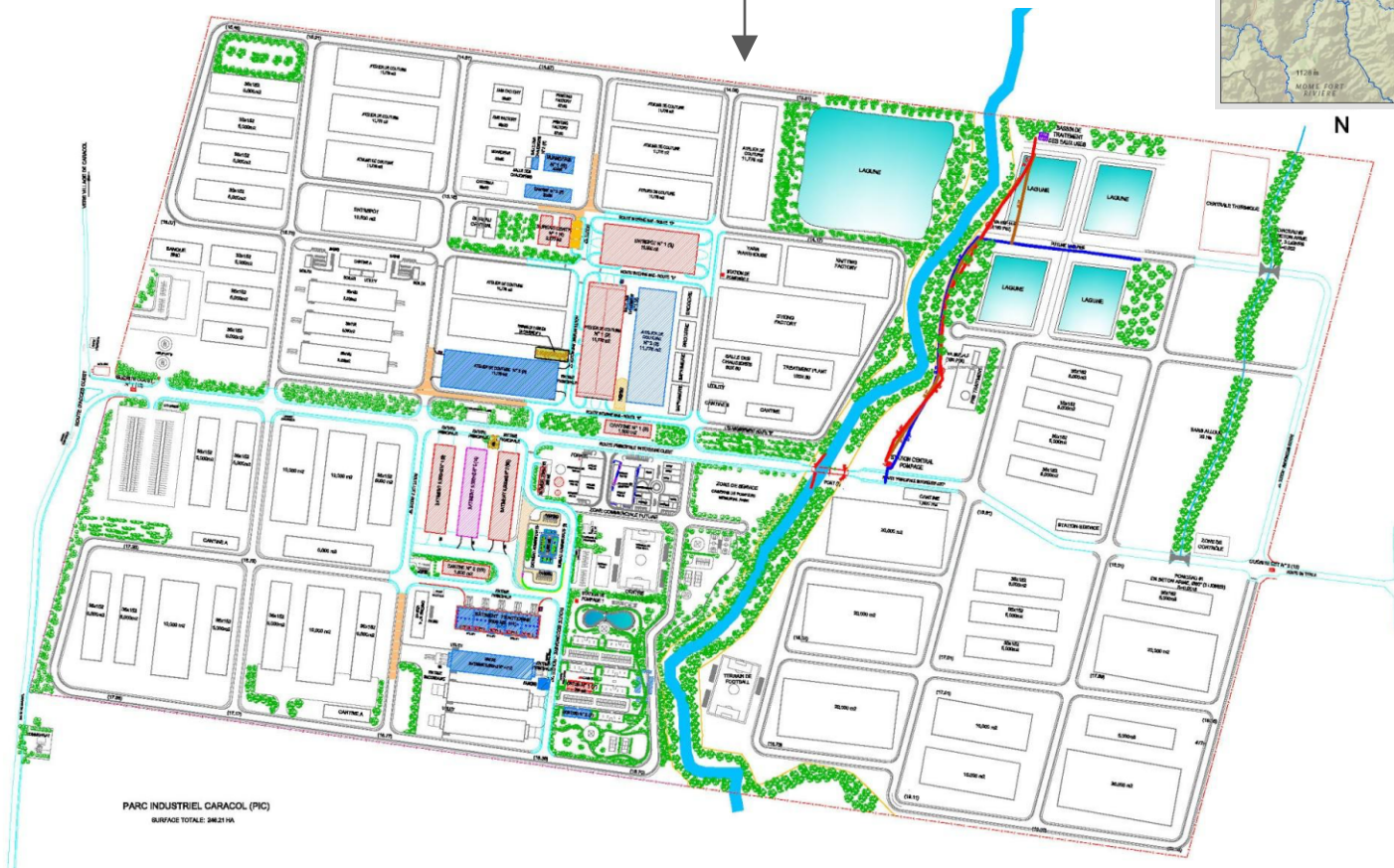
Implementation: Ministry of Economy and Finance Technical Execution Unit

