

Nature-based Solutions for Coastal Flooding Workshop Series:  
***Nature-based Solutions (NBS) Co-Benefits Workshop***

Salvador Herrera Montes

Urbanística

México

***What barriers must be overcome to demonstrate and defend NBS Co-benefits?***

13 May 2022



COMISIÓN PARA LA  
COOPERACIÓN  
AMBIENTAL



**urbanística**

UNOFFICIAL TRANSLATION | TRADUCCIÓN NO OFICIAL

# CONTENTS

## **Barrier 1:**

Discrepancies and lack of integration between the *Programa de Ordenamiento Ecológico* (Ecological Management Program), *Atlas de Riesgos* (Risk Atlas) y *Programa de Desarrollo Urbano* (Urban Development Program).

## **Barrier 2:**

Wide margin of choice and lack of information for individuals to adopt nature-based solutions (NBS)

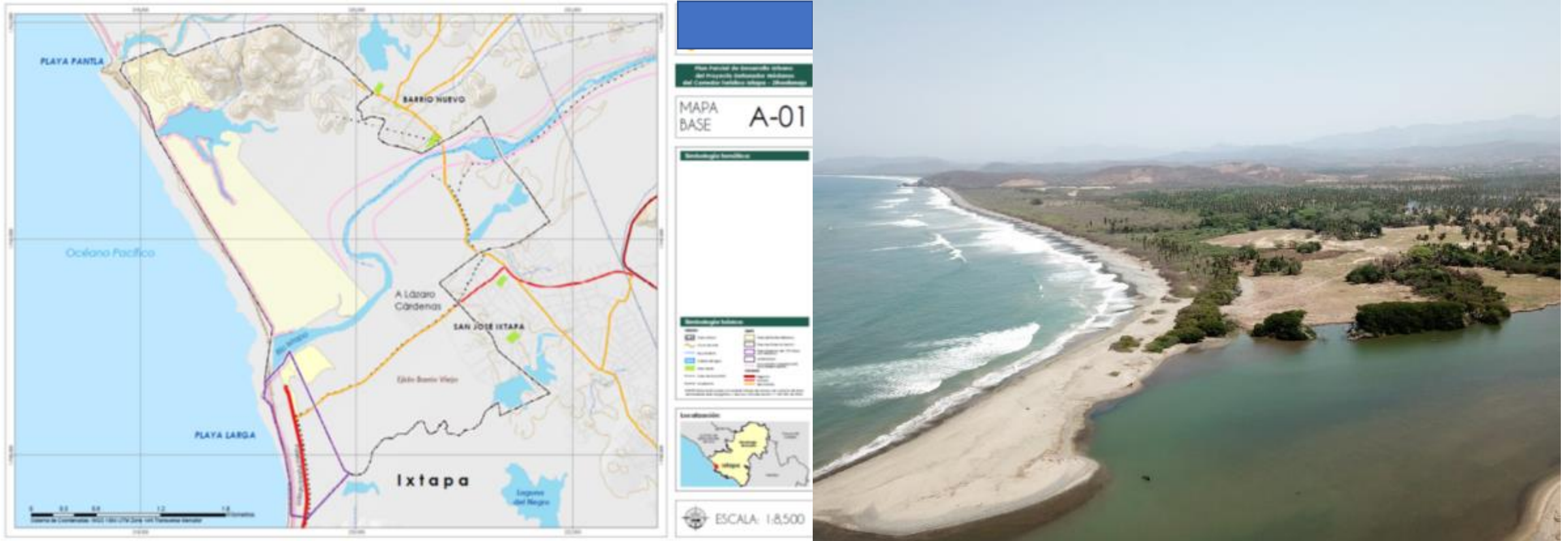
## **Barrier 3:**

Investment in nature-based solutions in real estate developments is left to the private sector, without any municipal/state support or facilitation.

## BARRIER 1:

Discrepancies and lack of integration between the *Programa de Ordenamiento Ecológico* (Ecological Management Program), *Atlas de Riesgos* (Risk Atlas) y *Programa de Desarrollo Urbano* (Urban Development Program).

Ixtapa Zihuatanejo, Guerrero



Concurrence between federal, state and municipal competencies (beaches, river, tourism, urban development, social development).

