Movimento Verde en contra del Agua Verde

Tesis para la Universidad de Cornell

I Maria Calderon

Contenido de la presentación

Contexto

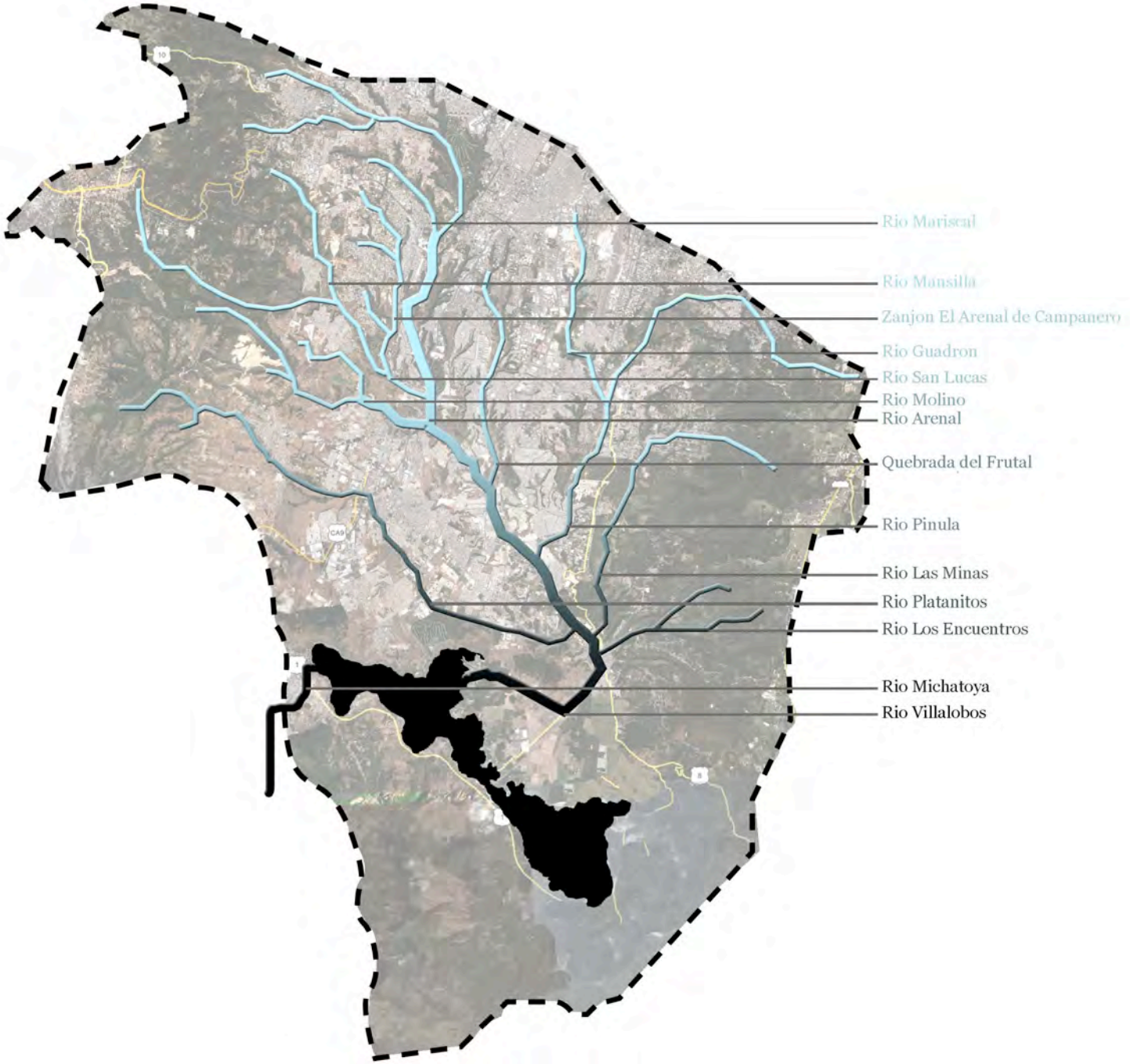
Problemas actuales

Soluciones existentes

Soluciones propuestas

Contexto

Ciudad de Guatemala + Lago de Amatitlan


Rio Mariscal
Rio Mansilla
Zanjon El Arenal de Campanero
Rio Guadron
Rio San Lucas
Rio Molino
Rio Arenal
Quebrada del Frutal
Rio Pinula
Rio Las Minas
Rio Platanitos
Rio Los Encuentros
Rio Michatoya
Rio Villalobos