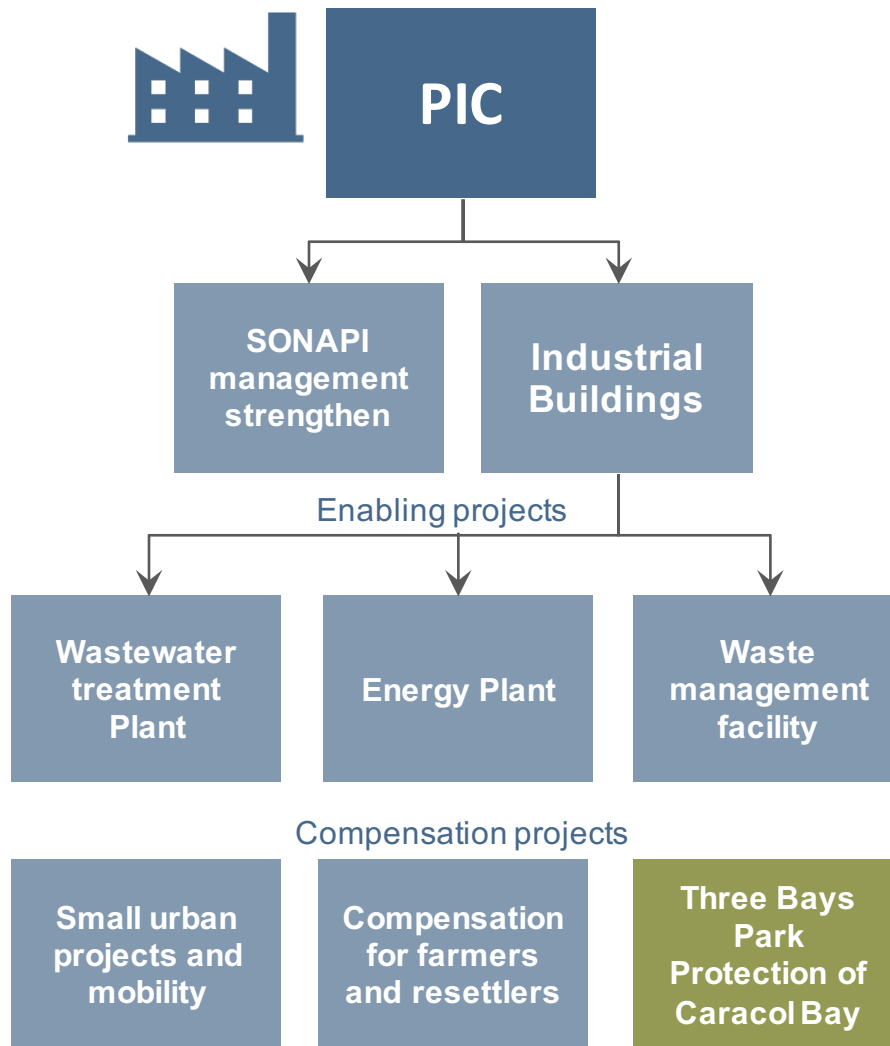
Management: National Society of Industrial Parks (SONAPI)

Components:

- Industrial facilities
- Compensation programs (social & environmental)
- Enabling projects (water, energy, waste)
- Operation and Management Capacity building
- Environmental mitigation studies

PIC location and master plan of the industrial park





Opportunities:

- Attract investors and encourage the establishment of firms to generate new employment
- Sustainable development of the north region of Haiti
- Protect the Caracol Bay area

Obstacles:

- Lack of institutional capacities
- Complex socio economic conditions
- Social challenges, lack of housing, security and gender-based violence, basic social services, transport, food, etc...
- Multiple project components led to conflicting priorities
- Influx of population seeking jobs causes environmental degradation

Serra do Mar and Atlantic Forest Mosaics System Socio-Environmental Recovery

Country: Brazil

Location: coast of Sao Paulo
Sector: Environment and natural disasters
Type: Resettlement and forest conservation