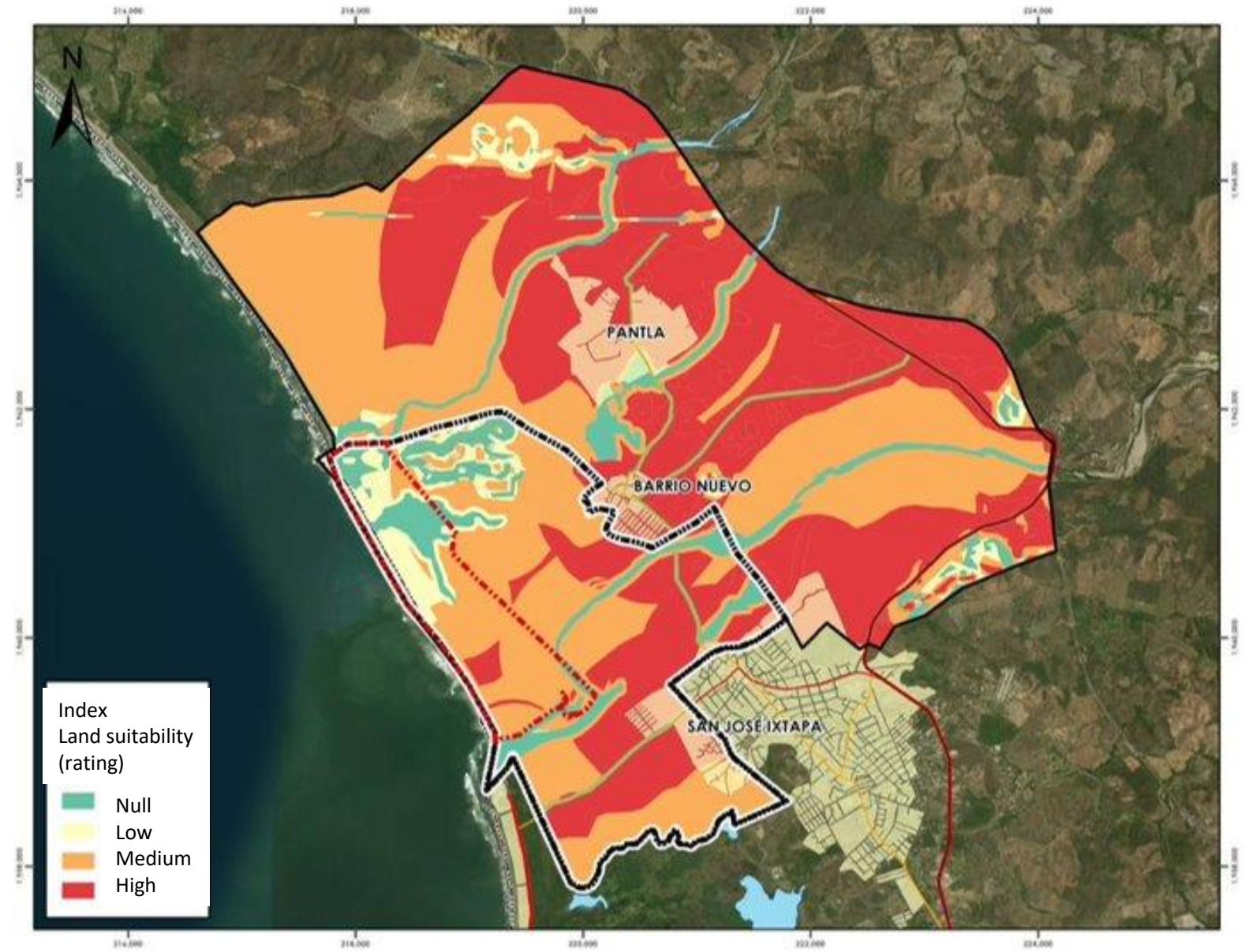
Partial Urban Development Programs (PPDU) as part of a National Urban Development Planning System, incorporating National Strategy for Territorial Planning (ENOT), PNDU and the Zihuatanejo-Ixtapa Urban Development Plan 2015-2030

# Analysis - Natural Elements for the calculation of land suitability

Concept	Variable	General percentage	High	Medium	Low	Null
Hydrology	Shore from CONAGUA restriction	40%	Greater than 500 m	459 to 50 m	49 to 10 m	9 to 0 m
	Water bodies		Greater than 500 m	459 to 50 m	49 to 10 m	9 to 0 m
	Proximity to coast		Greater than 500 m	459 to 50 m	49 to 10 m	9 to 0 m
	Flood zone		Greater than 500 m	459 to 50 m	49 to 10 m	9 to 0 m
Slopes	0 – 2	20%		X		
	2 – 12		X			
	12 – 18			X		
	18 – 24				X	
	>24					X
Land use and vegetation	Agricultural land	20%	X			
	Pasture		X			
	Tular (marsh)					X
	Deciduous forest					X
	Secondary vegetation		X			
Conserved land	Conserved land (mangrove)	10%				X
Soil science	Regosol Eutrico	5%		X		
	Solonchak Gleyico				X	
Infrastructure	Roads	5%	9 to 0 m	49 to 10 m	459 to 50 m	More than 500 m
	Service infrastructure		9 to 0 m	49 to 10 m	459 to 50 m	More than 500 m



## Results – Land suitability



# Planning instruments allow for a very high development potential that does not take into account NBS

## Comparison of uses and densities

Concept	NORMATIVE		STUDIES		
	Authorized change 2007	Zoning Regulations	Cost – Benefit Analysis (	Market Research	Master Plan
Land use	TRM* (Tourist Residential Average) CTR** (Residential Tourist Corridor) THA*** (High Tourist Hotel)	TRM* (Tourist Residential Average) TRC ****(Turist Residential Commercial) THM ***** (Tourist Hotel Average)	Hotels Residential Mixed	Hotel Residential Commercial/Mixed Natural and Entertainment Park	TRM* (Turístico Residencial Media) TRC**** (Turist Residential Commercial) THM***** (Tourist Hotel Average)
Area in hectares	181 hectares	181 hectares	165 hectares	110 hectares	65.8 hectares
Density of rooms	More than 130 rooms/ha	130 rooms/ha	Not specified	Not specified	130 rooms/ha
Lodging units	THA 44 ha: 5,720 rooms	THM 8 ha= 1,040 rooms	3,648 rooms	3,520 rooms	Not specified
Housing density	TRM: 21 – 50 housing/ha CTR: 21 – 50 housing/ha	TRM: 60 housing/ha TRC: 110 housing/ha	Not specified	Not specified	50 ctos/ha
Housing units	TRM 38 ha: 1,900 housing CTR 91 ha: 4,550 housing	TRM 38 ha= 2,280 housing TRC 135 ha= 14,850 housing	3,352 housing	Residencial: 1,155 housing Residencial Plus: 660 housing	6,400 housing

Source: Own elaboration with information from Gaceta Oficial del Estado de Guerrero, Análisis Costo – Beneficio para el proyecto ), Estudio de Mercado , Plan Maestro y Reglamento de Zonificación

\*spanish acronym for Turístico Residencial Media

\*\* spanish acronym for Corredor Turístico Residencial

\*\*\* spanish acronym for Turístico Hotelero Alto

\*\*\*\* spanish acronym for Turístico Residencial Comercial and Hotel Turístico Especial

\*\*\*\*\* spanish acronym for Turístico Hotelero Medio

UNOFFICIAL TRANSLATION | TRADUCCIÓN NO OFICIAL



## Specific example:

Authorizations, concessions and permits overlap with no relation to each other.



