Serving Multiple Ends:
WATER AND URBAN DESIGN

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What value does water have for you?

What are your favorite places near water?

What experiences with water in the urban environment do you enjoy?

Water is a necessity:
drinking, bathing, flushing, washing, irrigating.

3 Waters

- Clean Water source

- Stormwater quantity and quality

- Sewage (Gray Water, Black Water)

Water is habitat:

Streams, rivers, wetlands, lakes, ponds, beaches estuaries, bays, sounds, oceans.

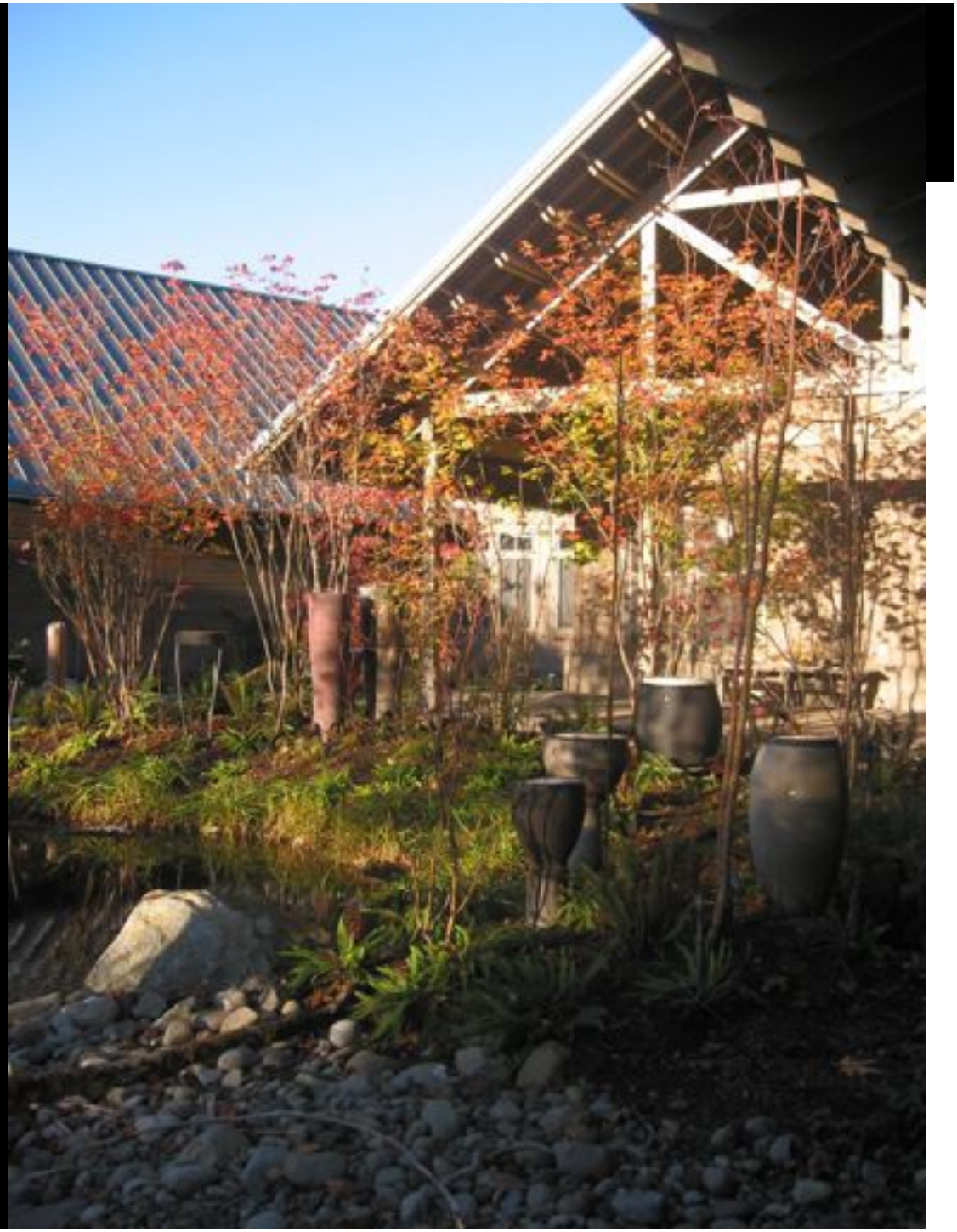
Photo: Seattle Times

Water is Pleasure:

sensory
recreation
meaning.

We are drawn to water.

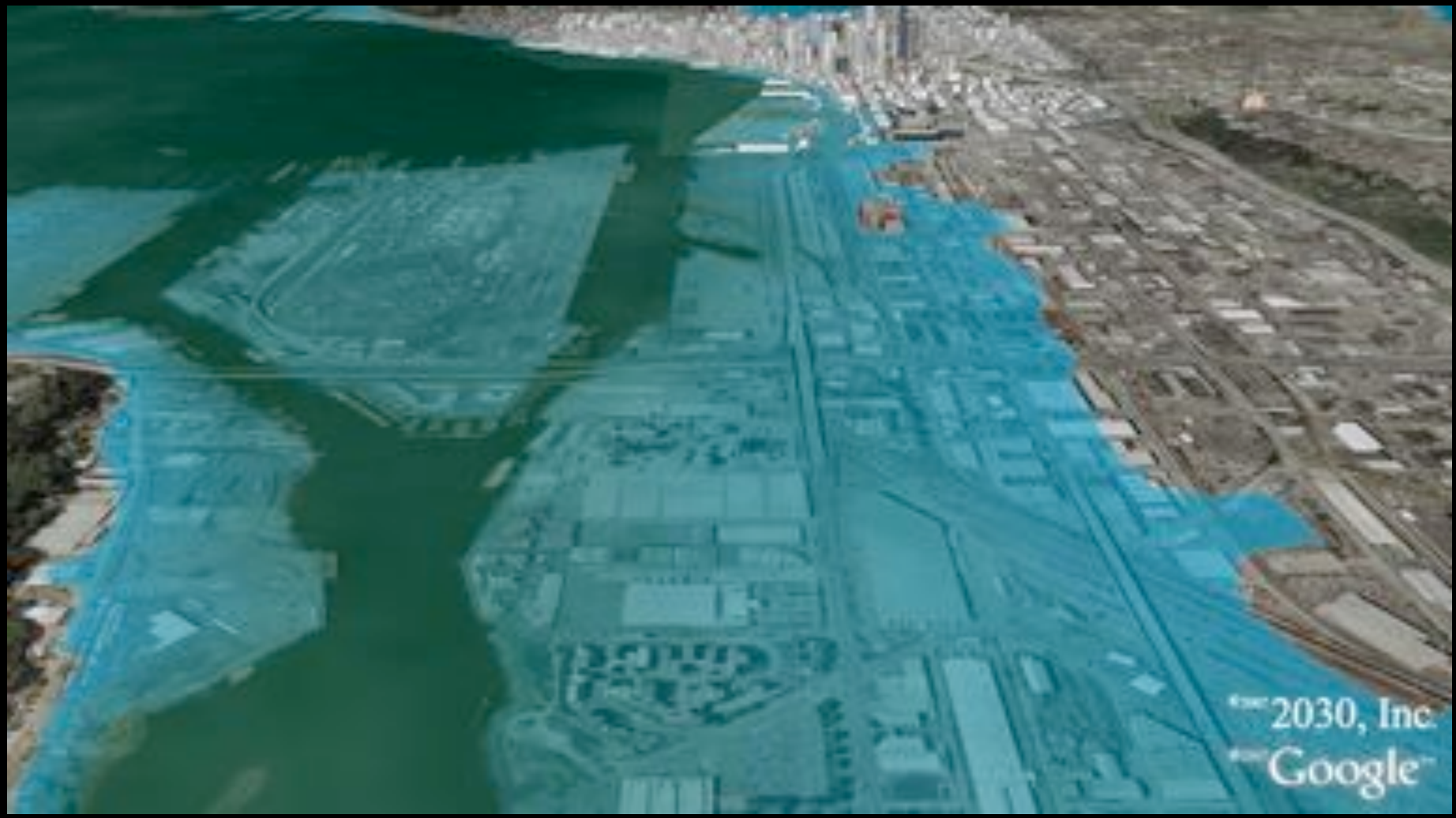
"If there is magic on this planet, it is contained in *water*." – *Loren Eiseley*