Total Cost: US\$ 470 million

Dates: from 2008 to 2016
Status: Implementation

Owner: Government of Sao Paulo

Execution Agency: partnership Ministry of Housing Ministry of Environment

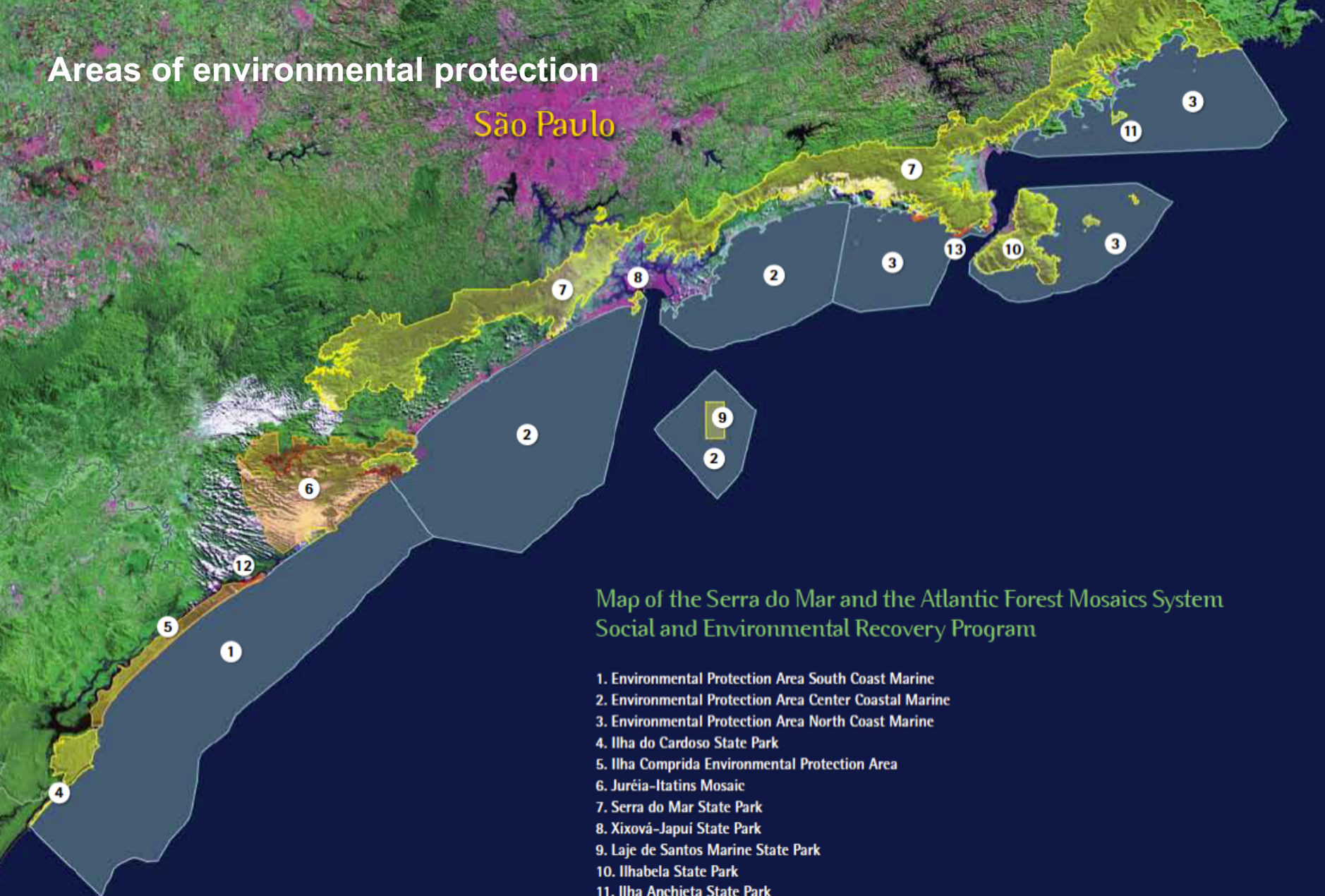
Coordination: Program Management unit

Components:

1. Protection of land and marine Conservation Units
2. Resettlement in the Serra do Mar State Park
3. Monitoring of protected conservation units

Areas of environmental protection

São Paulo



Map of the Serra do Mar and the Atlantic Forest Mosaics System Social and Environmental Recovery Program