Federal Concessions

### 7 SEMARNAT

- 5 Beach (Protection)
- 1 Lagoon (Fishing)
- 1 Agricultural (Processing)

### 5 CONAGUA

- 1 Ixtapa river (Protection)
- 1 Pantla river (Protection)
- 2 Ixtapa river (Protection/processing)
- 1 Bridge work (processing)



4 Environmental Impact Statements

Protection Works on the Banks of the Ixtapa river  
Ixtapa Island Bridge  
Ixtapa Island Bridge Extension  
Ixtapa Islands (infrastructure works)



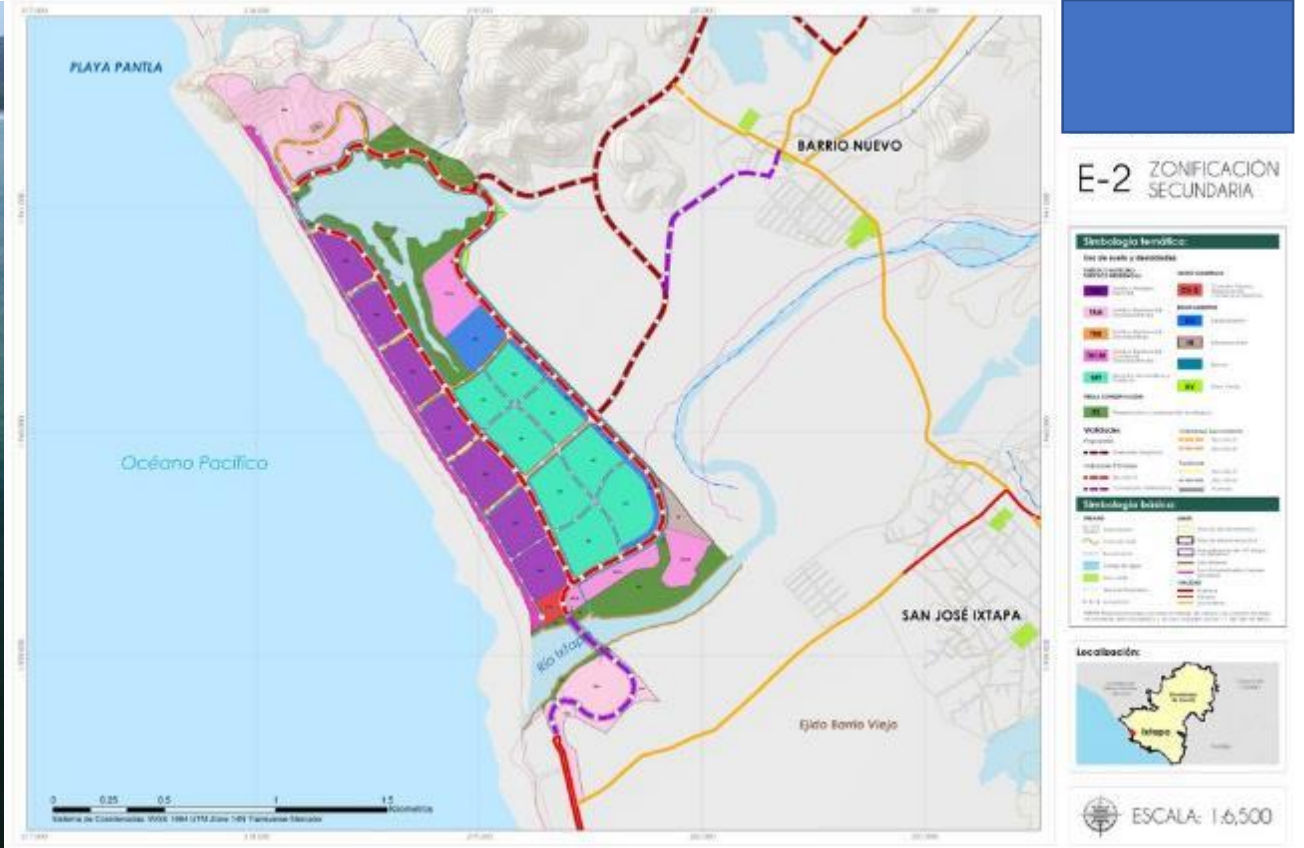
4 Construction licenses

2 urbanization works  
2 construction of a bicycle lane

*Fuente: Análisis Costo – Beneficio. Proyecto de infraestructura turística .*



## Specific example : Lack of protection to minor and seasonal bodies of water.



Photographic record of the site.  
Fuente: Recorridos de campo, Urbanística.

Secondary Zoning Plan



## Proposed strategies for NBS that lack adequate funding for their implementation.

The urban design guidelines were developed in accordance with the Plan Director de Desarrollo Urbano, Reglamento de Construcción del Municipio of Zihuatanejo, Reglamento de Imagen Urbana del Municipio de Zihuatanejo and los Lineamientos de Imagen Urbana .