Goldilocks syndrome: Not too much or too little – the right amount at the right times

Mt. Vernon flood 2003
Skagit Information Management System

Predictability vs Uncertainty



Seattle modeled with 3 meter sea level rise
Architecture 2030

Most cities are located on or near a water body.

Some of our favorite cities are water cities…

Amsterdam……..Vancouver BC……Venice, Italy

Some of our favorite cities are water cities…

Copenhagen, Denmark……Sydney, Australia …….Suzhou, China

Cities are often located in important aquatic habitat areas: e.g. estuaries, lake, rivers,

Seattle's critical passage for migrating salmon

Challenges

How do we simultaneously fulfill the needs for

- **resource for human use and health**
- **aquatic ecosystem integrity**
- **urban amenity:**

to create “magnet cities” that reduce our overall ecological footprint

Urban Design for local and global sustainability.

Intensity

(Density done right)

+

Amenity

=

Sustainability

"In livable cities lies the preservation of the world"

Mike Houck, Urban Greenspaces Institute

Today's talk

1. Urban Water:

Meeting Multiple Needs Simultaneously for Urban and Ecological Sustainability

2. Examples of Water in Urban Design

Contexts: parks, streams, waterfronts, streets, neighborhoods, buildings, outdoor spaces

3. Waterfront Stormwater Solutions

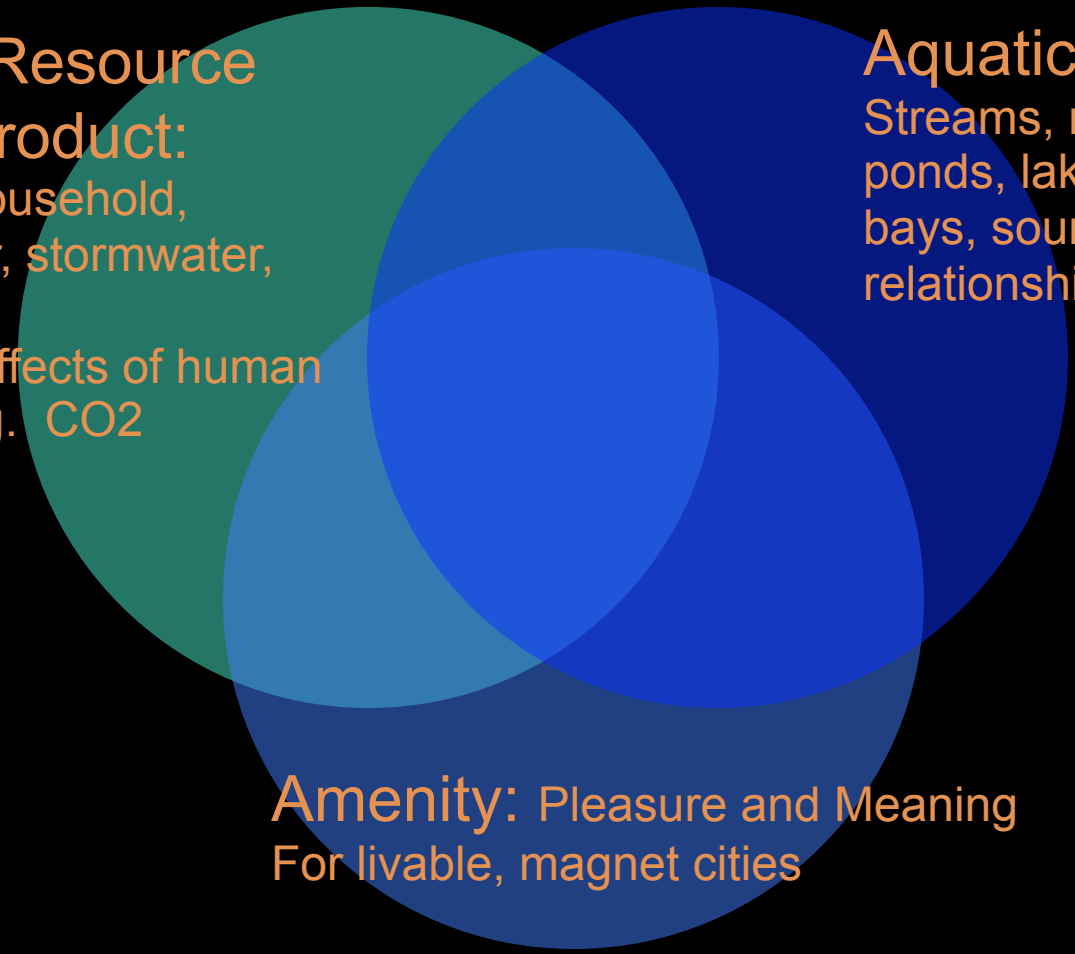
Green Futures Lab project for Puget Sound

4. Concluding Principles:

How will we manage and design with water to serve multiple ends?

1. Urban Water:

Meeting Multiple Needs Simultaneously for Urban Sustainability



2. Examples of Water in Urban Design

Contexts: parks, streams, waterfronts, streets, neighborhoods, buildings, outdoor spaces

A. PARKS

Sydney 2000 World Olympics Site Park

Sydney Olympic Site: Integrated Water system

- **collection and treatment of sewage**
- **collection, treatment and storage** of stormwater
- **supply of recycled water for** non-drinking uses to all residents, commercial premises and sporting venues
- **is capable of servicing a population** of approximately 20,000 people.