1. Environmental Protection Area South Coast Marine
2. Environmental Protection Area Center Coastal Marine
3. Environmental Protection Area North Coast Marine
4. Ilha do Cardoso State Park
5. Ilha Comprida Environmental Protection Area
6. Juréia-Itatins Mosaic
7. Serra do Mar State Park
8. Xixová-Japuí State Park
9. Laje de Santos Marine State Park
10. Ilhabela State Park
11. Ilha Anchieta State Park
12. Relevant Ecological Interest Area Guará
13. Relevant Ecological Interest Area São Sebastião



Opportunities:

- Generate social and environmental benefits
- Improve living conditions of families living in informal housing
- Protect a high-value & diverse ecosystem
- Effective protection of water sources that supply the metropolitan area of São Paulo and Baixada Santista
- Environmental benefits, such as carbon retention, climate regulation, rainwater runoff retention

Obstacles:

- Long-term sustainability of resettled communities
- Environmental degradation by new informal settlements

IV. Comparative analysis

1) Measure sustainability

Without measurement, there is no way of progressing toward increased sustainability. ENVISION offers a mechanism that allows for measurement of projects that can be summed and compared across projects

2) Identify critical sustainability issues

- **Achievements:** Identify and track sustainability outcomes across projects
- **Opportunities:** Identify areas for improvements in projects

3) Recommendations to improve



Seven cases



Argentina **1**

Uruguay **2**

Bahamas **3**

Brazil **4**

Ecuador **5**

Haiti **6**

Brazil **7**

Norte Grande Electricity Transmission Program

Punta del Tigre B Combined Cycle Power Generation

New Providence Transportation Program

Mario Covas Rodoanel Northern Section

Metropolitan Quito Water & Sanitation Program

Caracol Industrial Park

Serra do Mar Socio-Environmental Recovery

US\$ 725 million

US\$ 440 million

US\$ 195 million

US\$ 3 billion

US\$ 113 million

US\$ 257 million

US\$ 470 million

Program

Analysis focus:
Northeast section (NEA)

Project

Analysis focus:
Punta del tigre B (PTB)

Program

Analysis focus:
19 Corridors (new & upgraded)

Project

Analysis focus:
Highway northern section

Program

Analysis focus:
Landslide management

Program

Analysis focus:
Industrial Park

Program

Analysis focus:
Environmental conservation & housing

Implementation

Implementation

Completed

Implementation

Completed

Implementation

Implementation

Achievements - Opportunities

Quality of life



- All the cases contributed to the national **economic development and growth**, by including improvements in job growth, capacity building, productivity, business attractiveness and livability
- From a the perspective of the communities directly affected by the projects, programs to **expand local set of skills and capacities**, beyond construction works should be integrated
- Most cases enhanced community livability by improving **public spaces**, including the creation of new parks, recreational facilities, or wildlife refuges. A broad scope of interventions were considered including areas far beyond the project's site
- Opportunities for preservation, protection, and enhancement of **historic and cultural resources** were identified in close coordination with all stakeholders and approaches to avoid or minimize impacts were developed
- A big opportunity of improvement relies in the identification and integration of most **vulnerable groups**, including women and indigenous or afro-descendant peoples

Quality of Life

Promote economic development and growth

High impact: NEA Transmission line

Promote social equity

- The program improved energy accessibility by lowering costs and providing more capacity to the existent electrical system.
- Attracted industry, businesses, and workers with increasing economic opportunities and enhancing productivity.
- Reduced the economic disparity between the Norte Grande region and other areas of the country

High impact: Industrial Park Caracol

Business attractiveness

- Promotes the economic development of the northern region of Haiti by attracting investors and encouraging the establishment of firms
- Created jobs throughout its design, construction, and operation.
- The resultant creation of jobs from the industrial park has created an attractive community for smaller business as well.
- 700 small and micro enterprises were opened in 2014 in the PIC's surrounding area

Quality of Life

Develop local skills and capacities

High impact: Serra do Mar Socio-Environmental recovery Education and training programs

- The program provided a broad range of capacity building programs, including education and technical training
- Promoted women empowerment and entrepreneurship among resettled communities
- Included education activities for residents to work in forest restoration activities in the Serra do Mar state park, and in public green spaces in Cubatão
- Activities promoted residents' citizenship and social cohesion