Problemas actuales

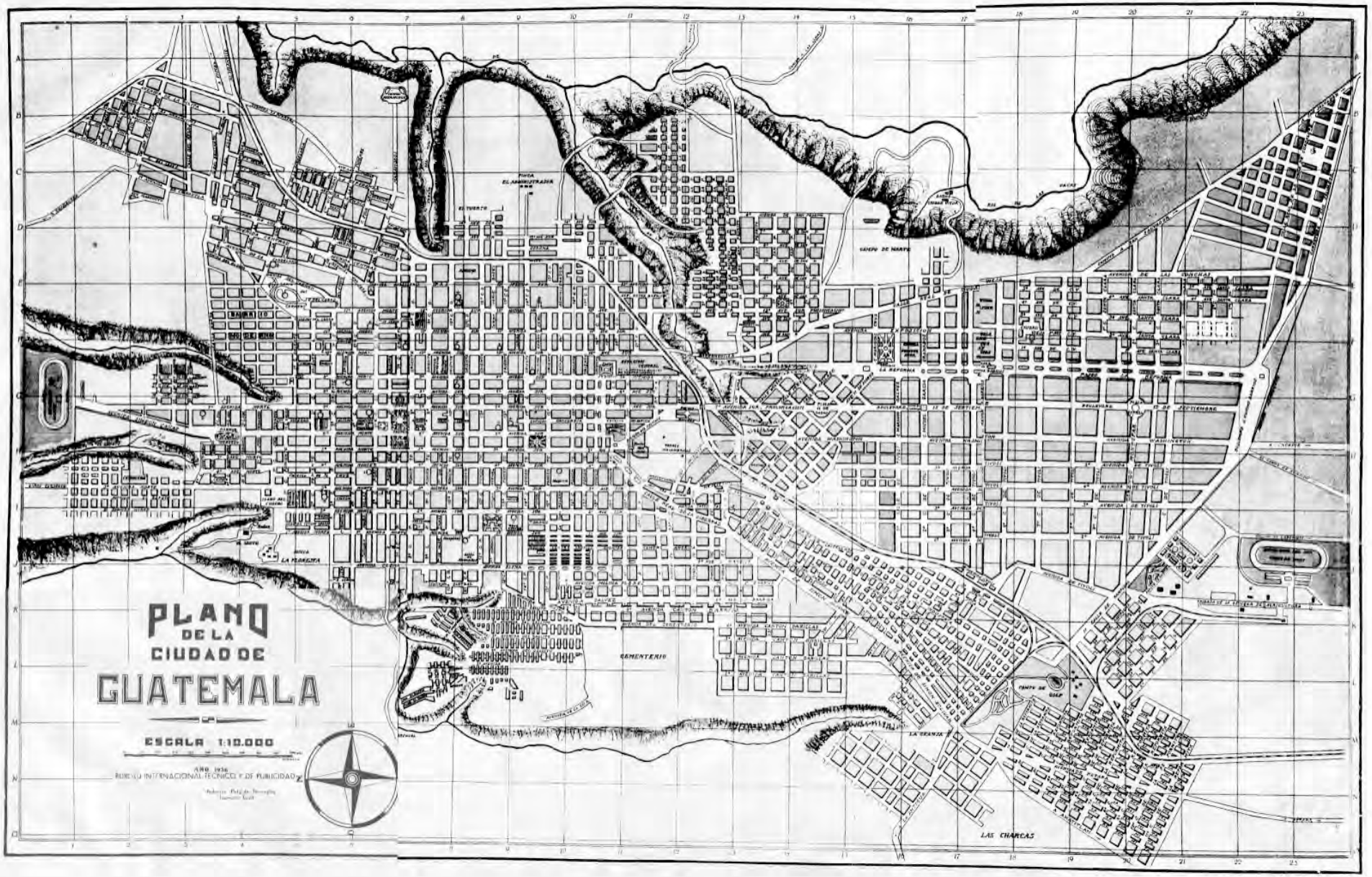
Erosión en Barrancos

Desechos depositados en ríos

Invasión de ninfa

Eutrofización

Inundaciones


PLANO
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GUATEMALA
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AÑO 1936
BUREAU INTERNACIONAL TECNICO Y DE PUBLICIDAD
CEMENTERIO
LA FLORESTA
LA REFORMA
LAS CHARCAS


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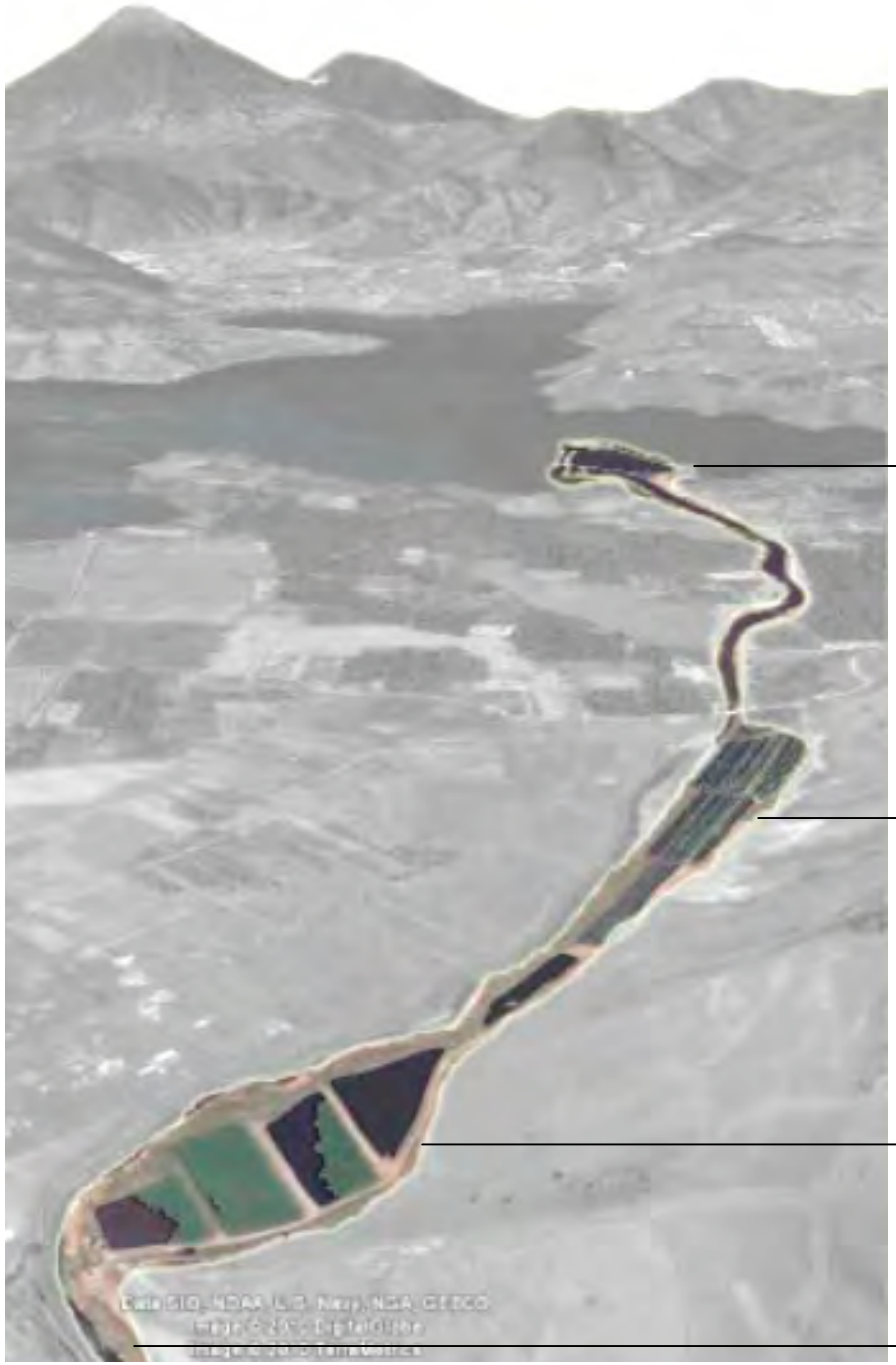
Soluciones Existentes (AMSA)