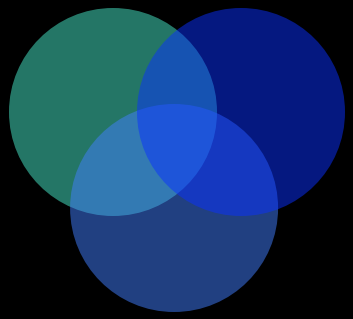
- Sydney integrated water management

Sydney Olympic Site: Habitat

over 400 plant species • over 180 bird species • 7 frog species • 10 bat species • 10 reptile species • 1000s of invertebrate species

Sydney Olympic Site: Urban Design for Pleasure and Livability

Sydney Olympic Site: Integrating Water Conservation, Habitat and Livability



Christchurch Waterways, Wetlands and Drainage Program

Drainage Department reorganized in 1999 to address six values in all projects:

- landscape
- ecology
- recreation
- culture
- heritage
- drainage

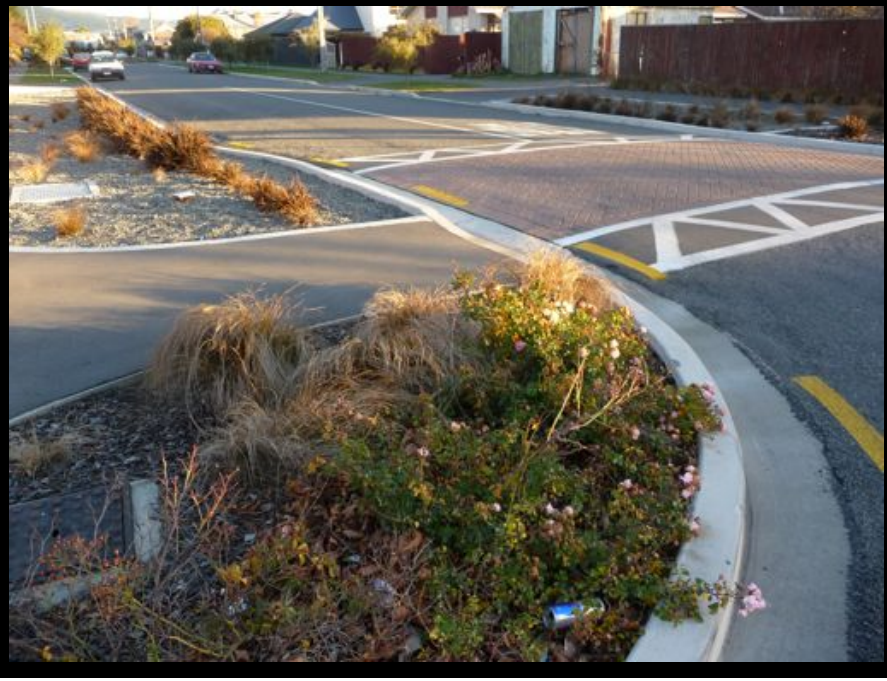
Christchurch Waterways, Wetlands and Drainage Program

Addington Retrofit Design Addresses:

- Stormwater flooding and cleansing with rain gardens and detention (human welfare + downstream river and estuary habitat)

+

- Traffic calming
- Pedestrian and bike circulation
- Connected park space
- Art and interpretation
- Neighborhood identity



Christchurch Waterways, Wetlands and Drainage Program

New park space doubles as flood control and pedestrian/bike circulation.

Christchurch Waterways, Wetlands and Drainage Program

Addington Neighborhood Retrofit

Playground, stormwater, art, landscape interpretation, neighborhood identity

Christchurch Waterways, Wetlands and Drainage Program:

Disraeli Stormwater Park, Addington Neighborhood

Wellington, NZ: City on a Bay Overlapping Systems

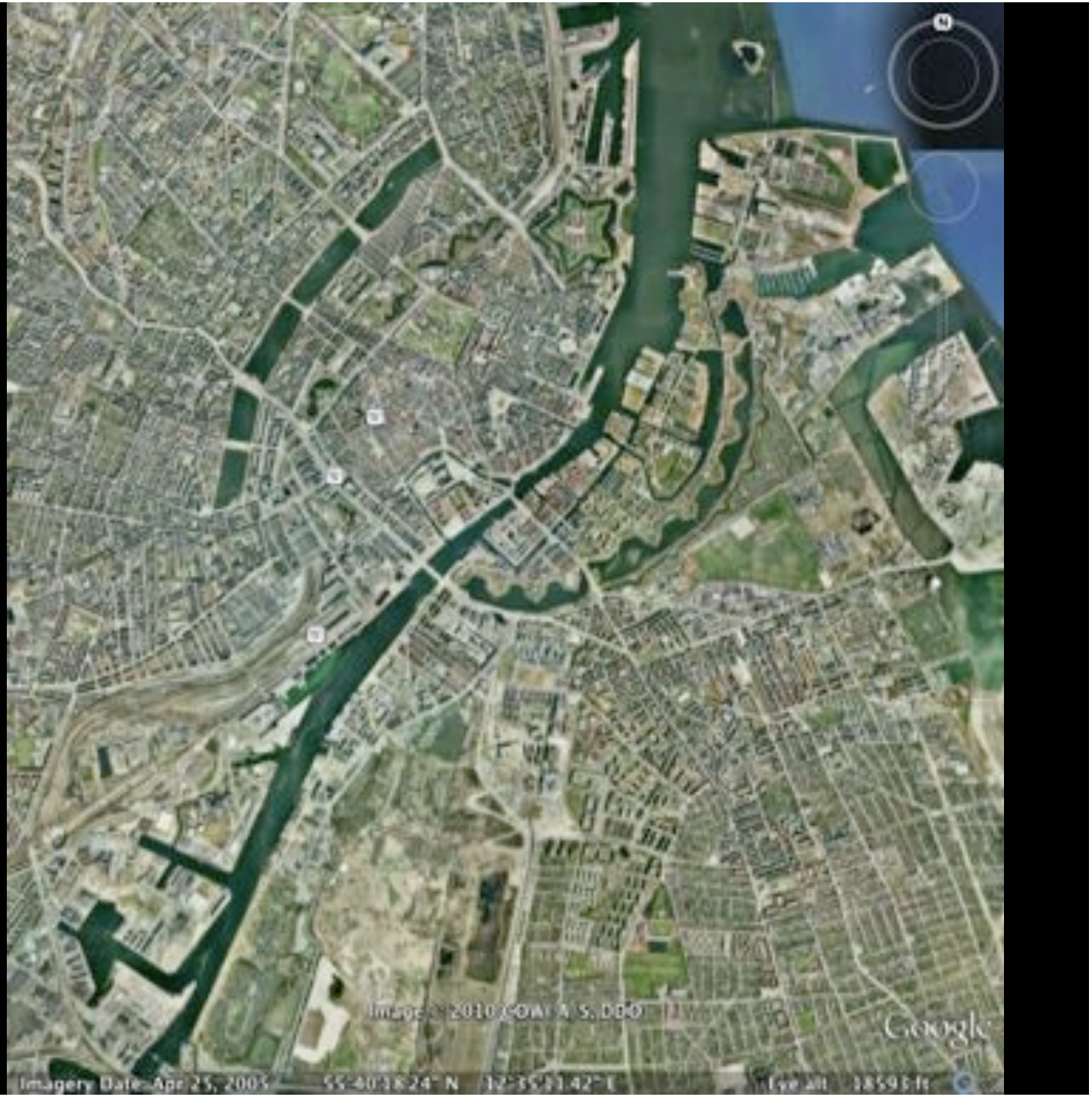
'City parks and green spaces', Te Ara - the Encyclopedia of New Zealand, updated 5-Mar-10
URL: http://www.TeAra.govt.nz/en/city-parks-and-green-spaces/2/4