### Natural vegetation formations

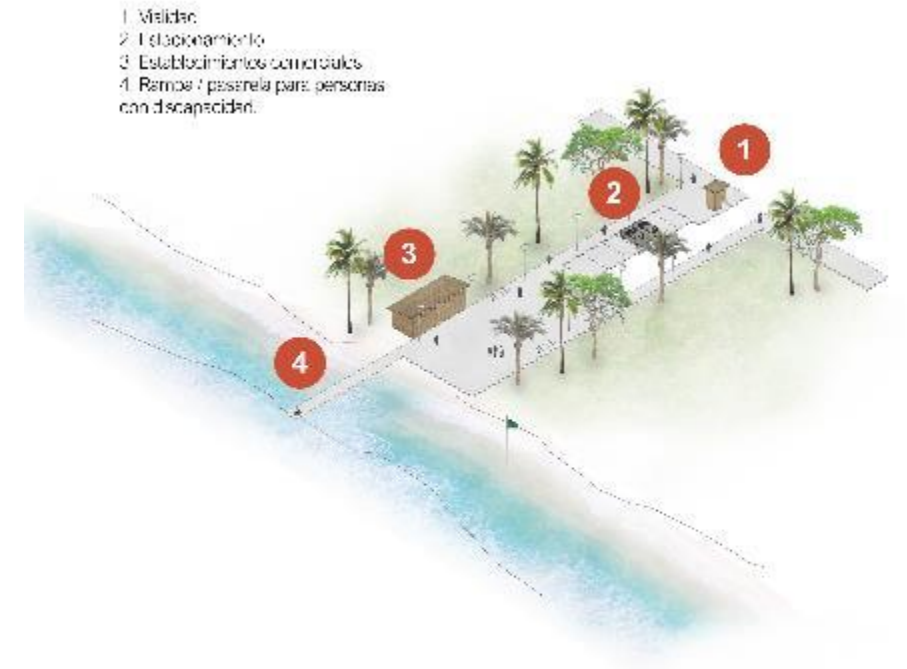
Transición entre entornos naturales y artificiales



1. Rampas de acceso y pasarela para personas con discapacidad.
2. Módulo de provisión de equipo para personas con discapacidad.
3. Wócher urbano producido a partir de material obrado en sitio.
4. Bandera indicativa de condiciones de marea.

### Beach preservation

Integración de elementos de accesibilidad urbana y protección de playa formando un solo espacio público



1. Vialidad.
2. Estacionamiento.
3. Establecimiento comerciales.
4. Rampas y pasarela para personas con discapacidad.

### Beach access

Integración de elementos urbanos con el entorno natural y servicios de apoyo ambiental, dentro del espacio público

Fuente: Elaboración propia Urbanística

## BARRIER 2:

Wide margin of choice and lack of information for individuals to adopt nature-based solutions (NBS)

### Example 1:

#### AVDC (Area Voluntarily Designated for Conservation)

Progreso, Yucatán

- Strategy for the creation of an AVDC, regulated by la Comisión Nacional de Áreas Verdes (CONANP), for the integration of natural areas in real estate developments.
- Conservation of areas with high environmental value.
- Preservation of the biodiversity characteristic of the region's low deciduous forest.
- The search for greater use of saleable area becomes a priority over the AVDC strategy.
- Green and natural areas are destined to reduced spaces, such as medians or residual areas near homes.





## AVDC (Area Voluntary Designated for Conservation)

Progreso, Yucatán



Photographic record of pre-existing vegetation

Source: Recorridos de campo, Urbanística

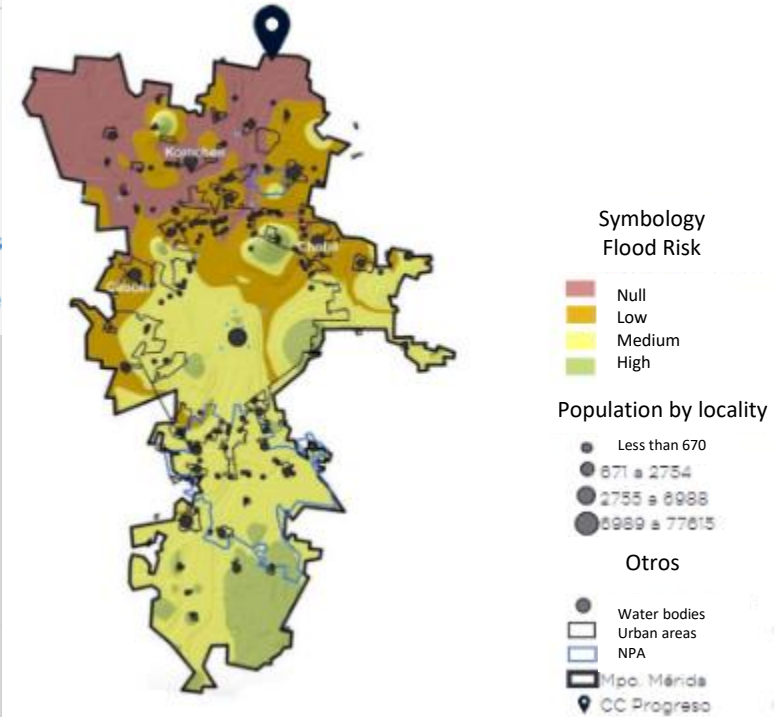


Defined design of green areas with a focus on preservation of pre-existing vegetation.

Source: Urbanística

## Regulatory instruments of Progreso, Yucatan.

Estatal	Programa de ordenamiento ecológico del territorio costero del Estado de Yucatán (POECTY) - 2007	Fase IV Propuesta Costero	5. Propuesta	5.5.2 Criterios de Uso	Criterios de construcción, control de emisiones y biodiversidad según el POECTY, de la zona en la que se encuentran los terrenos de Central Progreso	1. No se permite desecar cuerpos de agua.	
						2. No se permite modificar o alterar físicamente o escénicamente cenotes, cavernas u algún otro elemento del paisaje.	
						4. La autorización de desarrollos residenciales, turísticos, industriales y agrícolas debe limitarse al criterio de extracción máxima de agua de hasta 5 lt/segundo con pozos ubicados a distancias mínimas de 500 m (1 pozo /25 Ha). Este criterio podrá modificarse en relación a una extracción de agua de hasta 15lt/ sec. Siempre y cuando se demuestre la capacidad del acuífero con un estudio geohidrológico detallado del predio. Debe implementarse un sistema de monitoreo con registro continuo del acuífero y debe inscribirse en el Consejo de Cuenca de la CNA.	
						8. Se deberán restaurar las áreas afectadas por las actividades de prospección y/o abandono de proyectos.	
						Control de emisiones	5. Los desarrollos urbanos, turísticos, industriales, comerciales y de servicios deberán contar con un programa integral de reducción y separación de residuos sólidos y con sistemas integrales de tratamiento y disposición de aguas residuales, estos últimos de acuerdo a la NOM-SEMARNAT-001-1996, la Ley de Aguas Nacionales y su Reglamento.
						Biodiversidad	2. La utilización de cavernas y cenotes para uso recreativo y deportivo, estará sujeto a una evaluación de impacto ambiental y de estudios ecológicos que garanticen el mantenimiento de la diversidad biológica.