Enrocado de ríos

Aereadores

Reforestación de taludes

Limpieza de basura



4 la dárcena

3 biofiltros

2 lagunas anaerobicas

1 canalización

Soluciones Propuestas

Carteles informativos

Parque Funcional

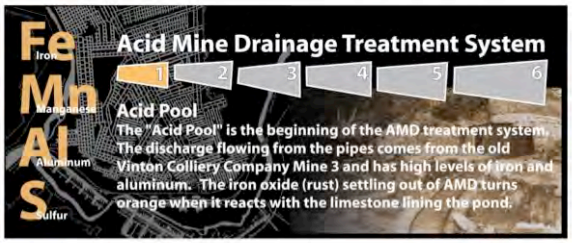
Naturalización del caudal del río

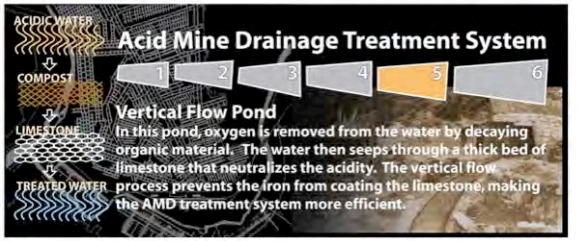
Planeamiento Urbano

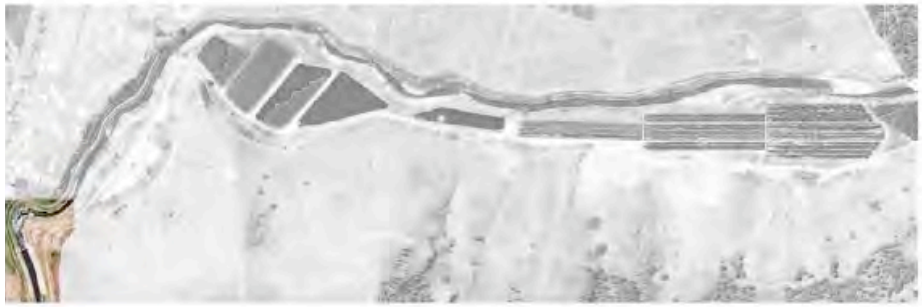
Carteles informativos

AMD&ART

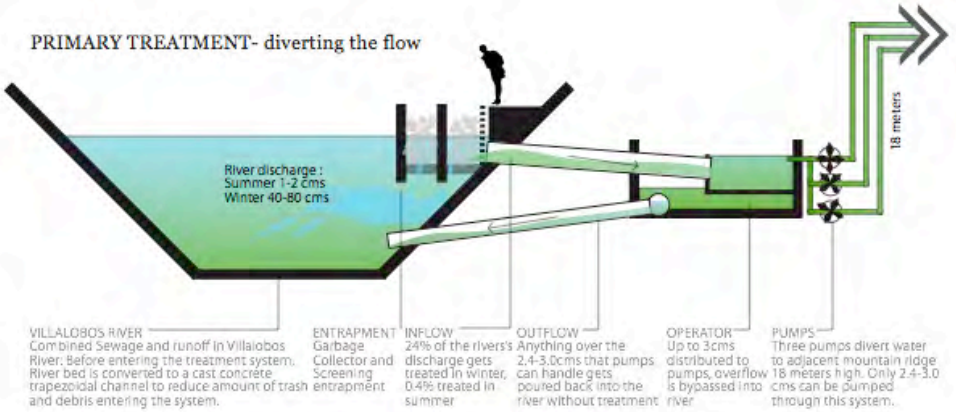
Vintondale Pensilvania







PRIMARY TREATMENT- diverting the flow



VILLALOBOS RIVER
Combined Sewage and runoff in Villalobos River: Before entering the treatment system, River bed is converted to a cast concrete trapezoidal channel to reduce amount of trash and debris entering the system.

ENTRAPMENT
Garbage Collector and Screening entrapment

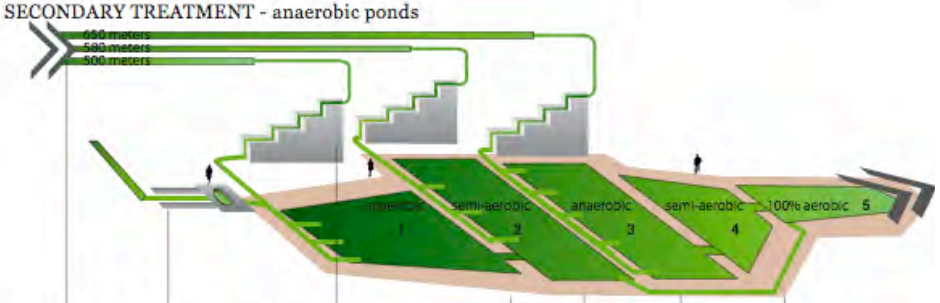
INFLOW
24% of the rivers's discharge gets treated in winter, 0.4% treated in summer

OUTFLOW
Anything over the 2.4-3.0cms that pumps can handle gets poured back into the river without treatment

OPERATOR
Up to 3cms distributed to pumps, overflow is bypassed into river

PUMPS
Three pumps divert water to adjacent mountain ridge 18 meters high. Only 2.4-3.0 cms can be pumped through this system.

SECONDARY TREATMENT - anaerobic ponds

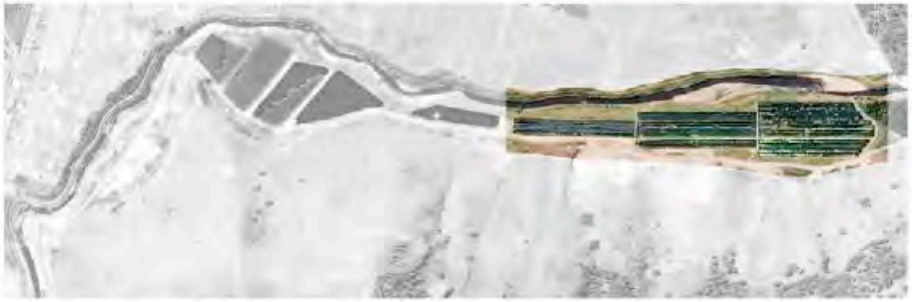


DISTRIBUTION CHANNELS
water effluents from Villa Lobos River travel 500 to 650 meters along mountain ridge

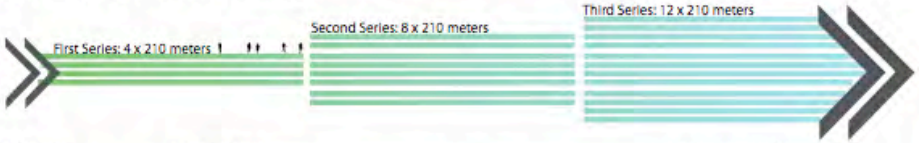
VILLA CANALES RIVER
effluents from different river chanelled in suspended pipe and pretreated in a twin desedimentation system

CASCADING STEPS
water effluents from distribution channels cascade into ponds 1, 2 & 3 getting aerated in the process

FILTRATION PONDS
Secondary treatment of anaerobic and aerobic processes aided by the use of bacteria and aerators. First 4 ponds are 1.5-2 m deep. Water in ponds flows in order 1-2-5 (plus villa canales pipe), and 3-4-5



TERTIARY TREATMENT - bioremediation filters



BIOFILTERS
after the 5 pool sequence, distribution channel splits water into four biofilters.

AIDING PLANTS
biofilters are planted with local typha and nympha, with a 35-50% pollutant removal efficacy