Wellington Waterfront for all: Oriental Bay

Wellington Closed-Loop Water Cycling and Habitat: Waitangi Park

www.wellingtoncivictrust.org

Copenhagen

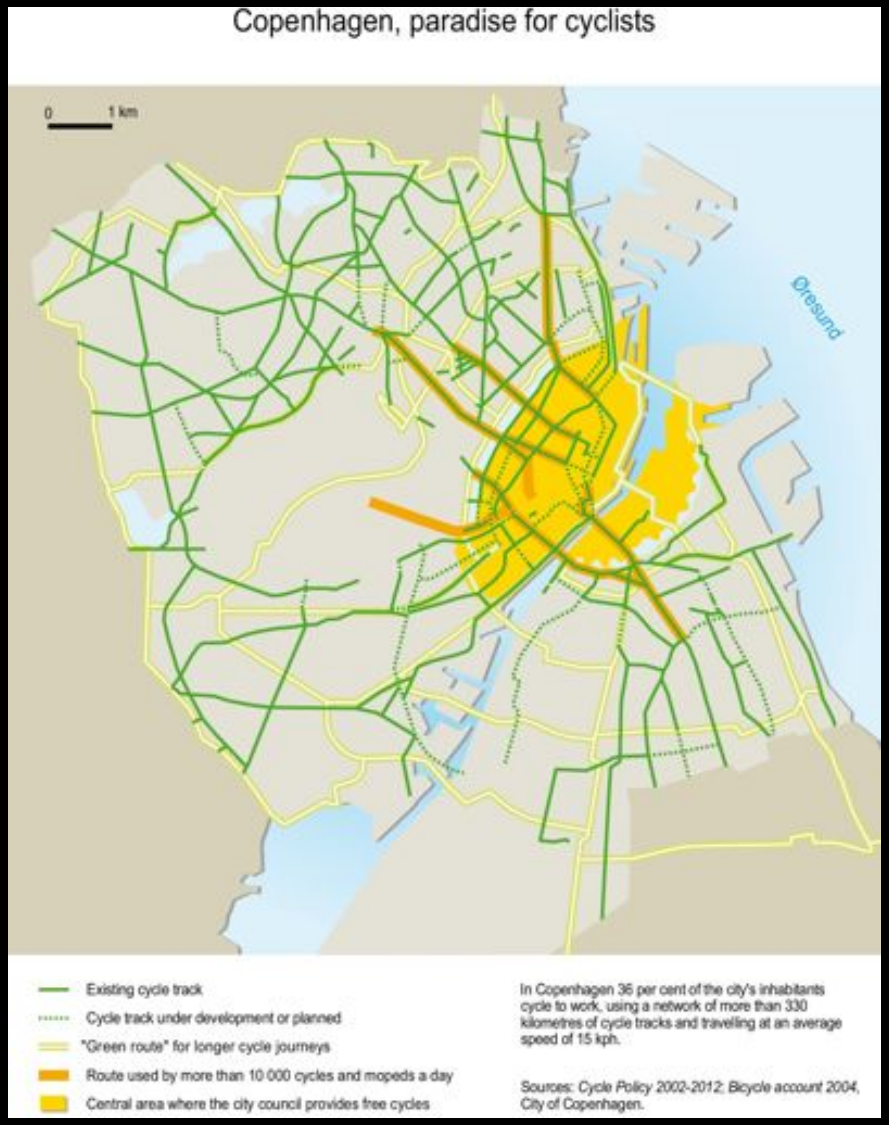


Copenhagen Harbourfront Park and Swimming Baths

Copenhagen Harbourfront Park

Copenhagen's Amager Strand: 4 km new beach and shoreline habitat

Copenhagen cycling



UNEP/GRID-Arendal http://maps.grida.no/go/graphic/copenhagen-paradise-for-cyclists1

Copenhagen commuter cycling

Seattle

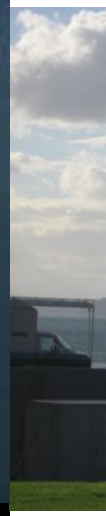
Duwamish River Restoration

Herring's House Park

Paul Joseph Brown / P-I

J. A. Brennan

Seattle



Olympic Sculpture Park

Weiss-Manfredi & Charles Anderson

Pocket Beach and Salmon Bench Restoration at OSP

Beach and Salmon Bench Restoration at OSP

OSP 1-year Monitoring Results

"Overall, Olympic Sculpture Park monitoring results indicate that there has generally been a rapid development of aquatic and terrestrial biota within the newly created habitats."

Toft et al, City of Seattle, 2008

Compared to baseline and adjacent control sites, an increase in:

- Juvenile fish (incl. chinook, chum, coho salmon)
  feeding salmon common, predator species rare

- Invertebrates – densities and taxa richness of
  epibenthic, benthic and terrestrial invertebrates

- 23 algae species, 46 – 74% cover on bench

2. Examples of Water in Urban Design

Contexts: parks, streams, waterfronts, streets, neighborhoods, buildings, outdoor spaces

A. PARKS

B. STREETS, BUILDINGS and PLAZAS

Seattle's priority creek watersheds:

Piper's Creek

Thornton Creek

Longfellow Creek

Seattle's SEA Streets: Headwaters of Piper's Creek.

SEA
Street #1

Ridgeline
Block

SEA Street Monitoring Results :

- Can fully attenuate runoff from up to 0.75 inch of rain, 99% of 2-year 24-hour storm event
- Prevented discharge of 98% of wet season runoff and all dry season runoff
- Only 10% of events produced discharge (all events measured, mostly in dry season, discharged from preceding street)
- Discharge estimated at <25% of conventional street discharge

Horner et al 2002, City of Seattle

SEA Street #2:
110th Cascade

Attenuates and treats 21 acres of sloping catchment

Water quality

Removal rates (based on mass loading):

Total suspended solids (TSS) 84%
Motor oil 92%
Total lead 90%
Total copper 83%
Dissolved copper 67%
Total zinc 76%
Dissolved zinc 55%
Total nitrogen 63%
Total phosphorus 63%

SEA Streets #3: Broadview Green Grid

Vine Street

Beckoning Cistern and Cistern Steps

Buster Simpson, Gaynor, and SvR Design

Seattle City Hall

Photo: Christian Richters

Seattle Justice Center

Green roofs helping to reduce combined sewer overflows

Siskyou Street, Portland Oregon

Pioneer Market, Portland

12th Avenue, Portland

Epler Hall Courtyard, Portland

2. Examples of Water in Urban Design

Contexts: parks, streams, waterfronts, streets, neighborhoods, buildings, outdoor spaces