Flood risk map, obtained from analysis of elevations in Merida, and water flows. Source: Bautista and Aguilar (2020)

Absence of environmental risk management strategies in state instruments. POECTY, 2015.



## Example 2: Conservation of coastal dunes

Ciudad del Carmen, Campeche

- Coastal strip within a mixed-use, tourist and residential project.
- An area of dunes with high landscape value, sedimentary type and habitat for endemic species was identified.
- The initial development proposal did not consider the protection of the dune; beachfront occupied by a high-density hotel zone
- Through the NXM-AA-SCFI-2016, which establishes the requirements and specifications for beach quality sustainability, the dunes were integrated into the project.





## Conservation of coastal dunes

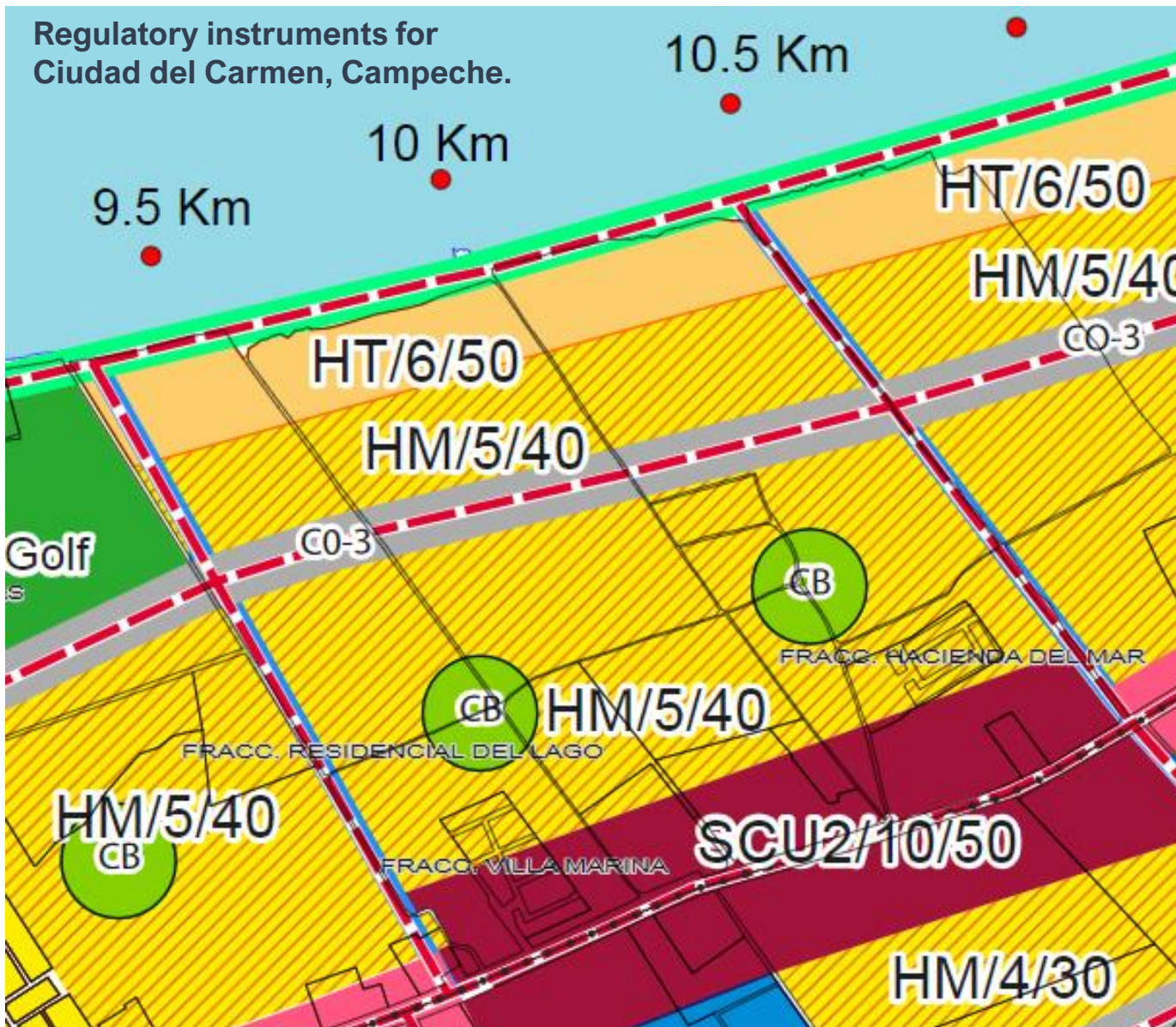
Ciudad del Carmen, Campeche



Photographic record of the site on the beach.  
Source: Recorridos de campo, Urbanística



# Regulatory instruments for Ciudad del Carmen, Campeche.



Urban Charter of the Programa Director de Desarrollo Urbano 2009 Ciudad del Carmen, Campeche