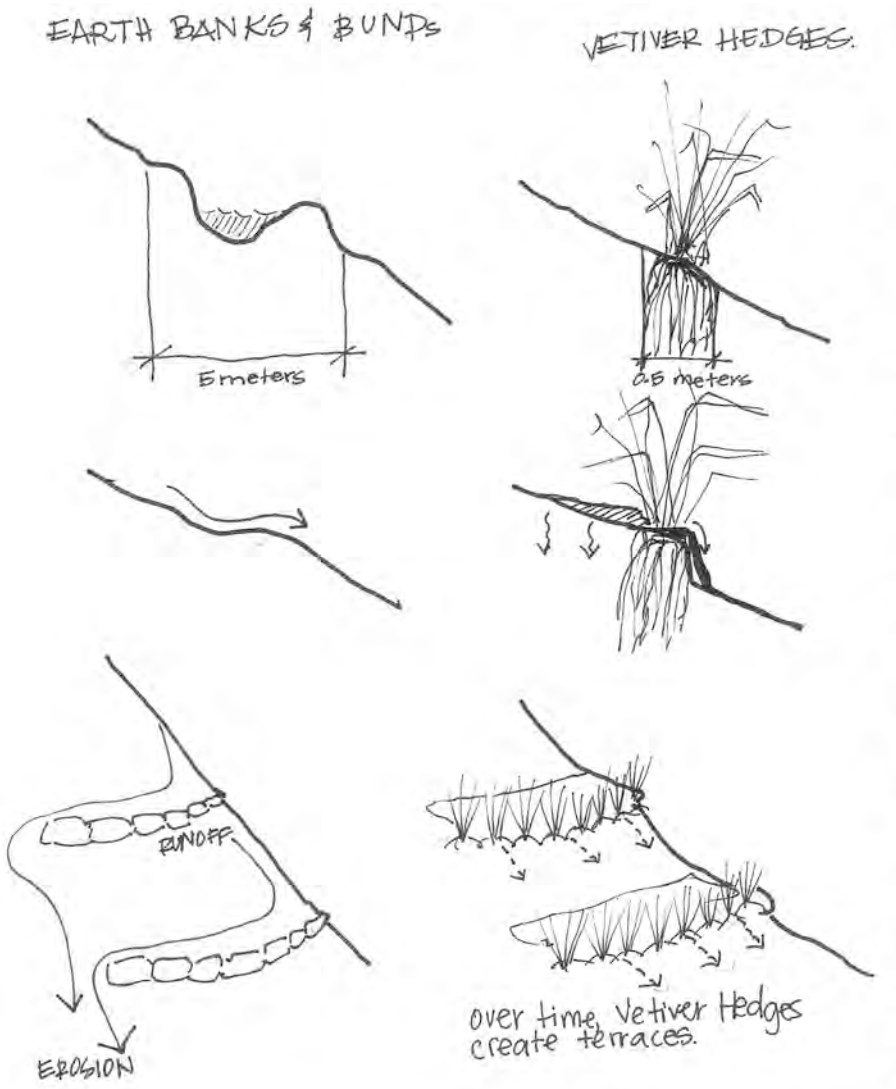
biofilters are then split into 8 and 12 biofilters, comprising a total of 24 lagoonettes.

The length of each one is 210 meters, which altogether compile to a length of 5.4 kilometers.

QUANTITY TREATED
210m x 5.625m, (trapezoid area) = 28,350 m, of water goes through the system every day

Reforestación de Taludes

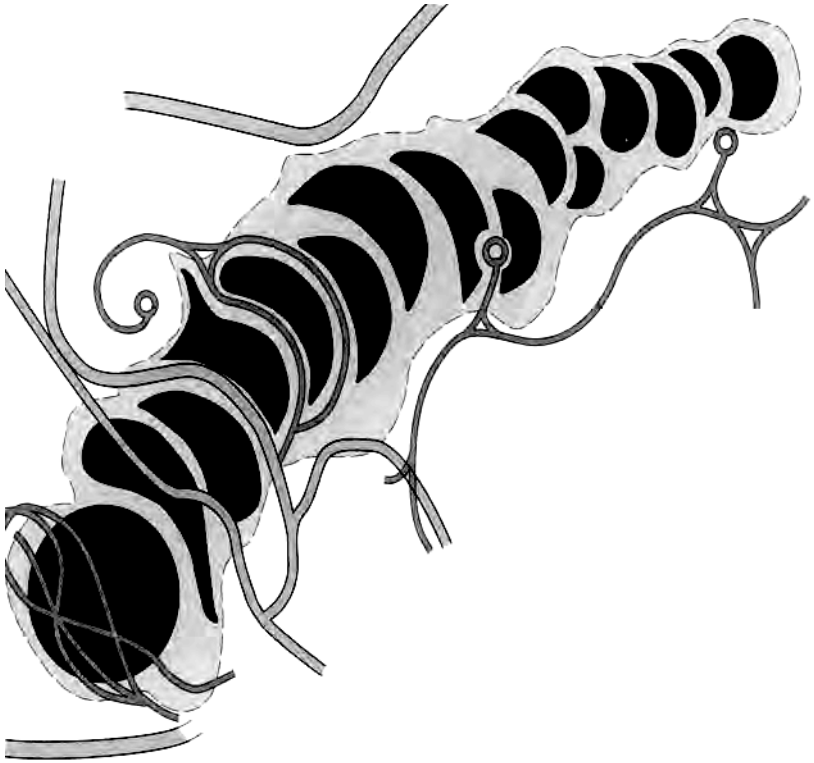
Estabilización de taludes y detención de agua



Adaptado de “Vetiver System Applications”