A. PARKS

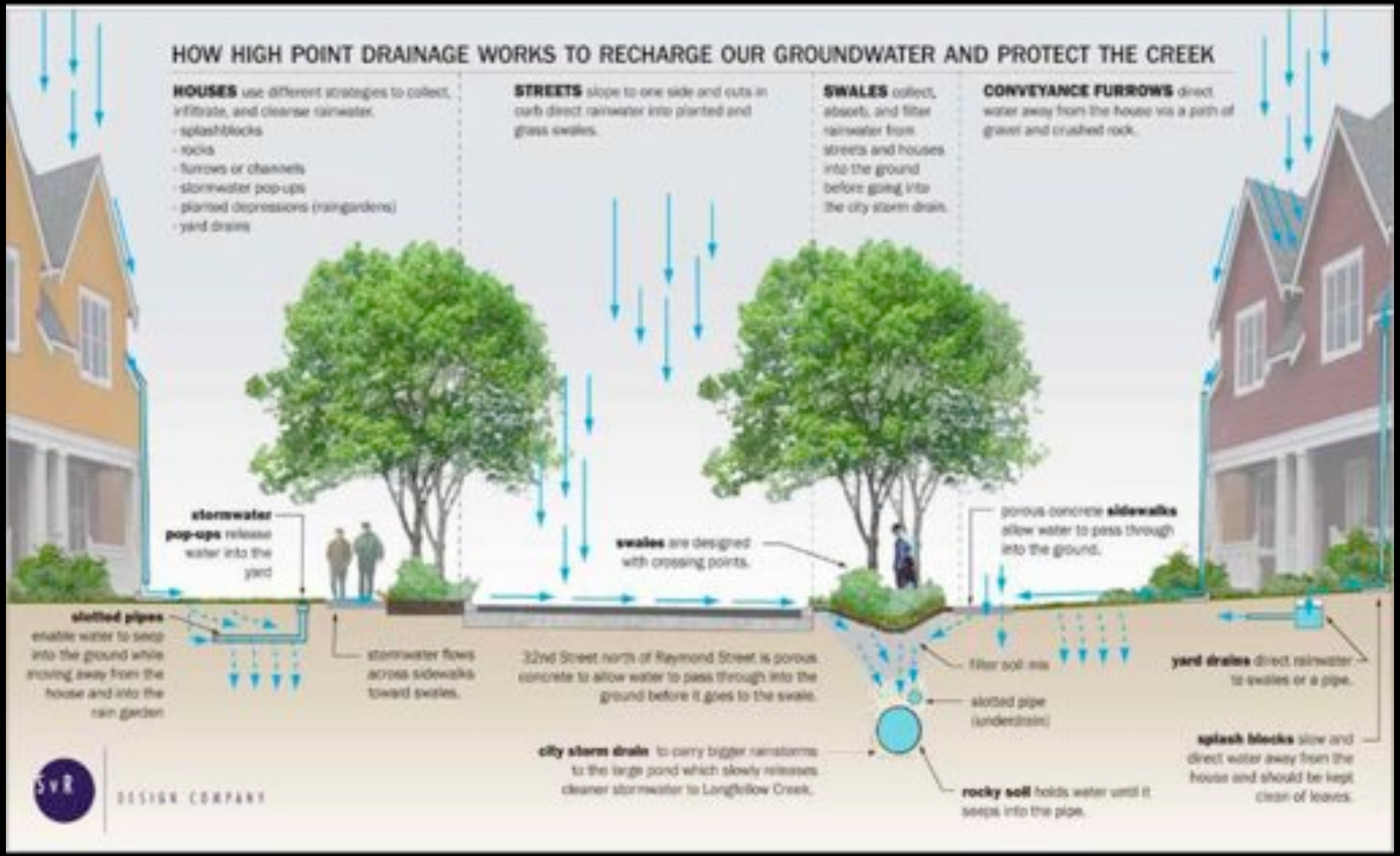
B. STREETS, BUILDINGS and PLAZAS

C. NEIGHBORHOODS

Drainage Goals:

- Function as Forest Grassland
- Treat 10 % of Longfellow Creek Watershed

High Point Housing – Medium Density


HOW HIGH POINT DRAINAGE WORKS TO RECHARGE OUR GROUNDWATER AND PROTECT THE CREEK
HOUSES use different strategies to collect, infiltrate, and cleanse rainwater.
- splashblocks
- rocks
- furrows or channels
- stormwater pop-ups
- planted depressions (raingardens)
- yard drains
STREETS slope to one side and cuts in curb direct rainwater into planted and grass swales.
SWALES collect, absorb, and filter rainwater from streets and houses into the ground before going into the city storm drain.
CONVEYANCE FURROWS direct water away from the house via a path of gravel and crushed rock.
stormwater pop-ups release water into the yard
swales are designed with crossing points.
porous concrete sidewalks allow water to pass through into the ground.
slotted pipes enable water to seep into the ground while moving away from the house and into the rain garden
stormwater flows across sidewalks toward swales.
32nd Street north of Raymond Street is porous concrete to allow water to pass through into the ground before it goes to the swale.
filter soil mix
slotted pipe (underdrain)
yard drains direct rainwater to swales or a pipe.
city storm drain to carry bigger rainstorms to the large pond which slowly releases cleaner stormwater to Longfellow Creek.
rocky soil holds water until it seeps into the pipe.
splash blocks slow and direct water away from the house and should be kept clean of leaves.
SvR
DESIGN COMPANY

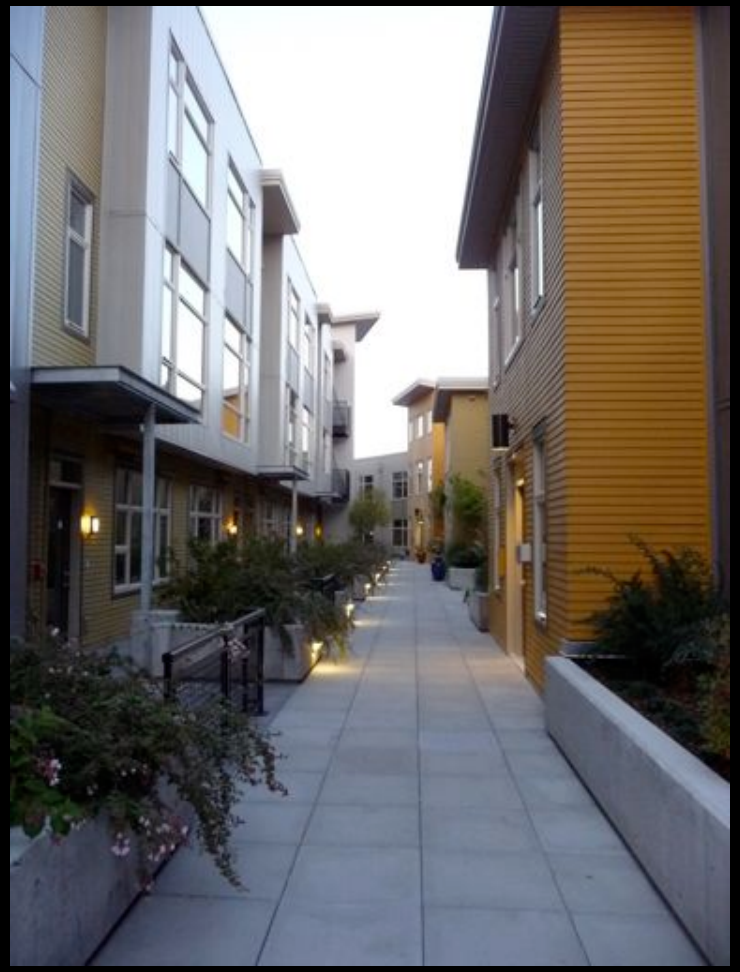
High Point Phase I Results

- 65-70% impervious surfaces
  Achieved target runoff ("grassland") with pond size reduced x 5
- Treats water-quality storm (6 – month)
- Peak flow control for 25 and 100-year storms
- Retained 107 legacy trees
- 830 housing units