Low impact: Combined Cycle Plant Punta del Tigre Cost-efficient perspective

- Hiring and training are done as needed, or as required by regulations and standards, driven by a cost efficient perspective
- No hiring specifications directed towards the construction contractor were displayed
- Educational programs and training initiatives to expand the skill set of fishermen and other local workers and ensure sustainable development of the community were not included

Quality of Life

Enhance public space

High impact: Metropolitan Quito Environmental Sanitation Environmental restoration for public use

- The actions undertaken by the program not only sought to enhance the existing public areas, but also to create new ones.
- 19 ravines were intervened for environmental restoration, comprising a total of 84,2 hectares.
- The environmental restoration of degraded areas, contributed on improving the low-level of green areas per inhabitant in Quito, especially in the southwest zone
- New infrastructure such as luminary, playgrounds, lagoons, and workout equipment enhanced the new public spaces

Low impact: Northern section Rodoanel highway Limited scope

- Besides environmental restoration and fixing public amenities damaged by the project, on planning documents there are no clear evidences of measures to enhance public space.
- Consideration of wildlife is notable since refuges have been created, but public access to these areas is not granted

Achievements - Opportunities

Leadership



LEADERSHIP

- The creation of **special units for management**, with continuity beyond political periods, autonomy in decision making and financial resources, ensured interinstitutional coordination and the successful implementation of programs
- It is necessary to foster **collaboration and teamwork** by strengthening interinstitutional coordination and providing strong political support
- Shift from information exchange to **active stakeholder engagement** and dialogue incorporating their input in resulting project decisions
- Aspects such as **infrastructure integration and master plans** for territorial planning contributed to optimize costs and benefits however, pursue **by-product synergy opportunities** with nearby facilities could be improved
- Design considerations for projects to be more durable, flexible and resilient to extend the **useful life of investments** were not included

Leadership

Leadership and management

High impact:

Metropolitan Quito Environmental Sanitation

Creation of a special execution unit

- The successful implementation of the program was carried out by a special execution unit
- Created especially for this program and it directly depended of the General Manager
- Autonomous for decision-making, had highly-trained personnel and a management area dedicated to control the works
- The project team was maintained throughout the whole duration of the program, avoiding political interference

Low impact:

New Providence Transportation Program

Lack of institutional capacity and implementation delays

- Design-Build Modality is more manageable within a developed technical oversight capability on the part of the Executing Agency
- Successive changes of political administrations contributed significantly to project delays.
- Streamlining procurement requirements to adequately balance risks and responsibilities.

Leadership

Provide for stakeholder involvement

High impact:

Combined Cycle Plant Punta del Tigre

Active engagement in decision making

- The team carried out active engagement and dialogues with the local affected community
- Comprehensive actions were taken by considering the feedback from these communities
- Commitments included the preservation of the La Plata River, hiring locally, road and lighting improvements, green curtains to minimize noise; and the creation of the Wilson Public Park

Low impact:

Industrial Park Caracol (PIC)

Lack of capacities for community integration

- Communication with the community did not follow any specific plan during the design phase and there is no evidence to show their active involvement, neither is possible to demonstrate if any changes to the project were made based on feedback
- One of the main restraining factors to efficiently implement a grievance mechanism and a stakeholder engagement plan is the lack of local capacities and limited resources

Leadership

Improve infrastructure integration

High impact:

New Providence Transportation Program

Improve existing infrastructure

- The program not only improved the existing infrastructure, but also extended it, enhancing roads hierarchy, and integrating them with the urban fabric
- To establish a working synergy with other transport elements, the Ministry of Transport developed a bus parking depot in downtown Nassau to reduce the blocking of traffic lanes on city streets
- The Ministry of Education also implemented a plan to reduce schools impacts on congestion levels

High impact:

Metropolitan Quito Environmental Sanitation

Integration of urban systems and territorial planning

- Decision to transform a typical hydrological regulation project into an integral project to reduce and mitigate risks, through wastewater interception
- Integration of urban systems through territorial planning
- Integration between new infrastructure for water management and natural drainage systems