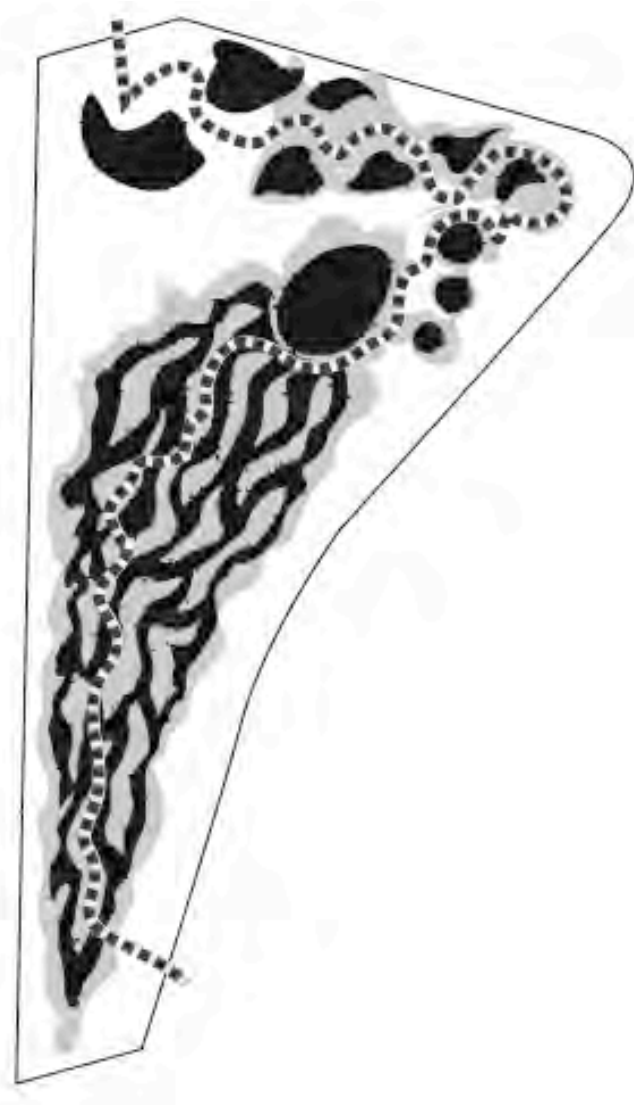
Parques Funcionales

Jardín de Agua de Oregon



Arcata Wastewater Treatement Marsh

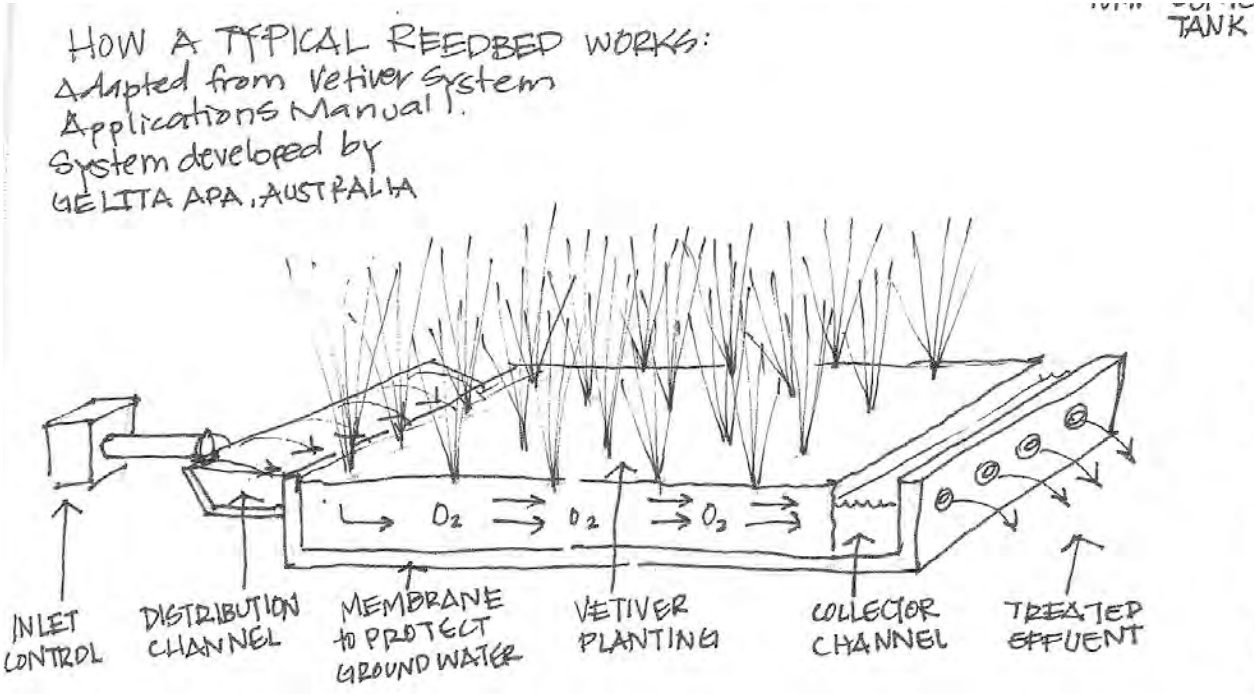
Waterworks Garden Washington

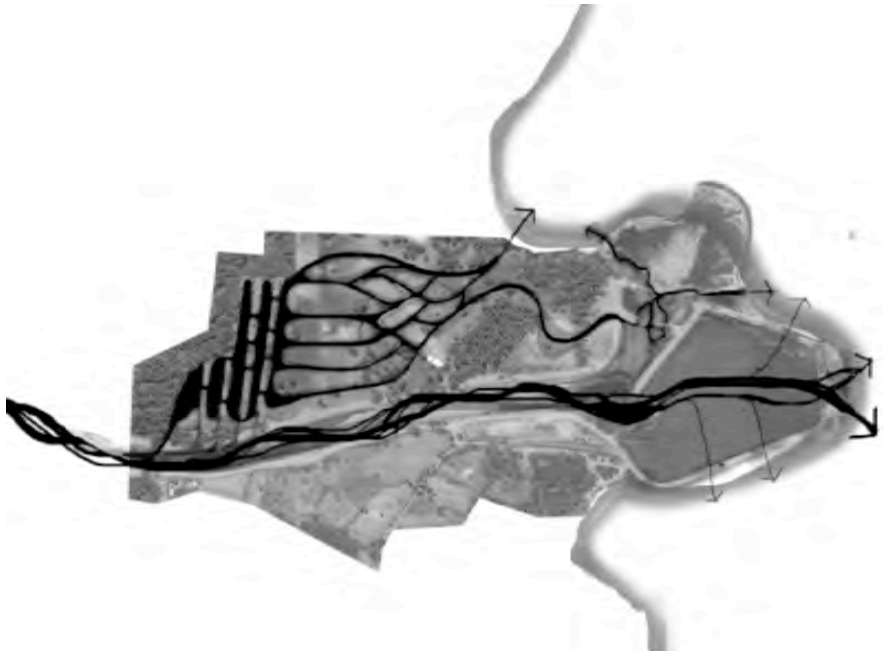


Laguna de Retención de Solidos
(Darcena)