3 – year monitoring complete in 2010
So far meeting attenuation and filtration goals

Thornton Place – High Density, (almost) Headwaters of Thornton Creek

Previous Condition – Parking, Northgate Mall

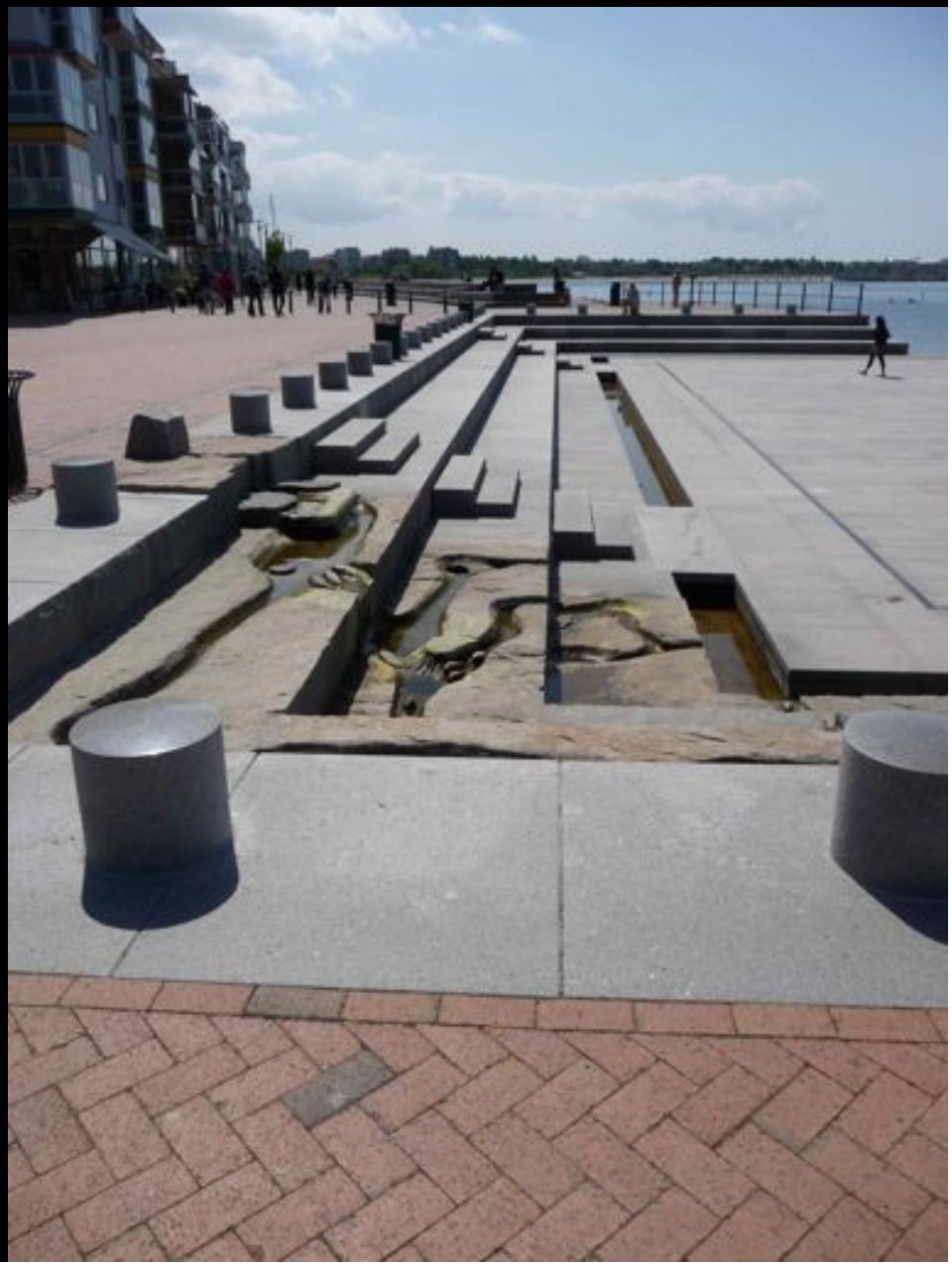


Thornton Place Water Quality Swale

- Detains and treats parking lot and roof runoff
- Public Amenity
- Habitat


Western Harbour, Malmo Sweden

Western Harbour, Malmo Sweden



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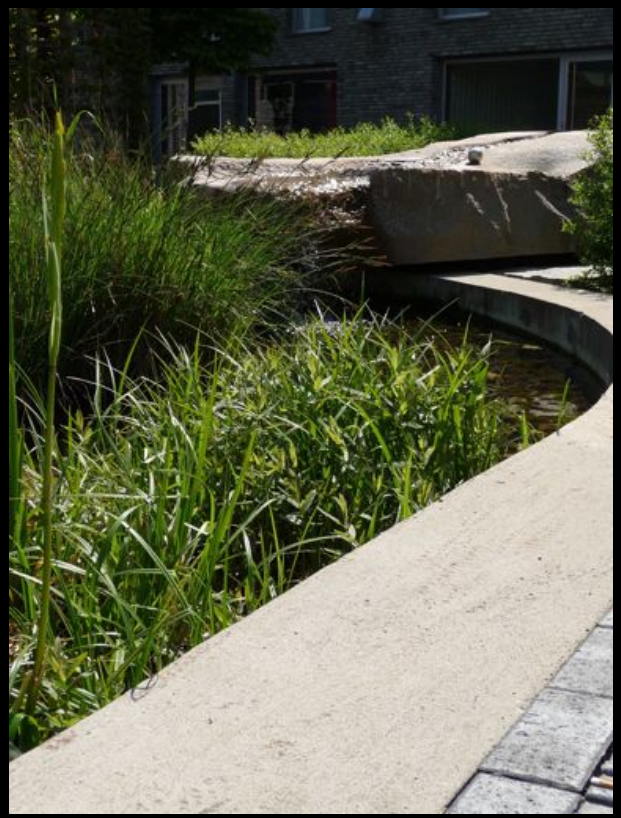


Western Harbour, Malmo Sweden

Western Harbour, Malmo Sweden
Biotope Cleansing Pond

3. Waterfront Stormwater Solutions

Green Futures Lab project for Puget Sound

FRONTLINE

POISONED WATERS

A far-reaching investigation into America's great waterways. They are in peril. There's a new wave of pollution that's killing fish, causing mutations in frogs — and threatening human health.