Achievements - Opportunities

Resource allocation



- In all the cases under study, a low level of consideration was found on how to optimize resources used to build the infrastructure, such as **materials, water and energy**.
- No considerations were made to obtain materials and equipment from suppliers that implement **sustainable procurement practices**
- The use of materials with **recycled content and locally sourced** should be integrated in the planning of infrastructure projects
- Beyond the end of a project's useful life, design should consider **deconstruction and recycling** of its components
- A general opportunity for improvement for all cases is to **reduce energy consumption** by performing a life-cycle assessment (LCA) to measure net embodied energy in materials utilized
- Reduction of overall **potable water consumption** is recommended by encouraging the use of greywater, recycled water and stormwater to meet water needs

Resource Allocation

Use of regional materials

High impact:

Northern Section Rodoanel highway

Locally sourced materials

- Planning documents provide strong evidence of local sourcing for soil and mulches
- Soil extraction and storage occurred within an optimized distance from construction site (less than 50 miles)
- An inventory of materials listed by type, volume, and distance was developed.

Low impact:

New Providence Transportation Program

Imported materials

- Given that New Providence Island does not have an abundance of natural resources, construction materials were imported, including water.
- The impact of Hurricane Katrina prior to the commencement of construction resulted in a premium on building material prices, which were already difficult to acquire.

Resource Allocation

Reduce energy consumption

High impact:

Combined Cycle Plant Punta del Tigre

Reduce overall operation energy

- The use of a combined cycle power plant was chosen over the common gas power plant, as a consequence of its improved energy efficiency
- The PTB achieves a 30% energy reduction compared with a conventional gas turbine plant
- The combined cycle power plant needs around 30% less fuel to produce the same amount of electricity

Low impact:

Industrial Park Caracol, Haiti

No strategies for energy consumption reduction

- USAID implemented a diesel fueled power plant that provides energy to the park tenants and 9,000 households
- There is no evidence of holistic cost analysis to determine the most effective methods for energy reduction
- Projected population increase necessitate plans to conserve energy throughout the project life

Resource Allocation

Potable water consumption

High impact:

Combined Cycle Plant Punta del Tigre

Protect potable water for community use

- The existing power plant was designed to intake water directly from the Raigon aquifer, from which potable groundwater is extracted
- This procedure impacted the quantity and quality of this aquifer, which actually is used for domestic and irrigation uses
- In PTB , water used is extracted directly from the Plata River instead that from the Raigon freshwater aquifer

Low impact:

Northern section Rodoanel highway

No considerations on water usage

- Water assessments to prevent negative impacts on water bodies such as monitoring programs were made
- However no evidences on planning documents towards the project's water requirements are included
- Is necessary to integrate water management policies that address freshwater availability and usage during construction and operations

Achievements - Opportunities

Environmental impacts



- Most of the programs considered the **restoration of areas of high ecological value** far beyond the area directly affected by the project, achieving a high impact on communities and the environment
- Projects **avoided surface and groundwater pollution** by the implementation of water quality monitoring programs. This was a common practice across all cases
- Several cases included initiatives to **preserve species biodiversity and the control of invasive species** to restore degraded habitats
- In reforestation programs the use of native species minimized the **use of pesticides and fertilizers** to reduce impacts in both the community and the environment
- The **preservation of farmlands or greenfields** was not part of the considerations in relation with project siting

Natural World

Restoration of high ecological value areas

High impact: New Providence Transportation Program Big Pond Park restoration

- Supporting mangroves and rare Caribbean Pine while simultaneously receiving significant watershed from surrounding land areas, the pond was identified as a unique ecosystem warranting protection
- Creation and maintenance of an 181 acre habitat that serves the public through educational and recreational facilities
- Restoration of contaminated soils and water

Low impact: Combined Cycle Plant Punta del Tigre Located in a valuable ecological area

- Site selection was based on technical and economic criteria only.
- Located in an area considered of environmental and archeological protection of the coastal zone
- The intake and discharge lines of the cooling system are located within coastal saline wetlands identified as an area of natural and conservation interest

Natural World

Preserve species biodiversity

High impact: Northern section Rodoanel highway Howler monkeys protection program

- Development of a special program to support the continuity and re-adaptation of endemic species of howler monkeys
- Monitoring campaigns were established to assess quantity and the ability of the species to cope and to adapt to the development of the project
- The road included underpasses for the fauna to avoid roadkill and to sustain the connectivity of fauna between natural areas