AMSA
www.amsa.gob.gt

Depósito de aguas domesticas





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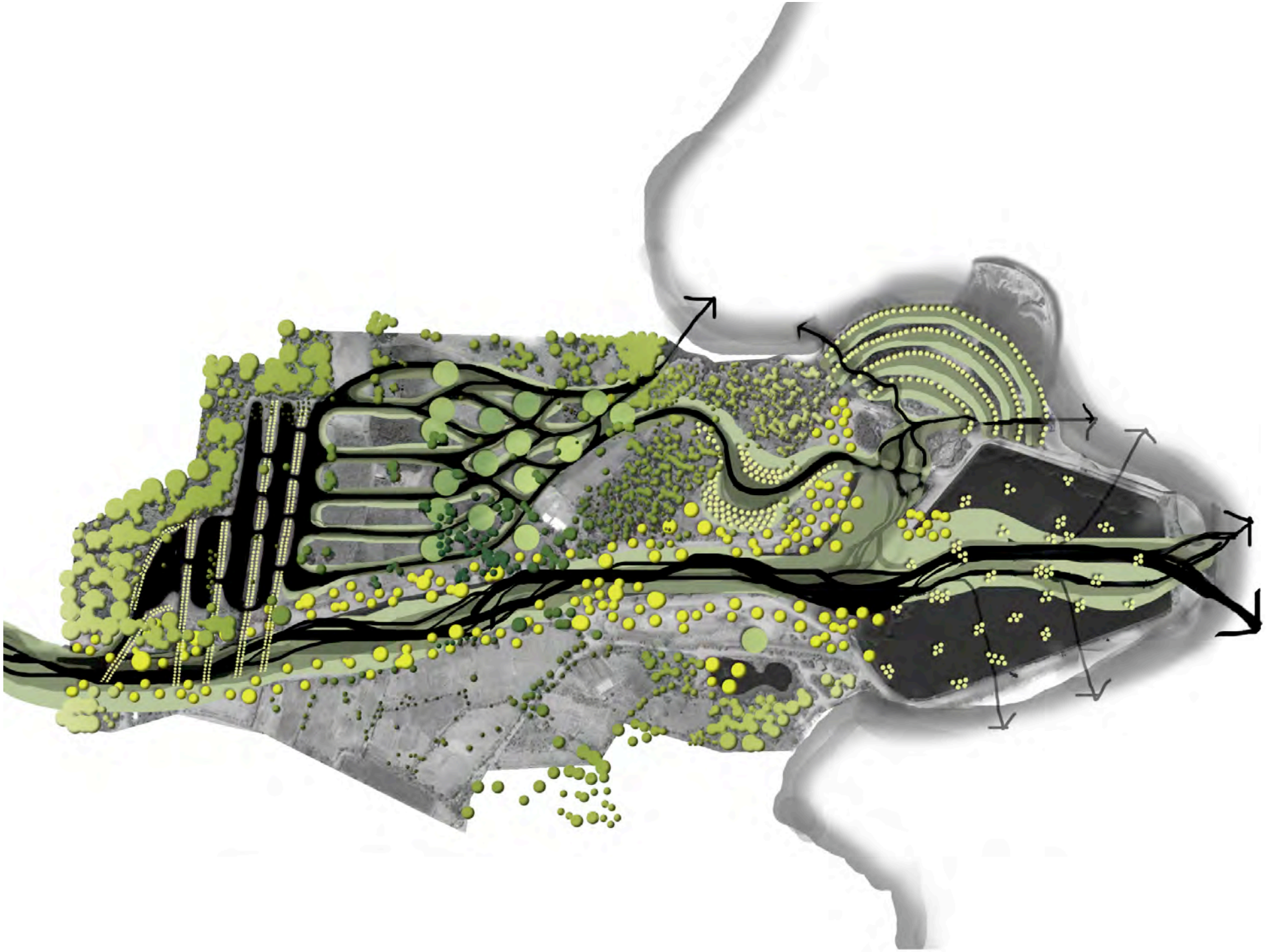
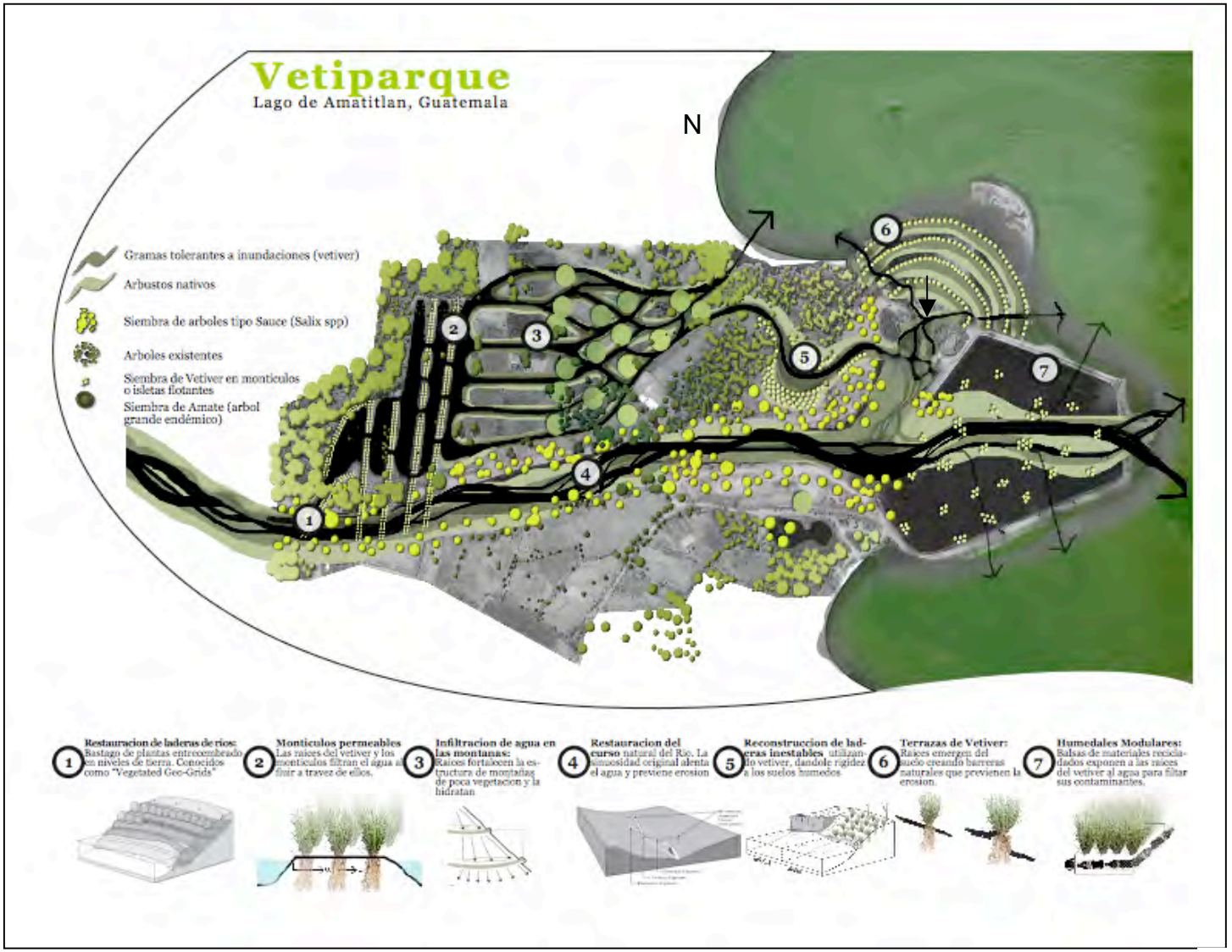
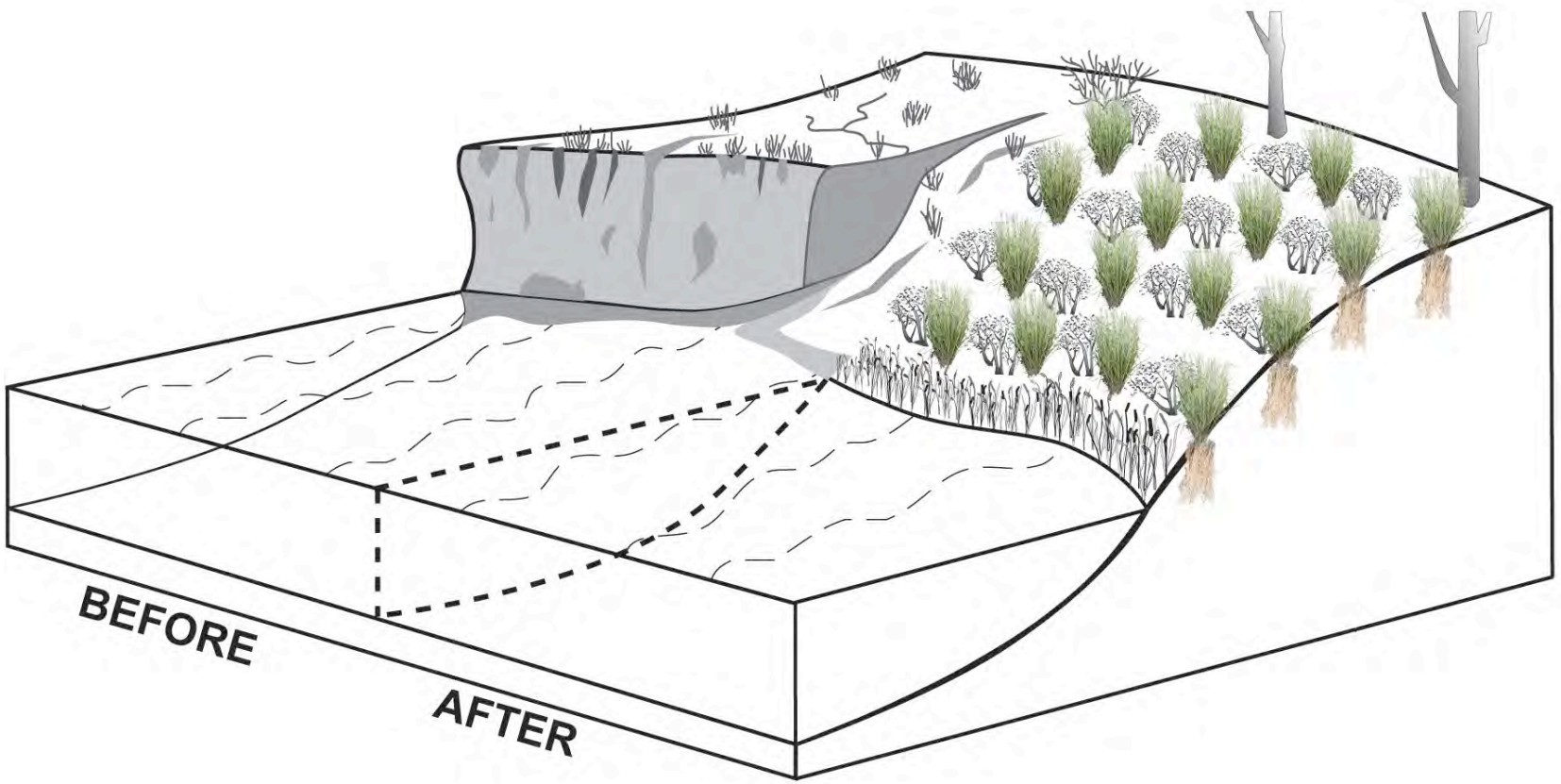