## Housing

- H Housing
- HM Mixed housing
- MC Controlled mixed
- HMS Sustainable mixed housing
- HT Tourist housing

## Equipment, commerce and services

- Cys Store and Services
- I Infrastructure
- AV Green areas
- Airport

## Equipment, commerce and services

- SCU Urban Sub-Center
- CD District Center
- CB Neighborhood Center
- E Equipment
- SAP Port Support Services
- ST Tourist Services

## Industry

- BT Warehouses and workshops
- LBI Low impact industry
- AP Fishing activity

## Natural reserves

- CAU Urban Area Conservation
- ZPE Ecological Preservation Zone

## Corridors

- CO-1 Corredor Urbano 10/40 (Habitacional Plurifamiliar Vertical, Comercio y Servicios)
- CO-2 Corredor Urbano 8/40
- CO-3 Corredor Urbano 6/40
- CT-1 Corredor Turístico 5/40
- CT-2 Corredor Turístico 4/40
- C-4 Calle Comercial 4/40
- CI Corredor Industrial
- CRV Corredor Recreativo Verde

## Programs and Projects

- Programa Parcial "Zona Centro"
- Programa Parcial "Arroyo La Caleta"
- Polígono de Actuación Concertada
- Puerto Industrial Laguna Azul
- Programa Parcial Playa Norte

## General data

- Tunnel
- Waterfront
- High Voltage Line
- Urban layout

## Roads

- Road Distributor
- Regional
- Primary
- Secondary

## BARRIER 3:

Investment in nature-based solutions in real estate developments is left to the private sector, without any municipal/state support or facilitation.

### Example 3:

#### Treatment of areas at high risk of flooding

Los Cabos, B.C.S.

### Regulatory instruments for Los Cabos, B.C.S.

State Urban Development Law

State Regulation of Fractions

Obligation to have technical reports of no impact in case of building in risk areas.

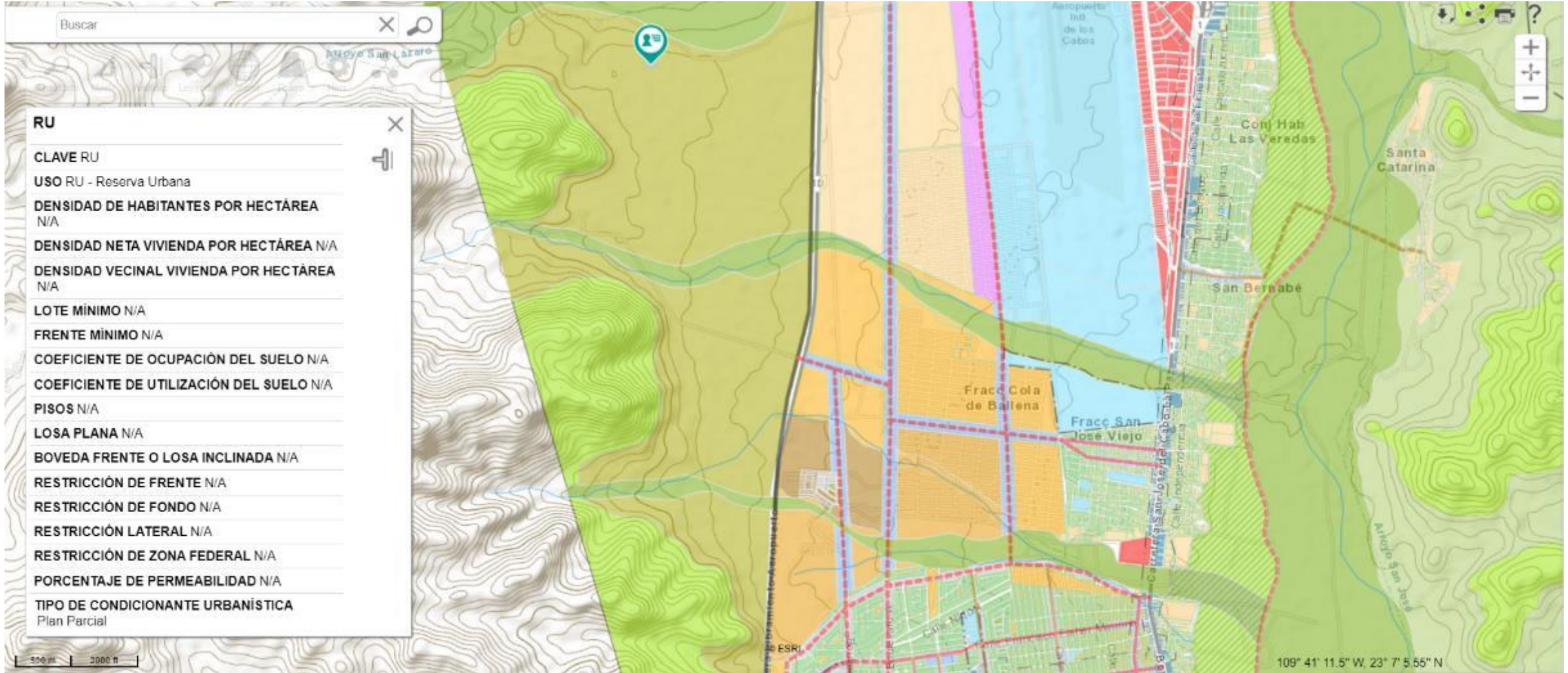
Integral works for subdivisions:

- I. Sanitary drainage, network, domiciliary discharges and final disposal site.
- II. Potable water, supply source, storage, distribution network and home connections.
- III. Paving of roads.
- IV. Sidewalks and curbs.
- V. Electric power, distribution network and street lighting.
- VI. Road signs and nomenclature.

There is no obligation or mention of green infrastructure systems.