Moderate impact: NEA Transmission line Efforts focused only in reforestation

- The project assessed habitat and species biodiversity prior to and after construction.
- Connectivity designs to facilitate movement between habitats were not addressed
- Species biodiversity preservation was addressed primarily through mitigation efforts of the project's extensive reforestation, which contributed to restored habitat

Natural World

Prevent surface and groundwater contamination

High impact: Metropolitan Quito Environmental Sanitation River decontamination program

- The project carried out a baseline assessment to achieve water quality improvement goals on Quito's rivers.
- The comprehensive recovery solution began with a detailed study of the watershed involved
- The program team has designed and implemented water-quality monitoring programs on the rivers and also on 30 sewage-water discharges to water bodies

Moderate impact: Combined Cycle Plant Punta del Tigre Limited efforts to prevent water contamination

- The PTB increases the temperature of the water used for cooling between 10 and 15° C, which is discharged to the Plata River
- The temperature is a physical factor of pollution. It is non-toxic but triggers processes and organisms that can alter the ecosystem
- A study was conducted and long-term monitoring for phytoplankton is implemented

Achievements - Opportunities

Climate change & risks



CLIMATE
AND RISK

- Limited considerations in relation with the reduction of **greenhouse emissions and air pollutants**
- Most of the projects are well prepared to confront natural and human-induced **short-term hazards** by integrating protection measures
- However the majority of the projects didn't consider the threat of **climate change** or strategies for **long-term adaptability**
- The creation of a comprehensive **Climate Impact Assessment and Adaptation Plan** is recommended
- Strategies to **reduce heat island effect** to avoid microclimate alterations were not part of the criteria applied for project design

Climate and Risk

Emissions

High impact: **Combined Cycle Plant Punta del Tigre** Reduction of emissions

- Combined-cycle plant PTB contributes to a cleaner energy supply scenario.
- CO₂ emissions from power plants using combined cycle technology are about 50% lower than most coal-fired plants
- A comprehensive life cycle net carbon dioxide equivalent (CO₂e) emissions analysis for the key materials used during construction could be conducted.

Moderate impact: **Serra do Mar Socio-Environmental recovery** Need to measure overall net carbon footprint

- The program will provide an important carbon negative impact through carbon sequestration
- The conservation of the Atlantic Forest is anticipated to result in a 400,000 hectares of forest that will result in a carbon retention estimated to be between 50 and 100 t/ha.
- However, the net carbon footprint of the program remains unclear as the program has not conducted a life cycle assessment of the greenhouse gas emissions of all its components.

Climate and Risk

Prepare for short term hazards

High impact:

New Providence Transportation Program

Multiple prevention measures

- The project commissioned a Hazardous Materials Spill Contingency Plan (HAZMAT Plan) to enable a coordinated, controlled and effective response to incidents
- Increased stormwater runoff were dealt with along particularly sensitive areas through vertical wells, while in others natural drainage patterns were restored to enhance infiltration
- These physical fortification measures allowed the project to adapt to changing hazards, restoring environments while reducing risk.

High impact:

Metropolitan Quito Environmental Sanitation

Environmental restoration and risk reduction

- The environmental restoration interventions to protect natural drainage systems included in the program were key to prepare the communities for short-term hazards.
- Stormwater management, increment of infiltration capacities, definition of risk areas, and relocation of communities directly contributed to minimize damage to public and private property caused by flooding, landslides, and discharges of mud and rubble