Vetiparque
Lago de Amatitlan, Guatemala
N
Gramas tolerantes a inundaciones (vetiver)
Arbustos nativos
Siembra de arboles tipo Sauce (Salix spp)
Arboles existentes
Siembra de Vetiver en monticulos o isletas flotantes
Siembra de Amate (arbol grande endémico)
1
2
3
4
5
6
7
1 Restauracion de laderas de rios: Bastago de plantas entrecembrado en niveles de tierra. Conocidos como "Vegetated Geo-Grids"
2 Monticulos permeables Las raices del vetiver y los monticulos filtran el agua a fluir a travez de ellos.
3 Infiltracion de agua en las montanas: Raices fortalecen la estructura de montañas de poca vegetacion y la hidratan
4 Restauracion del curso natural del Rio. La sinuosidad original alenta el agua y previene erosion
5 Reconstruccion de laderas inestables utilizando vetiver, dandole rigidez a los suelos humedos
6 Terrazas de Vetiver: Raices emergen del suelo creando barreras naturales que previenen la erosion.
7 Humedales Modulares: Balsas de materiales reciclados exponen a las raices del vetiver al agua para filtar sus contaminantes.

Restauración de ríos

Reconstrucción de laderas inestables

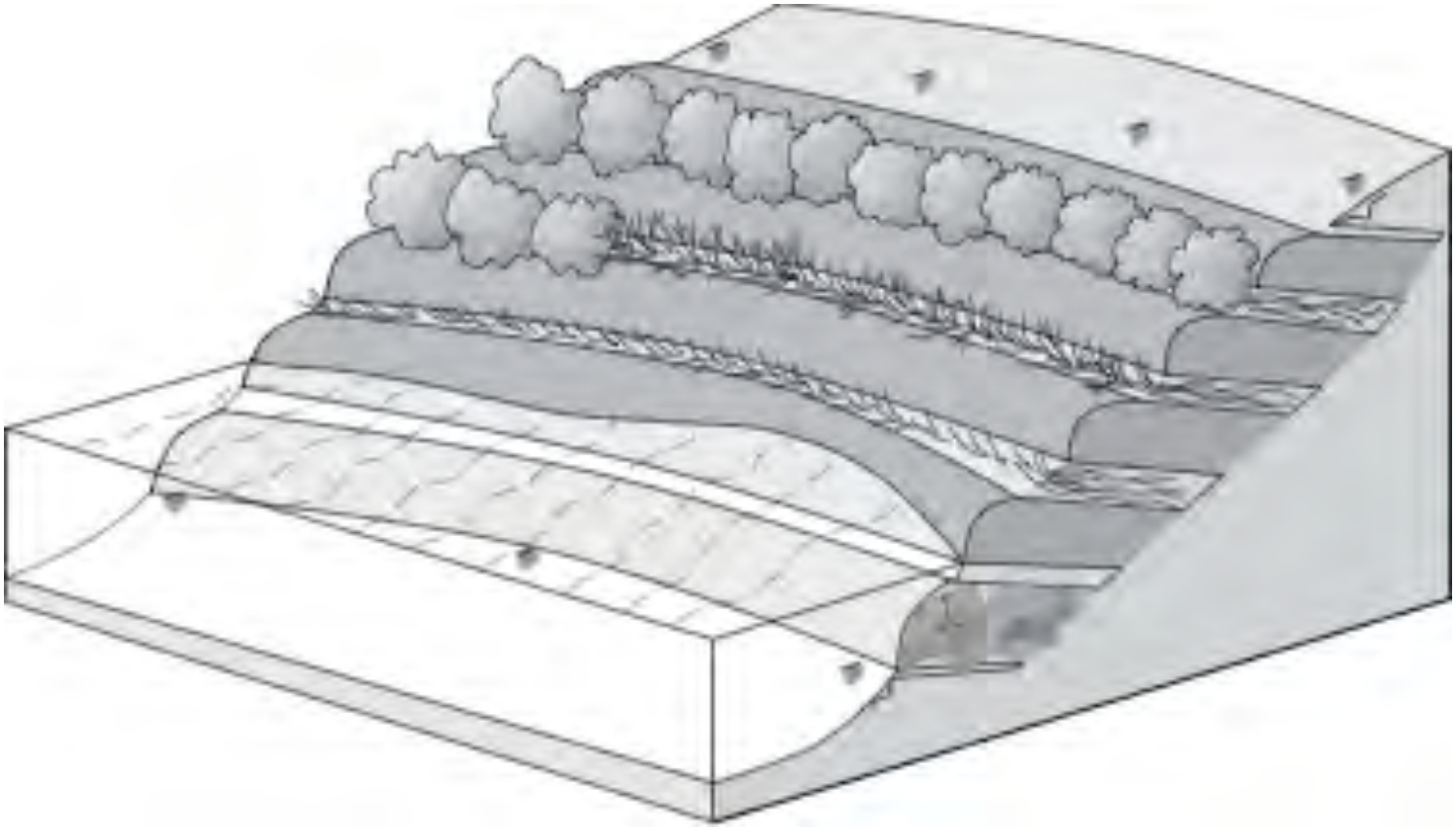
El cauce del río es regresado a su estado natural



Adaptado de “Stream Corridor Restoration: Principles, Processes, and Practices, 10/98, by the Federal Interagency Stream Restoration Working Group (FISRWG)”

“ Vegetated Geo-Grids”