# Urban Development Plan for the Cabo San Lucas-San José del Cabo Population Center 2040 (PDU 2040)



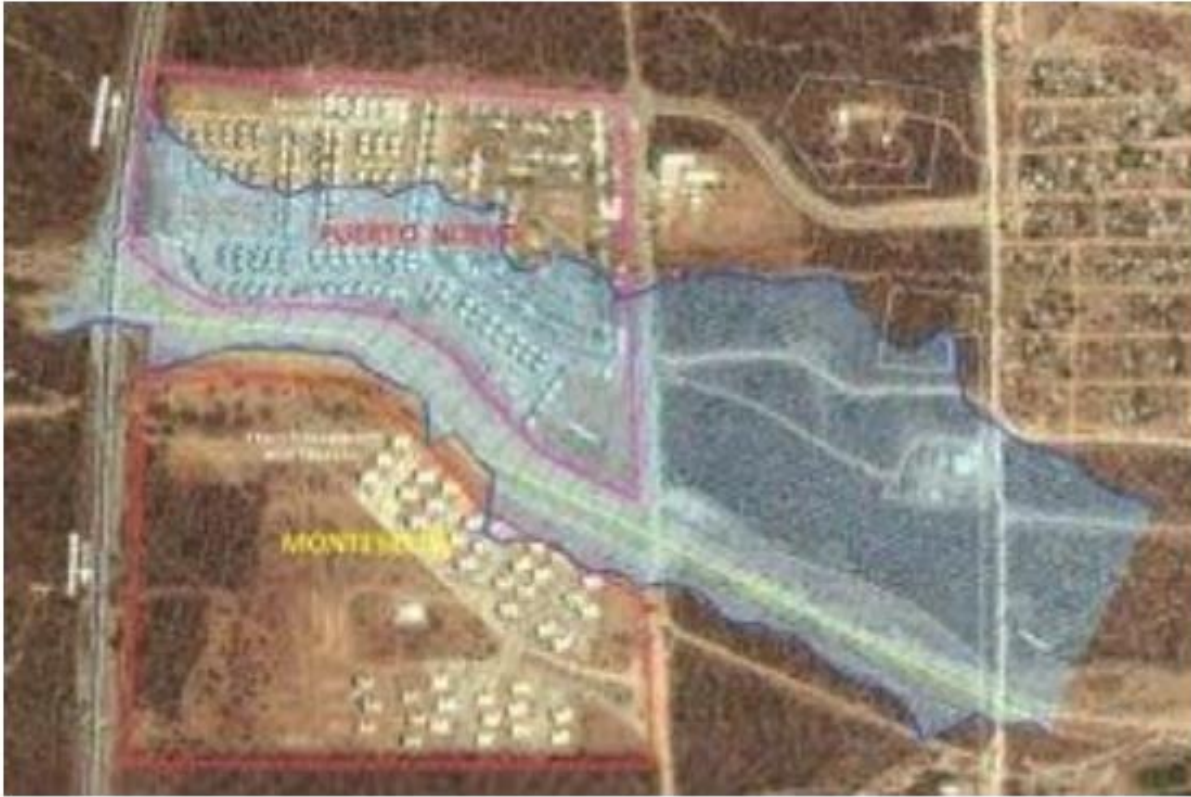
Authorized land uses in the area. Ambiguity in requirements related to environmental risk management.



- Storm water runoff in San José del Cabo, close to low-income housing areas.
- High volumes of rainwater are recorded during hurricanes and storms.



## Flood zone and building collapse in the Puerto Nuevo subdivision



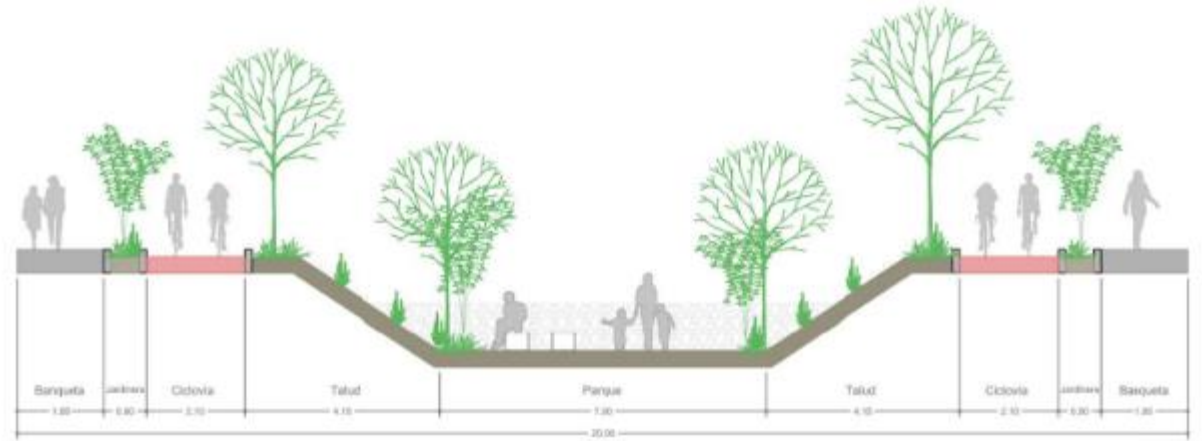
Source: bcsnoticias (2019)





Implemented solution: containment for future flooding in Puerto Nuevo subdivision