Watch the full program

Introduction

Join the Discussion

So What's Safe to Eat & Drink?

Weren't Our Waters Supposed to Be Cleaned Up *Years* Ago?

I Want to Get Involved...

THE NEW POLLUTERS

Scientists now point to the ecologically damaging runoff from highways, parking lots, malls, suburban developments, any and all of the hard surfaces used in development as the largest single source of toxic waste flowing into Puget Sound and other iconic American waterways. In short, we're all the New Polluters. This poses a new and daunting challenge for policy-makers and ordinary citizens.

- Hedrick Smith, Pulitzer Prize-winning journalist

The Problem:

Declining numbers of salmon, orca, marine birds, forage fish, rock fish, eelgrass bed habitat:
21 species listed as “threatened” or “endangered”

Causes:

- Petroleum hydrocarbons
- Heavy metals (zinc, copper, lead, arsenic)
- Sediments
- Nutrient loading
- Waste
- Stream and river damage
- Fragmented habitat

Outfalls conveying Stormwater into Puget Sound

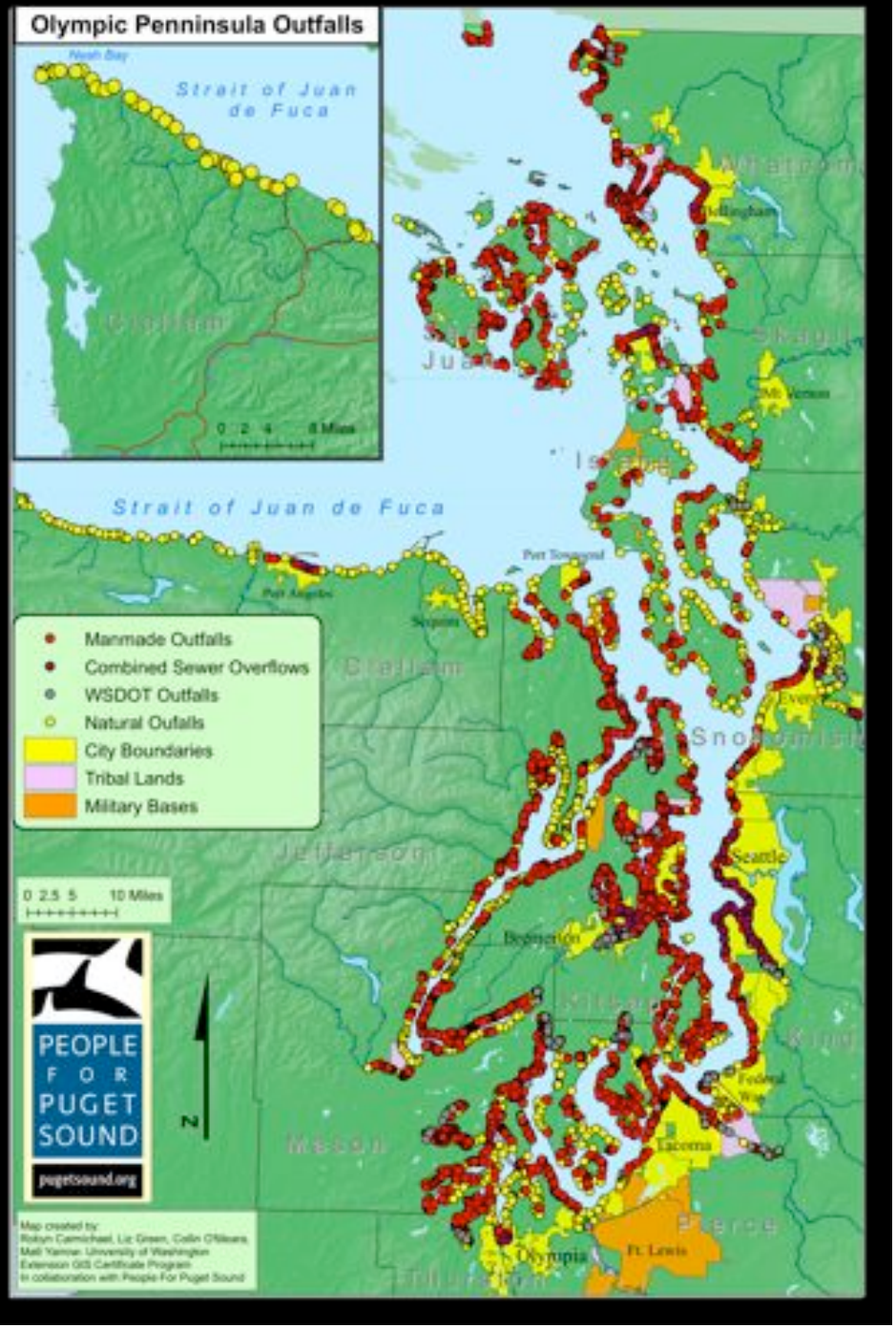
- 4,529 storm sewers

- 93 combined sewer overflow (CSO)

- 297 mapped WSDOT outfalls

- 70 WSDOT bridges

- 2,123 natural



People for Puget Sound 2009

Green Futures Lab Prototype Design and Research

Waterfront Stormwater Solutions for Puget Sound

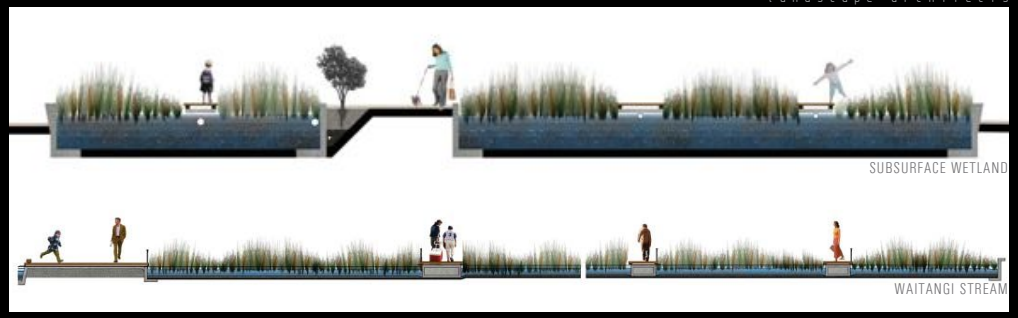
Waitaingi Park, Wellington, NZ is a design inspiration