Climate and Risk

Climate threat & long term adaptability

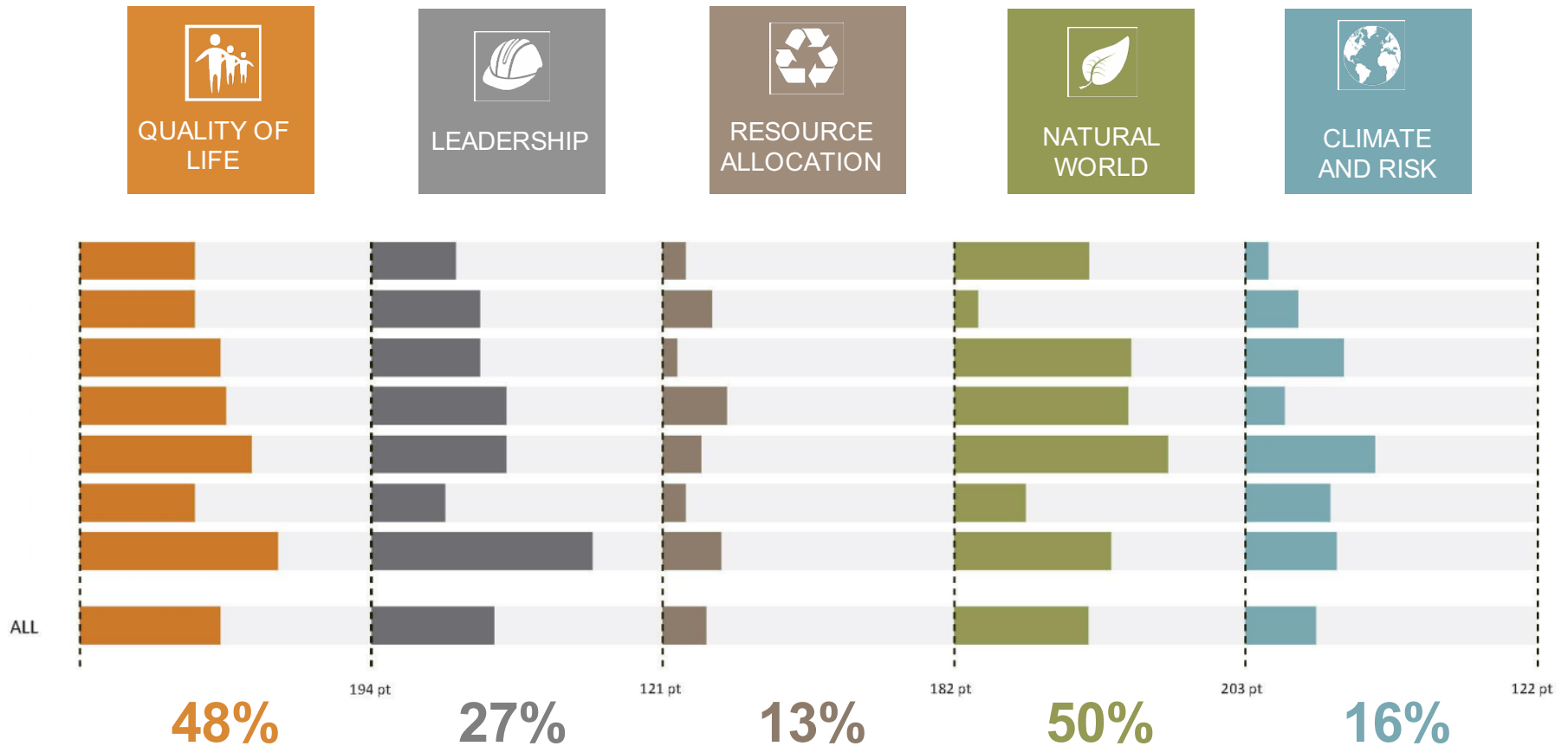
High impact: Industrial Park Caracol (PIC) Plans addressing climate change threat

- Haiti context could exacerbate the impacts caused by natural hazards and climate change
- The PIC is currently completing a Disaster Risk Assessment (DRA) that incorporates risks posed by climate change
- Buildings were designed and built based on a preliminary DRA to ensure resistance to disasters and it incorporated main risks such as flooding, hurricanes and earthquakes
- The PIC will implement a Disaster Risk Management and a Climate Change Adaptation Plans

Low impact: NEA Transmission line Limited scope

- Specific areas, particularly floodplains, were considered to minimizing equipment damages
- Plans to identify risks related to climate change and possible responses were not evaluated
- The project did not consider adaptability and resiliency in relation to long-term climate change and other non-project specific environmental conditions

Comparative analysis and findings



Quality of Life and **Natural World** categories concentrate the higher achievements

Resource Allocation and **Climate and Risk** categories present the highest opportunities for improvement

Thank you



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