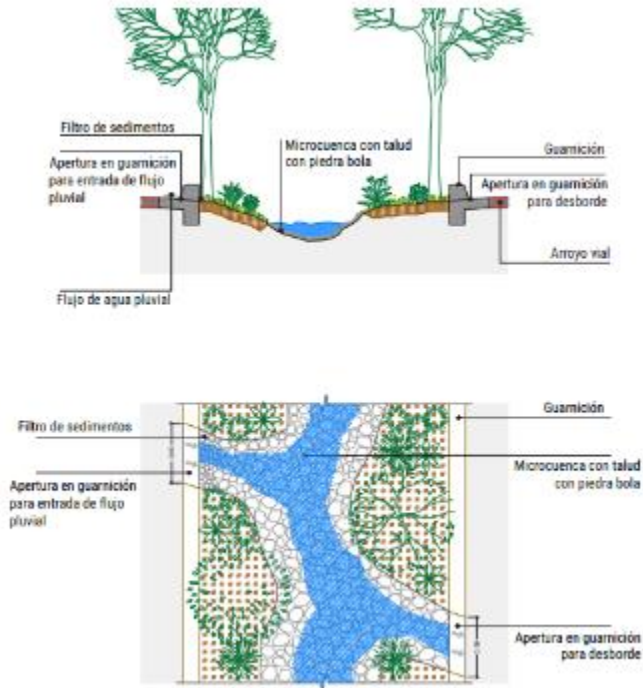




Alternative solutions: linear parks in runoffs

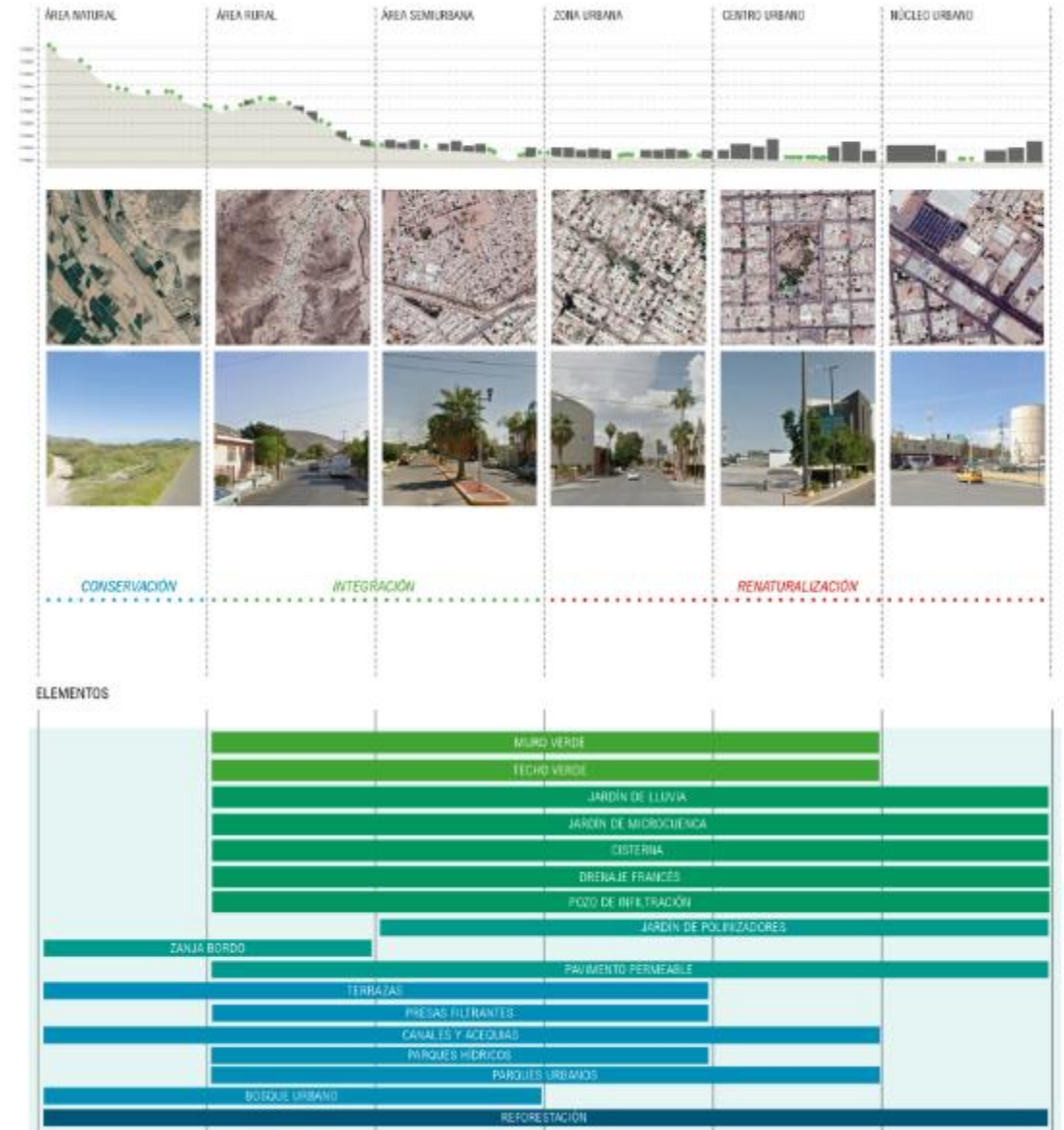
# Conclusions

- Development of methodology for the implementation of green infrastructure techniques.
- Inclusion of technical guidelines for green infrastructure elements in municipal Technical Construction Standards.
- I.V. financing mechanisms through environmental compensation measures.



Construction detail of a micro-watershed garden.  
 Norma Técnica de Infraestructura Verde de León, Guanajuato.  
 Source: Own elaboration, Urbanística (left).

Urban transect of analysis  
 Source: Own elaboration, Urbanística (right).



Nature-based Solutions for Coastal Flooding Workshop Series:  
***Nature-based Solutions (NBS) Co-Benefits Workshop***

Salvador Herrera Montes

Urbanística

México

***Thanks!***

***salvador@urbanistica.mx***

13 de mayo, 2022



COMISIÓN PARA LA  
COOPERACIÓN  
AMBIENTAL



**urbanística**

UNOFFICIAL TRANSLATION | TRADUCCIÓN NO OFICIAL