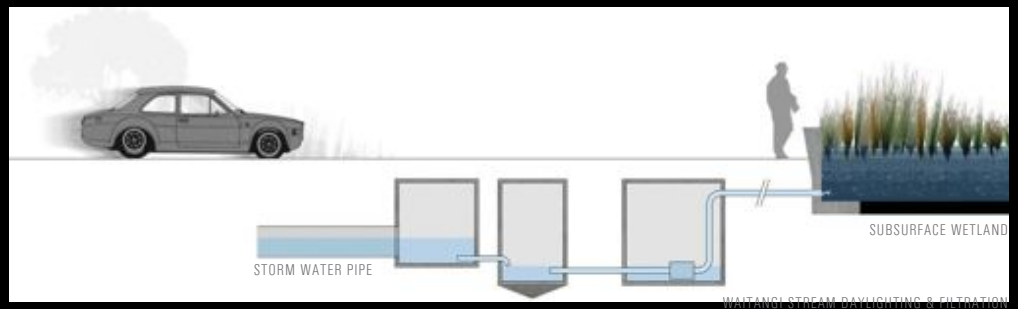
City stormwater is filtered and re-used for irrigation, with documented reduction in heavy metals, nitrogen, and suspended solids below water quality guideline levels. (Wellington City Council 2007)

Green Futures Lab Prototype Design and Research

Waterfront Stormwater Solutions for Puget Sound

wa
landscape architects





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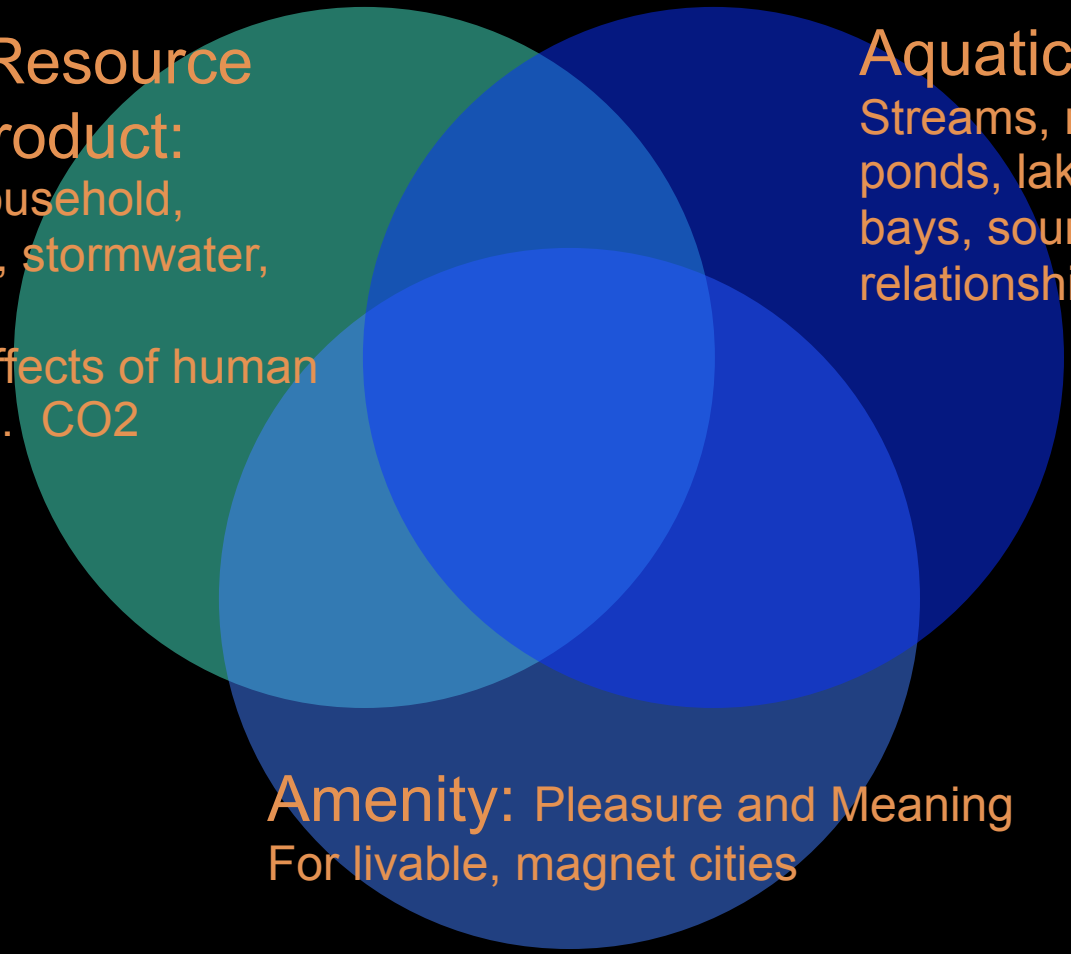
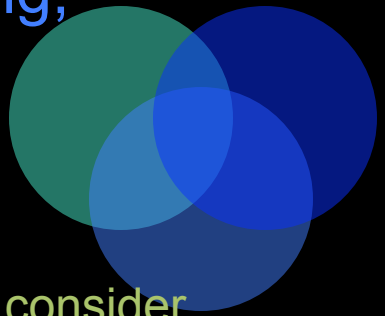
4. Concluding Principles:

How will we manage and design with water to serve multiple ends?

Meeting Multiple Water Needs for Urban Sustainability



Principles for sustainable urban hydrology planning, designing and management:



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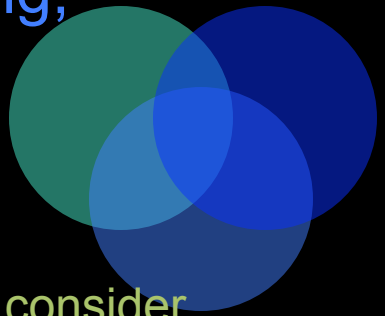


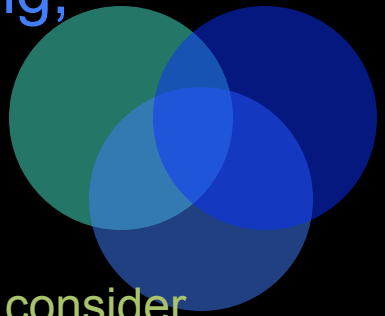
1. When planning, designing and managing water resources, consider human, resource needs, ecological integrity, and urban amenities simultaneously.

2. Strive for closed-loop systems that conserve resources and promote environmental integrity.

Take into account the entire water cycle when considering water use systems. Examples:

- water capture, cleansing and re-use;
- stormwater infiltration - soaking in where it lands, for stream and groundwater recharge and flow attenuation

Principles for sustainable urban hydrology planning, designing and management:



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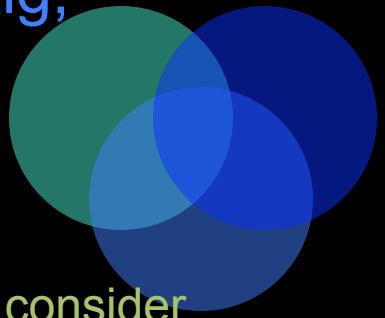

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3. Take every opportunity to create quality aquatic habitat in urban areas, and give human access in ways that don't degrade habitat quality but enrich the human experience.

4. Integrate artful water capture, cleansing and re-use into design of the urban environment for resource conservation, habitat improvement and human delight in the urban environment.

Great cities are magnet cities, promoting an overall smaller human footprint.

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WATER AND URBAN DESIGN

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