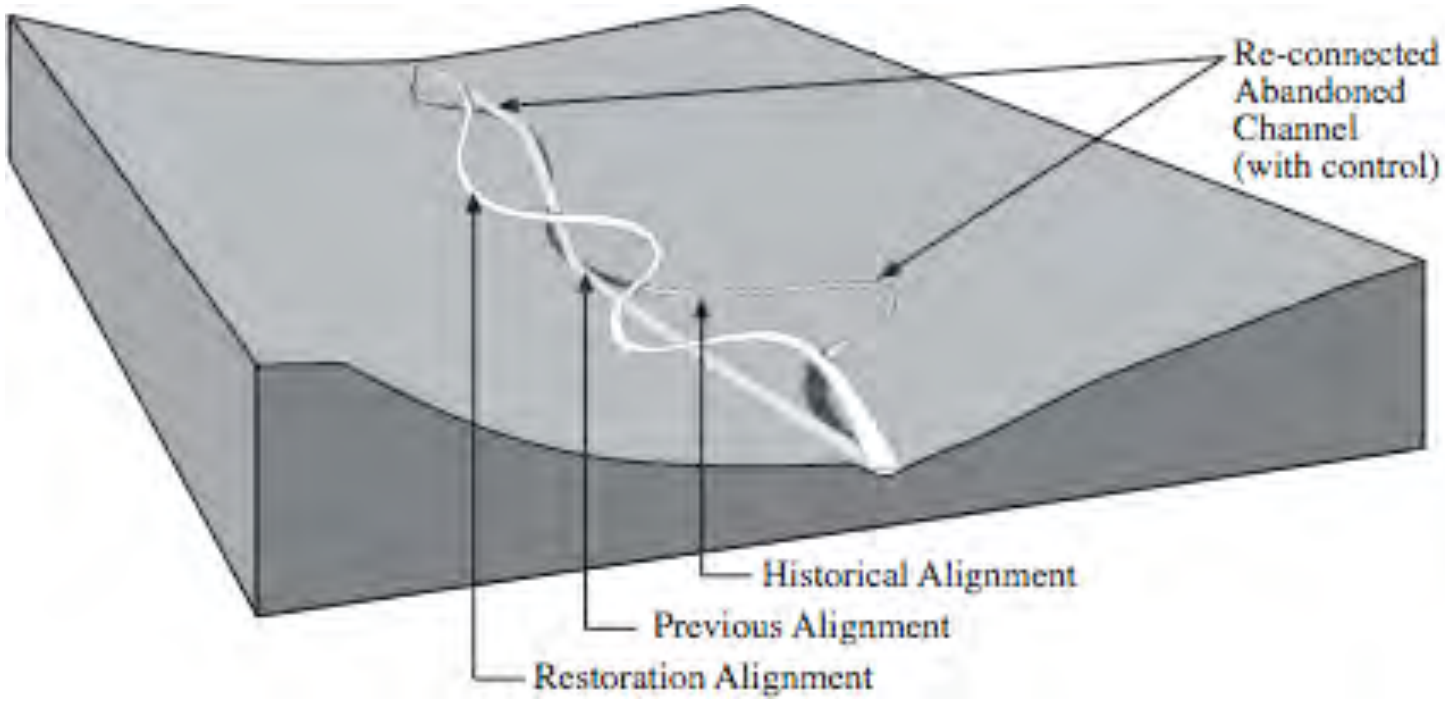
Ramas de plantas entrecembradas en niveles de tierra.



Adaptado de “Stream Corridor Restoration: Principles, Processes, and Practices, 10/98, by the Federal Interagency Stream Restoration Working Group (FISRWG)”

Restauración del curso natural del río

La sinuosidad original alenta el agua y previene la erosión

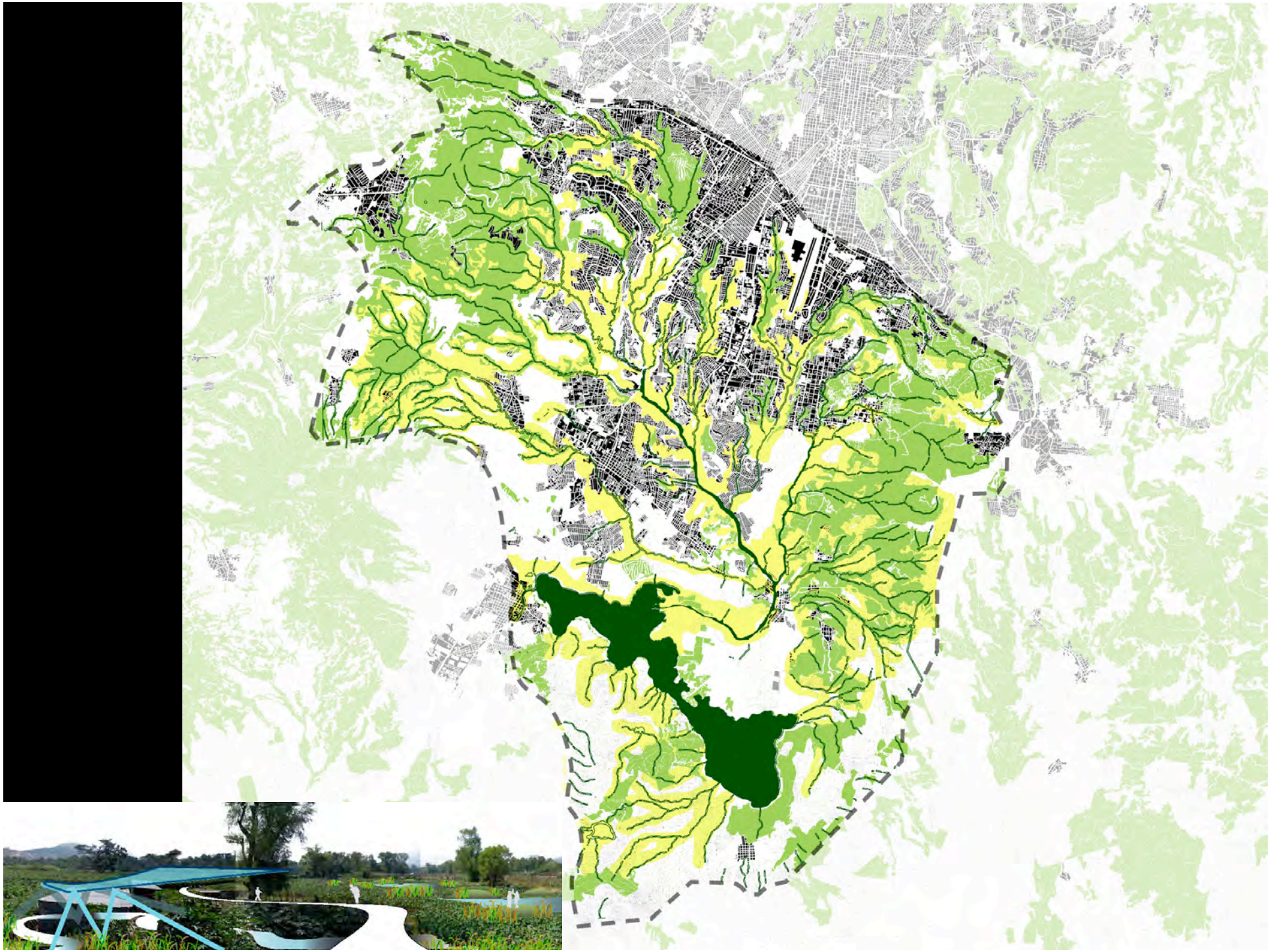


Adaptado de “Stream Corridor Restoration: Principles, Processes, and Practices, 10/98, by the Federal Interagency Stream Restoration Working Group (FISRWG)”

Balsas flotantes de Vetiver

Planeamiento Urbano

Cleveland, Ohio



Un movimiento verde

Preguntas?